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Human Resources Strategy in The Implementation of Electronic Medical Records in Hospitals: Literature Review

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Abstract: Electronic Medical Records (EMR) represent a digital transformation aimed at enhancing the efficiency and effectiveness of healthcare services. However, EMR implementation faces significant challenges, particularly in the human resources (HR) domain, such as a lack of technical competence and resistance to change. This study aims to identify the barriers and strategies for EMR implementation from an HR perspective. This study employed a literature review with a critical appraisal method, analyzing 14 studies published between 2017-2022. Journals were selected based on their relevance to the EMR theme in healthcare facilities. The critical appraisal process validated the validity, results, and relevance of scientific evidence to address the methodology and mind mapping for the literature review. Journals were filtered using inclusion and exclusion criteria, and thematic analysis was conducted to identify factors influencing the effectiveness of EMR implementation. A total of 14 studies were included in this literature review. Analysis and synthesis revealed that barriers and strategies for EMR implementation from an HR perspective can be categorized into six aspects: management support, knowledge and skills regarding EMR, organizational culture, user characteristics, and user perspectives. Successful EMR implementation requires active collaboration between management, users, and supporting parties, with ongoing support to address barriers and enhance technology adoption.

Keywords: Electronic Medical Records; Human Resources; Implementation Strategies.

Introduction

Health information systems are evolving globally by integrating data and information systematically to support hospital health management. One of the technological implementations of health information systems is the Electronic Medical Record (EMR) (Anwar, 2024; Setiatin & Syahidin, 2017).

Electronic Medical Records (EMRs) represent a digital transformation in healthcare services, facilitating both primary and referral healthcare delivery (Goldman & Panageas, 2020). The benefits of using EMRs include increased efficiency, reduced operational costs, tracking patient medical history, and simplifying the collection of health information. This, in turn, aids clinical decision-making, such as diagnosis, therapy administration, preventing medication duplication, and more. Additionally, for administrative staff, EMRs facilitate patient information retrieval, data storage, transmission, and data processing, either individually or collectively (Purwandi, 2018; Risdianty & Wijayanti, 2019).

Despite their advantages, EMRs also have drawbacks, one of which is the risk of user data input errors. Such errors can lead to serious consequences, including incorrect therapy administration, flawed clinical decisions, and inappropriate medical actions affecting patients (Mustakim & Wardoyo, 2019; Silalahi & Sinaga, 2019).

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The development of EMRs requires a roadmap and sustainability plan that includes an analysis of human resource (HR) readiness, organizational culture, governance, leadership, and infrastructure (Nurhayati et al., 2020; Sulistya, 2021).

In 2016, the World Health Organization (WHO) stated that the development of EMRs heavily depends on human resources (HR). The role of HR in EMR implementation includes patient identification, treatment, prescription management, laboratory results, and documentation of medical examinations by doctors during patient visits (Bednorz et al., 2023; Hapsari & Mubarokah, 2023; Pohan et al., 2022; Widyastuti et al., 2020; Yustina, 2020).

Previous studies on the implementation of EMRs concerning human resources have reported an incompleteness rate of 50.12% in EMR documentation. This includes 15.55% missing general condition entries, 36.92% missing physical examination records, 3.10% missing diagnoses, 28.12% undocumented prescriptions, and 61.99% incomplete laboratory results. These findings indicate that regardless of how advanced an EMR system is, its successful implementation relies heavily on competent human resources (Pratama & Darnoto, 2017; Scott & Martin, 2021).

Therefore, further research is needed to assess the readiness for EMR implementation, particularly regarding human resource preparedness. This is because no matter how well-designed or expensive a system is, its implementation will be ineffective if not supported by skilled human resources.

Method

Data collection for this literature review on EMR implementation strategies was conducted through a collaborative research team in the Master's Program in Hospital Administration Management, Batch 19, Universitas Muhammadiyah Yogyakarta, in 2022. After collecting relevant journal articles, discussions were held with experts or advisors to develop a mind map. This approach facilitated the exploration of key issues addressed in this literature review, which will be presented using qualitative analysis.

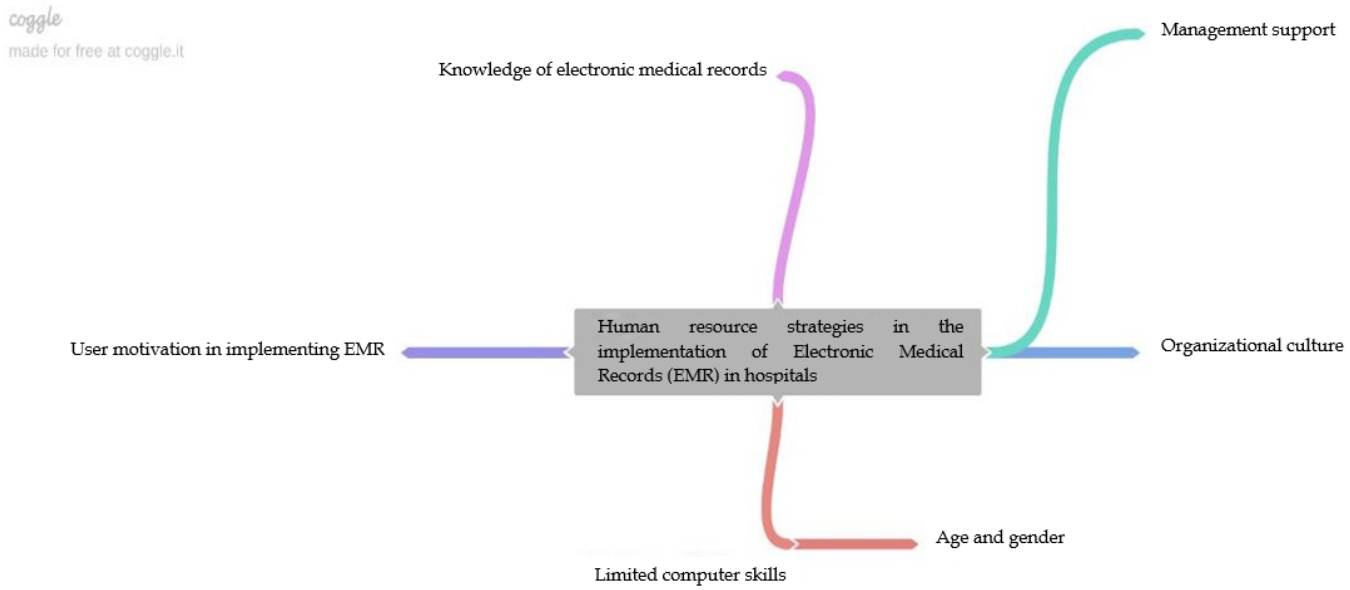

Figure 1. Mind Mapping of Human Resource (HR) Strategies in the Implementation of Electronic Medical Records (EMR) in Hospitals

From the mind mapping above, a search for relevant supporting journals was conducted using keywords derived from both English and Indonesian journal sources. The keywords used included "Electronic Medical Records (EMR)," "Implementation of Electronic Medical Records," and "Electronic Health Records (EHR)." The search was performed on PubMed, Google Scholar, and The Cochrane Library to find relevant literature for this review. The inclusion criteria for this journal review were as follows Journals discussing Electronic Medical Records (EMR) in healthcare facilities. Journals published between 2017 and 2022. Journals written in either Indonesian or English. Meanwhile, the exclusion criteria were All manuscripts classified as grey literature, including papers without clearly identified authors, lacking credible sources, or not controlled by their authors. Journals published before 2017

This literature review analysis employed the critical appraisal method, a systematic process used to assess

the validity, results, and relevance of scientific evidence. This evaluation determines whether a piece of literature can be used to support the methodology and mind mapping in the discussion of the literature review on human resource (HR) strategies in the implementation of Electronic Medical Records (EMR) in hospitals.

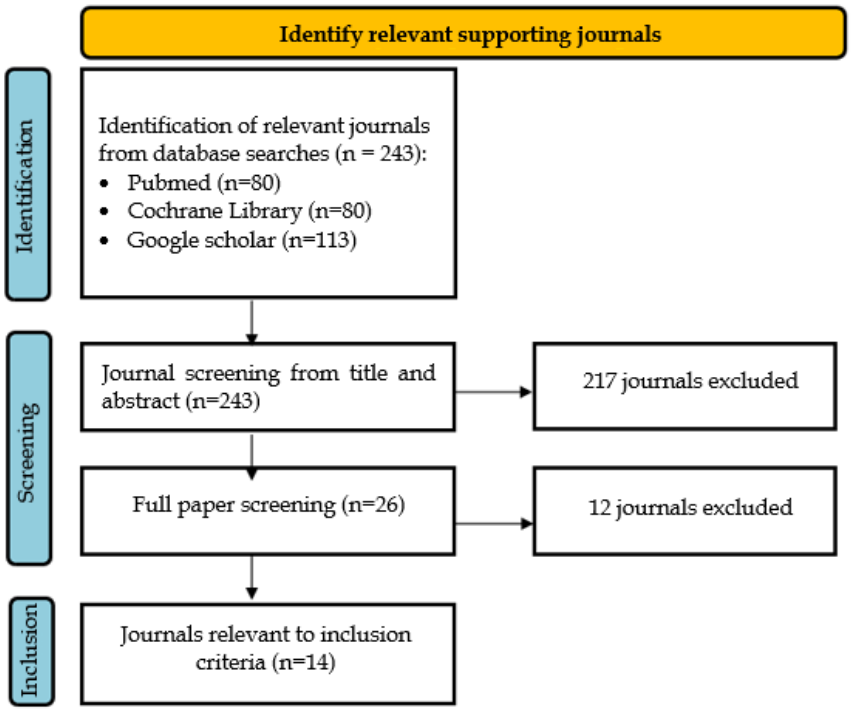

Figure 2. PRISMA flowchart of the supporting journal identification process

A total of 243 relevant journals were initially identified. After a thorough selection process, 14 journals were chosen for further literature study. The primary objectives of this study were to identify the strategies and steps required for implementing Electronic Medical Records (EMR) in hospitals and to analyze the factors influencing human resources in operating EMRs.

Result and Discussion

Study Characteristics

After identifying 243 relevant studies, fourteen (14) studies were selected. Among them, four studies were conducted in Indonesia, eight in Ethiopia, one in Ghana, and one in Kenya. The included research employed various methodologies, consisting of four qualitative studies, eight quantitative studies, and two mixed-methods studies. These studies were published between 2020 and 2023 (see Table 1 for detailed study information).

Table 1. Study Characteristics

Author	Method	Chriteria Inclusi
Ngugi (2021)	Design: Qualitative Study Technique: Focus Group Discussions (FGDs)	Participants who could provide insights into the usability, facilitators, and barriers of Electronic Medical Records (EMR) usage included professionals from all relevant fields. These participants encompassed medical record/data officers, IT personnel, and clinicians (doctors/nurses) involved in the EMR implementation process.
Amin et al. (2021)	Design: Qualitative Study Technique: Semi-structured Interviews	Employees of a private Islamic hospital in Yogyakarta with a minimum of 1 year of service. Direct EMR users (doctors, nurses, pharmacists, medical record staff, nutritionists): have used EMR for at least 6 months and have received training in using the system.Non-direct EMR users: involved directly in the EMR implementation process (IT staff) and management at the managerial level overseeing EMR operations

Author	Method	Chriteria Inclusi
Ramdani et al. (2023)	Design: Qualitative Study Technique: Semi-structured Interviews Design: Mixed Methods Study Technique: Quantitative Data: Cross-sectional, using the e-ISSM questionnaire Qualitative Data: In-depth interviews	Nurses and head nurses at RS Hermina Sukabumi who use Electronic Medical Records (EMR).
Yulida et al. (2021)	Design: Qualitative Study Technique: Interviews and Observations	Staff at RSGM Prof. Soedomo Yogyakarta who use Electronic Medical Records (EMR). 4o mini
Kalayou et al. (2021)	Design: Mixed Methods Study Technique: Quantitative Data: Cross-sectional, using a questionnaire Qualitative Data: In-depth interviews	General doctors, residents, specialists, and subspecialists from 5 hospitals in the Amhara Regional State (Ethiopia) who have been using Electronic Medical Records (EMR) for more than 6 months.
Dubale et al. (2023)	Quantitative Cross-Sectional Study	Medical staff (laboratory technicians, pharmacists, radiologists, nurses, etc.) from several hospitals in Addis Ababa (Ethiopia) who use Electronic Medical Records (EMR) and have worked for more than 6 months.
(Berihun et al., 2020)	Instrument: Questionnaire	Medical staff (laboratory technicians, pharmacists, radiologists, nurses, midwives, etc.) from several hospitals in Bahir Dar City (Ethiopia) who use Electronic Medical Records (EMR).
(Senishaw et al., 2023)	Quantitative Cross-Sectional Study	Medical staff (laboratory technicians, pharmacists, nurses, midwives, etc.) from 10 hospitals in the Amhara Regional State (Ethiopia) who use Electronic Medical Records (EMR).
(Wubante et al., 2022)	Instrument: Questionnaire	Medical staff (doctors, laboratory technicians, pharmacists, nurses, midwives, etc.) from 10 hospitals in the Amhara Regional State (Ethiopia) who use Electronic Medical Records (EMR) and have worked for more than 6 months.
(Wubante et al., 2023)	Quantitative Cross-Sectional Study	Medical staff (doctors, health officers, laboratory technicians, pharmacists, nurses, midwives, anesthesiologists, psychiatrists, etc.) from several hospitals in the Amhara Regional State (Ethiopia) who use Electronic Medical Records (EMR) and have worked for more than 6 months.
(Ngusie et al., 2022)	Instrument: Questionnaire	Medical staff (doctors, health officers, laboratory technicians, pharmacists, nurses, midwives, etc.) from several hospitals in the Illu Aba Bora and Buno Bedele zones in Ethiopia who use Electronic Medical Records (EMR).

Author	Method	Chriteria Inclusi
(Abdulai & Adam, 2020)	Quantitative Cross-Sectional Study Instrument: Questionnaire	Medical staff (doctors, laboratory technicians, pharmacists, nurses, midwives) from Tamale Teaching Hospital and Tamale Central Hospital in Ghana who use Electronic Medical Records (EMR).
(Adem et al., 2023)	Quantitative Cross-Sectional Study Instrument: Questionnaire	Medical staff (general doctors, nurses, psychiatrists, psychologists, social workers, etc.) from several hospitals in Addis Ababa (Ethiopia) who use Electronic Medical Records (EMR) and have worked for more than 6 months.

The synthesis and data sources regarding factors influencing human resources (HR) in operating Electronic Medical Records (EMR) and HR strategies for EMR implementation are presented in Table 1.

Factors Affecting Human Resources (HR) in Implementing EMR

This literature review divides the factors affecting HR in implementing Electronic Medical Records (EMR) into five themes: management support; knowledge and skills regarding EMR; organizational culture; user characteristics; and user perspectives on EMR.

Management Support

A study by Berihun et al. (2020) found that respondents who worked with strong management support were 2.59 times more likely to use the EMR system compared to those without it (AOR = 2.59; 95% CI: 1.40, 4.77). Management support, in this case, includes both technical and infrastructure support.

Challenges in technical support refer to any issues related to the use, installation, and updates of the software. One challenge is the software's inability to accommodate all user needs due to an imperfect system design. For example, missing image facilities, unvalidated SBAR signatures, the inability to display prescription quantities, lack of data on the number of doctors prescribing, non-standard prescription formats, inability to formulate medical diagnoses, not all medical record forms being on the EMR system, and the use of two languages, among others (Amin et al., 2021; Ramdani et al., 2023).

Another software-related issue is frequent downtime, where the information system is inaccessible for a period. This is due to high usage during peak hours, causing the system to malfunction, slow down, and fail to save inputted data (Ramdani et al., 2023).

Thus, continuous system updates are needed to adapt to work requirements. However, system updates and IT staff support are often delayed (Ngugi et al., 2021). Slow IT responses from hospitals/vendors when software issues are not resolved also contribute to challenges in technical support.

In terms of infrastructure support, challenges include inadequate hardware, insufficient server capacity, insufficient power supply, and slow internet speed (Amin et al., 2021; Ngugi et al., 2021). A study by Ramdani et al. (2023) illustrates infrastructure-related challenges, such as respondents having difficulty accessing and entering patient data during visits because no mobile computers were available for updating information. Insufficient server capacity led to server downtime, preventing access to EMR and causing delays in services. Additionally, the lack of big data management exacerbated the issue. Slow internet connection speeds led to long loading times in the EMR system. Furthermore, data loss sometimes occurred during power outages, where unsaved data hindered service delivery.

One solution to address technical support challenges is to make the system more streamlined, user-friendly, and easy to learn. It should include electronic signatures (e-sign), integrate all forms within the EMR system, and thus improve speed, accuracy, and work productivity. This approach also helps reduce the workload, costs, and overtime hours in the unit (Ramdani et al., 2023). One way to reduce the workload for medical staff is to implement a comprehensive EMR system, which should include electronic doctor signatures and electronic patient medical records that can be transmitted within or between hospitals. The use of electronic signature technology makes it more efficient for the responsible doctor to sign the EMR (Ramdani et al., 2023). Furthermore, the EMR software should continuously be developed and updated to meet user needs and comply with applicable regulations.

Another solution is to improve the quality of IT technician/software developer services. The quality of IT technician services plays a significant role in the success of EMR implementation because IT is responsible for ensuring the system runs smoothly and for its maintenance. Therefore, IT staff should possess expertise in software development, network management, and troubleshooting. They should be responsive to user complaints by quickly addressing system errors, either by visiting in person or remotely from the IT room, ensuring that the EMR system is

always ready for use (Amin et al., 2021). A study by Senishaw et al. (2023) shows that medical staff who receive adequate technical support from IT staff are 1.92 times more likely to use EMR (AOR = 1.92, 95% CI (1.122–3.305)).

Solutions for infrastructure support include providing adequate facilities and infrastructure. Several quantitative studies included in thi s literature review show a significant relationship between the availability of infrastructure and user motivation to use EMR (Adem et al., 2023; Wubante et al., 2022, 2023). For example, a study by Ngusie et al. (2022) shows that medical staff who have access to computers at their workplace are 2.76 times more likely to use EMR compared to those who do not [AOR = 2.76, 95% CI (1.44–5.27)]. Additionally, a study by Wubante et al. (2023) shows that medical staff who have internet access at their workplace are 6.0 times more likely to use EMR than those who do not [AOR = 6.0, 95% CI (3.0–12.0)].

Knowledge and Skills Regarding EMR

All of the quantitative studies included in this literature review indicate a significant relationship between knowledge and skills regarding Electronic Medical Records (EMR) and respondents' willingness to use EMR (Abdulai & Adam, 2020). According to the study by Senishaw et al. (2023), healthcare workers with good knowledge of the EMR software system are 1.85 times more likely to use EMR than those without (AOR = 1.85, 95% CI (1.004–3.409)). Similarly, respondents with strong computer skills are 1.77 times more likely to use EMR than those without.

However, in clinical practice, it is still common to encounter healthcare workers with limited computer skills. This is particularly noticeable at the initial stage of EMR implementation, where medical staff are not accustomed to typing on a computer and find it difficult to transition from handwriting to typing. This transition makes it harder for respondents to use the EMR system effectively (Amin et al., 2021).

Lack of skills often leads to negligence in using the EMR, such as incorrect input of patient data, entering data for one patient in another patient's record, missing patient progress notes, or overlooking doctors' instructions (Amin et al., 2021). Additionally, software updates are often carried out without accompanying periodic training, which makes it difficult for respondents to use the EMR system after each update. In addition to basic computer skills, IT skills are also important. Respondents often feel that their limited IT knowledge hinders them from performing technical tasks, such as troubleshooting when the system experiences malfunctions (Ngugi, Were, and Babic, 2021).

To address the lack of knowledge and skills regarding EMR, it is necessary to develop standard operating procedures and workflows for using the EMR software. This should be followed by continuous education, mentoring, and comprehensive training, along with periodic reviews of staff performance (Yulida et al., 2021).

Studies by (Amin et al., 2021; P. N. Ngugi, 2021) outline strategies for EMR training that can be adapted. In the initial stage, EMR is introduced to users such as doctors, nurses, laboratory staff, radiologists, nutritionists, and pharmacists through the medical committee. After an introduction, users provide feedback and suggestions for the EMR system, which is then tested. Any shortcomings are addressed through continuous improvements until a stable EMR system is achieved. Subsequently, EMR is trained to users through various methods, including: (1) Mentoring, which involves facilitating doctors who are unfamiliar with computers by offering about one month of mentoring; (2) Orientation training provided by the IT team and supervisors, including on-the-job training where users learn EMR from senior colleagues familiar with the system; (3) Self-learning through video tutorials on how to use the EMR, created by the IT team, and role modeling, where senior doctors share their experiences to encourage other doctors to use the EMR. Regular reviews, evaluations, and ongoing training are essential to maintaining system effectiveness.

If a hospital wants to adopt this strategy, there are several steps that need to be considered before, during, and after the system is implemented. First, hospital management needs to assess the knowledge level of the staff and computer literacy in the context of implementing the EMR system. Then, the appropriate training package should be selected based on the staff's identified needs. Additionally, there is a need for post-training and post-implementation evaluation to identify any additional training needs. The goal is to ensure that the educational sessions meet the stated objectives, providing improvements in productivity, efficiency, and effectiveness (Yulida et al., 2021).

Several quantitative studies included in this literature review found a significant relationship between EMR training and respondents' motivation to use the system (Adem et al., 2023; Dubale et al., 2023; Kalayou et al., 2021). The study by Berihun et al. (2020) mentions that healthcare workers who have received training on EMR are 3.75 times more likely to use the system than those who have not. The study also mentions that respondents who receive guidelines regarding EMR at their workplace are 2.76 times more likely to use the system compared to those who do not.

User Characteristics

The characteristics of users that influence their motivation to use the EMR system include age, gender, and years of experience. Differences in user characteristics based on age affect their acceptance and interest in using EMR. Senior healthcare workers, in particular, tend to show greater resistance and reluctance to adopt EMR due to their fear of change, lack of speed and skills in using new systems, the time required for entering medical records, and difficulty adapting to workflow changes, resulting in a loss of productivity (Amin et al., 2021). On the other hand, younger healthcare workers tend to have higher motivation, interest, and commitment to accepting new technological developments (Abdulai & Adam, 2020; Berihun et al., 2020). Younger staff are easier to train, more familiar with computers, have a better understanding of information technology (IT), and are from a tech-savvy generation, which results in lower resistance ((Amin et al., 2021). A study by Ngusie et al. (2022) states that healthcare workers under the age of 30 are 2.25 times more likely to adopt EMR compared to those over 30 years old [AOR = 2.25, 95% CI (1.33–3.82)].

Gender also affects users' motivation to use EMR. A study by Wubante et al. (2023) found that male respondents are 2.7 times more likely to use EMR compared to female respondents [AOR = 2.7, 95% CI (1.4–5.0)]. Similar findings were also obtained by Adem et al. (2023), which showed that female healthcare workers are 0.34 times less likely to use EMR compared to male healthcare workers (AOR=0.34; 95% CI 0.15, 0.76).

Lastly, years of experience also influence the motivation to use EMR. A study by Wubante et al. (2022) stated that respondents with more than 5 years of work experience are 3.1 times more likely to adopt EMR compared to those with less than 5 years of experience. This aligns with studies by Ngugi (2021) & Ngusie et al. (2022) which indicated that healthcare workers with less than 6 months of experience are more likely to struggle with adapting to the EMR system compared to those with more than 6 months of experience. This may be due to the fact that new healthcare workers are less familiar with the hospital's work environment compared to more experienced staff.

The resistance to using EMR among senior healthcare workers and the lack of adaptability from newer healthcare workers (less than 6 months of experience) can be mitigated by strengthening collegial support as a motivator for using the system. This can be achieved by promoting on-job training (OJT), where more skilled healthcare workers help guide their colleagues who are struggling with using EMR. Through good teamwork, it is hoped that both younger and older, junior and senior users will become competent in using the EMR system.

Additionally, to address the lower awareness of using EMR among female healthcare workers compared to their male counterparts, female healthcare workers need special attention. This can be achieved by improving and maintaining computer literacy, enhancing their perception of EMR technology, and developing their skills and experience with EMR. The goal is to help increase female healthcare workers' awareness of digital health technology (Adem et al., 2023).

User Perspective

Another barrier to the implementation of Electronic Medical Records (EMR) is the varied perception among users that the implementation of EMR will delay service processes and add to the workload. Many users remain skeptical about whether EMR will simplify tasks, both administratively and clinically. Users also express concerns about potential technical issues that may hinder the smooth implementation of EMR, which could slow down patient service processes (Yulida et al., 2021).

A study by Ngusie et al. (2022) showed that respondents who believed that EMR would bring significant benefits were 4.59 times more likely to adopt EMR [AOR = 4.59, 95% CI (1.62–12.99)]. Similarly, respondents who believed that EMR would improve work efficiency were 4.7 times more likely to accept EMR [AOR = 4.7, 95% CI (2.71–8.17)]. Additionally, Dubale et al. (2023) found that respondents who believed that the EMR system was of high quality (AOR 3.05, 95% CI: [1.32-7.05]), had quality information (AOR 3.26, 95% CI: [1.55-8.11]), and provided quality service (AOR 3.15, 95% CI: [1.58-6.28]) were more likely to be satisfied with the EMR system than those who did not have these beliefs.

Organizational Culture

The organizational culture that supports the motivation of respondents to use EMR includes high-quality leadership and a friendly, optimistic implementation environment. Quality leadership is demonstrated when the director provides support and supervises down to the management level, ensuring that managers support the implementation and use of EMR (Amin et al., 2021; Yulida et al., 2021).

Moreover, the use of EMR is not only dependent on the active role of leadership but also on the active participation of other organizational members. Contributions from users, such as disciplined documentation in EMR according to procedures, completeness, and mutual reminders, play a role in successful implementation. Other contributions include

staff involvement in modifying the EMR, such as in the pharmacy for developing electronic prescribing systems. Additionally, user participation in the development of the EMR includes providing input for system improvements and enhancements. Support for communication with patients is also essential, such as doctors reviewing EMR notes before rounds, making notes for supporting data, and setting reminders during documentation in EMR (Amin et al., 2021).

A study by Senishaw et al. (2023) found that respondents who worked in a supportive supervisory environment were 1.97 times more likely to adopt EMR compared to those who did not have such support. The implementation of Electronic Medical Records (EMR) as part of digital transformation in healthcare requires special attention to human resources (HR) readiness. Management support, including providing hardware, server capacity, and software updates, is a key success factor. Additionally, comprehensive training and technical assistance are essential to improving the competency of healthcare workers, especially in the face of system updates.

A supportive organizational culture is also crucial. Good supervision and active participation from organizational members can reduce resistance to change. A team-based approach and effective communication have proven to increase acceptance of new technologies, particularly among senior healthcare workers or those less familiar with digital systems.

Users' perceptions of EMR, including concerns about increased workload, should be addressed through education about the system's benefits, such as efficiency in managing patient data and clinical decision-making. Furthermore, the integration of EMR with existing information management systems, as well as support from national policies on interoperability standards and data security, are essential supporting elements. A holistic approach that includes improving HR capacity, technical support, and cultural changes within the organization is needed to ensure the long-term success of EMR implementation.

Conclusion

Electronic Health Records (EHR) is one of the digital transformation initiatives in healthcare aimed at facilitating the management of both primary and referral healthcare services. However, the implementation of EHR faces several challenges, particularly in terms of human resources (HR). In general, the barriers and strategies for implementing EHR from an HR perspective can be categorized into six aspects: management support, knowledge and skills regarding EHR, organizational culture, user characteristics, and user perspectives. Active participation from all involved parties, including users, IT staff, management, and the government, is needed to successfully achieve the optimal digital transformation of the healthcare system in Indonesia.

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In writing this article, the authors do not have any conflict of interest.

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