



IMPLEMENTATION BARRIER OF HOSPITAL MANAGEMENT INFORMATION SYSTEMS AND ELECTRONIC MEDICAL RECORDS IN EAST JAVA

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ABSTRACT

Hospitals are required to implement electronic medical records before December 31, 2023 (PMK RI No. 24 of 2022). However, of the 2,595 hospitals in Indonesia, there were still 304 hospitals that have not implemented SIMRS, and 993 hospitals had not implemented RME. East Java is the province with the highest number of hospitals, but most of its RMEs (75.85%) have not been integrated with the SatuSehat platform. So it is necessary to know what are the obstacles in the implementation of SIMRS and RME based on human, organizational, and technological factors. This study uses a narrative approach of literature review and thematic analysis. The results of the study stated that obstacles from human factors: limited ability, knowledge, and accuracy of hospital IT personnel in data input, limited development and implementation, and lack of understanding of the work code of ethics, especially in the digital sector. Organizational factor barriers: no regulations/SOPs/policies for the use of SIMRS and RME, lack of training and socialization for hospital employees. Technological barriers are the limitations of hardware, software, and network features in the implementation of SIMRS and RME. The implementation of SIMRS and RME in East Java hospitals offers benefits but faces challenges that can be overcome with the implementation of training, stakeholder commitment, technology support, and the use of open-source SIMRS or certified vendors.

Keywords: Digital Transformation; Hot-Fit Model; Hospital

ABSTRAK

Rumah sakit diwajibkan untuk menerapkan rekam medis elektronik sebelum 31 Desember 2023 (PMK RI No. 24 Tahun 2022). Namun dari 2.595 rumah sakit di Indonesia, masih ada 304 rumah sakit yang belum menerapkan SIMRS, dan 993 rumah sakit belum menerapkan RME. Jawa Timur adalah provinsi yang memiliki jumlah rumah sakit terbanyak, namun sebagian besar RME-nya (75,85%) belum terintegrasi dengan platform SatuSehat. Sehingga perlu diketahui apa saja hambatan dalam penerapan SIMRS dan RME berdasarkan faktor manusia, organisasi, dan teknologi. Penelitian ini menggunakan pendekatan naratif *literature review* dan analisis tematik. Hasil penelitian menyatakan bahwa hambatan dari faktor manusia: terbatasnya kemampuan, pengetahuan, dan akurasi tenaga IT Rumah Sakit dalam input data, keterbatasan pengembangan dan implementasi, serta kurangnya pemahaman terhadap kode etik kerja khususnya di sektor digital. Hambatan faktor organisasi: tidak ada peraturan/SOP/kebijakan penggunaan SIMRS dan RME, kurangnya pelatihan dan sosialisasi bagi karyawan rumah sakit. Hambatan faktor teknologi adalah terbatasnya perangkat keras, dan fitur perangkat lunak, dan jaringan dalam implementasi SIMRS dan RME. Penerapan SIMRS dan RME di rumah sakit Jawa Timur menawarkan manfaat tetapi menghadapi tantangan yang bisa diatasi dengan pelaksanaan pelatihan, komitmen pemangku kepentingan, dukungan teknologi, dan menggunakan SIMRS open-source atau vendor bersertifikat.

Kata kunci: Transformasi Digital; Model Hot-Fit; Rumah sakit



INTRODUCTION

One of the Strategic Plans of the Ministry of Health for 2020-2024 is the transformation of the National Health System (SKN), with one of the pillars is Health Technology Transformation consisting of: 1) Integration and development of health data systems, 2) Integration and development of health implementation systems, and 3) Development of health technology ecosystems (Kemenkes RI, 2022a). In hospitals, health technology transformation is carried out using Hospital Management Information Systems (HMIS). HMIS is a comprehensive computer-based information management system that integrates and processes all hospital service processes, including administrative services, medical and nursing services, resource management, and financial and accounting systems within a coordinated network. It aims to obtain accurate and timely information to support quality healthcare services (Wahyudin *et al.*, 2019; Kusmiranti, Narmi and Balaka, 2022; Roaini, 2022; Septiyani and Sulistiadi, 2022).

HMIS brings significant changes in hospital management to improve the efficiency of services to patients, optimize the distribution of information and tasks, and provide real-time access to data (Kemenkes RI, 2013). Moreover, using HMIS offers several benefits: enhancing the efficiency and effectiveness of healthcare services and leading to improved patient care and outcomes. HMIS also contributes to decreasing medical errors, increasing efficiency, cost-effectiveness, and timely decision-making, ultimately improving healthcare services (Ahmadi, Nilashi and Ibrahim, 2015). Additionally, HMIS facilitates the monitoring of evidence-based practice uptake and outcomes evaluation, thereby supporting the implementation of quality measures in healthcare (Gustavson *et al.*,

2022). Moreover, the system is perceived as easy to learn and operate, providing benefits in streamlining work processes for healthcare professionals (Jobber, 2021).

The Ministry of Health has mandated that every hospital must record and report all hospital operations through HMIS. One of the variables is the recording of data and history of patient health services through medical records (Kemenkes RI, 2013). The use of electronic medical records (EMR) must be implemented by a deadline of 31st December 2023, in all health service facilities in Indonesia (Kemenkes RI, 2022b). The regulation signifies the importance of the shift towards EMR as one of the key components in digital transformation in the healthcare sector. The use of EMR in hospitals offers several benefits, including improved patient outcomes, enhanced coordination of tasks, decision-making, and auditing, as well as facilitating the analysis of hospital bills and verification of materials and medications used in units (Mohamed *et al.*, 2019). EMR also contributes to reducing the need for repeat investigational interventions and drug use in primary care settings, ultimately leading to improved patient care and treatment outcomes (Luo, 2009). Additionally, EMR enables quick and accurate storage and retrieval of outpatient health history information, optimizing outpatient medical records services (Tominanto, Purwanto and Yuliani, 2018). Furthermore, the digitization of medical records helps patients in the hassle-free management of their medical data, contributing to improved patient engagement and empowerment (Batra *et al.*, 2023).

In order to realize the integration of health data throughout healthcare facilities more broadly, the Ministry of Health has launched the SatuSehat platform. SatuSehat is an integrated national health data exchange platform initiated by the Ministry of Health of the Republic of





Indonesia with global standard HL7 FHIR and can be obtained in near real-time (Rachmanto, 2023). The SatuSehat platform is a health data interoperability and exchange platform in Indonesia, aiming to facilitate the seamless sharing of health data among healthcare organizations, particularly primary healthcare and private clinics (Heryawan *et al.*, 2023). The platform was previously known as PeduliLindungi and underwent a change, which affected its usage, prompting research to gauge public enthusiasm for the rebranded application (Syifa, 2023). The platform's role in promoting health data exchange aligns with the broader vision of leveraging digital platforms to improve healthcare outcomes and patient management (Tsiouris *et al.*, 2017; Wang *et al.*, 2017; Rizky, 2019; López-Martínez *et al.*, 2020; Z *et al.*, 2022). The platform's potential to enhance healthcare services and patient care is underscored by its ability to support clinical data integration, augmentative and alternative communication service delivery, and remote exercise-based cardiac rehabilitation (Rawstorn *et al.*, 2016; Wang *et al.*, 2017; Z *et al.*, 2022). SatuSehat platform's significance is further highlighted by its potential to improve healthcare outcomes and clinical operations and reduce care costs (López-Martínez *et al.*, 2020). The platform's role in promoting the exchange of health data and supporting patient management underscores its potential to advance healthcare services and patient care. Based on data from the Ministry of Health from 2,595 hospitals in Indonesia, 304 (11.72%) hospitals still had not implemented HMIS and 993 (38.27%) hospitals had not implemented EMR (Kemenkes RI, 2023b). This data was also supported by a rapid survey conducted by PERSI in 500 sample hospitals; around 250 (50%) hospitals in Indonesia had not implemented EMR and still plan to use EMR in 2022 (Priharto, 2023). Based on the Digital Maturity Index (DMI) score

that can be seen in Picture 1, the EMR component received a low achievement, which was at the level of 2.53 out of 7 (Seviana, 2023) which means hospitals in Indonesia were only able to provide electronic devices so that medical records can be directly stored. Doctors can only store medical records online and can immediately provide treatment prescriptions (Pusdatin Kemenkes RI, 2022). DMI is a self-assessment conducted by the Hospital to assess 7 aspects: 1) Information systems and its infrastructure, 2) Data standards and interoperability, 3) Governance and management, 4) Data analytics, 5) HR and IT utilization, 6) Information security, privacy and confidentiality, 7) Electronic medical records (Seviana, 2023).

East Java Province is one of the provinces that has the highest number of hospitals in Indonesia but has a low number of DMI fillings. From 405 hospitals, only 30 (7.41%) hospitals fill the DMI (Kemenkes RI, 2023a). In fact, by knowing the value of DMI, stakeholders can assess the readiness of hospitals to implement EMR and integrate health data into the SatuSehat platform. Regarding EMR implementation, from 410 hospitals in East Java (BPS Jawa Timur, 2023), most (75.85%) of its EMR has yet to be integrated with SatuSehat (DTO Kemenkes, 2023). EMR's integration with SatuSehat is a crucial step towards efficiency and continuity in health data interoperability, which can improve overall healthcare coordination and provide substantial benefits for patients and decision-making in the health sector.



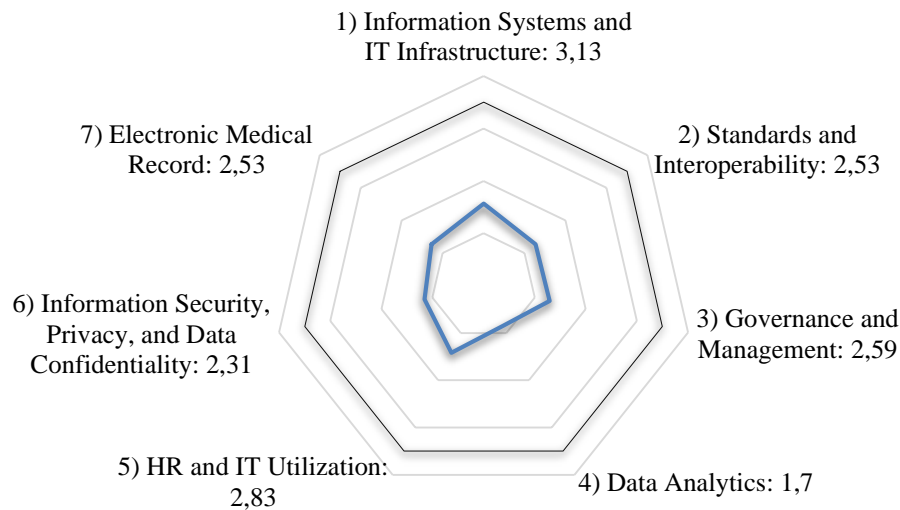


Figure 1. Hospital Digital Maturity Level Score in Indonesia in 2023

The implementation of EMR and HMIS can be evaluated based on Human, Organization, Technology, and Net-Benefit (HOT-FIT). HOT-FIT approach model, as proposed by Yusof (2008), encompasses the evaluation of the interrelationships and compatibility between human, organizational, and technological factors in the context of information systems. The model considers the impact of these factors on net benefits, aiming to assess the success and effectiveness of information system implementations (Yusof *et al.*, 2008). The HOT-FIT model provides a comprehensive framework for evaluating the success and effectiveness of various information systems, considering the interactions and compatibility between human, organizational, and technological elements and their influence on net benefits. So, the researcher is interested in examining the barriers to the implementation of HMIS and EMR in hospitals in East Java based on the point of view of the HOT-FIT model.

METHOD

This research was narrative literature review research. Unlike

systematic reviews, narrative reviews do not have a predetermined method and can use various styles (Handayani, Haryono and Darmawan, 2021). The research topic discussed was the results of evaluating the use of HMIS and EMR in Hospitals in East Java.

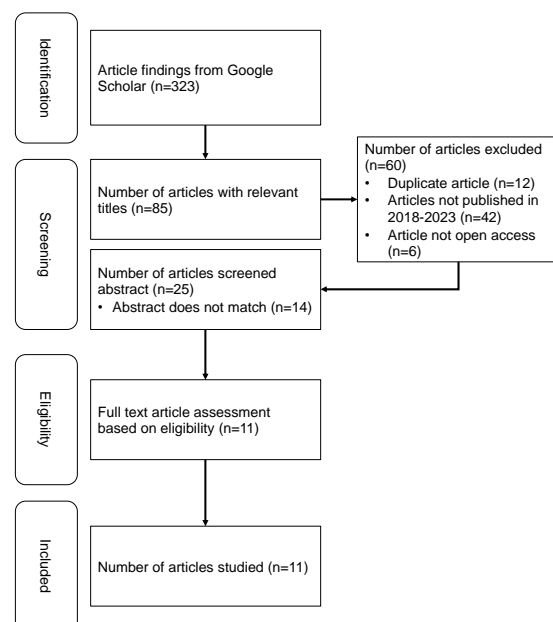


Figure 2 Article Search Flowchart



Data collection sources were taken from the Google Scholar indexing engine by listing keywords that match the research inclusion criteria. The article was searched using the keywords: “electronic medical record”, “management information system”, and “hospital”.

Criteria inclusion article:

1. Article discussing the evaluation of HMIS and EMR implementation in East Java hospitals.
2. The article is available in Indonesian.
3. Articles published in 2018-2023.
4. Articles are available in full text.

The exclusion criteria in this study are foreign-language articles that discuss the application of HMIS and EMR in non-hospital health facilities. Data analysis techniques use a thematic analysis approach, namely the qualitative analytic method that involves identifying, analyzing, and reporting patterns within qualitative data. This method allows researchers to identify and organize relevant themes and subthemes from a thorough reading of a subject (Nowell *et al.*, 2017). The flow of the article search process can be seen in Figure 2.





Table 1 Article extraction result

Title, Author, Year	Aims	Sample	Method	Result
Strategi Pengembangan Transformasi Sistem Informasi Manajemen Rumah Sakit (SIM-RS) di RSUD dr. Iskak Tulungagung (Zuhrotul Aini, Nurwijayanti, Supriyanto, Heru Eko Susanto, 2022)	The aim is developing electronic medical records, integrating patient service systems, improving back-office systems, and enhancing decision support systems.	The sample was user needs and regulations, optimizing support systems, maximizing human resource support, and enhancing digital information technology	The methods used was fishbone diagram analysis to identify factors affecting the transformation of SIM-RS, USG analysis to prioritize problem-solving, and SWOT analysis to determine development strategies	The results of the residency program include identifying factors hindering the optimal implementation of SIMRS, prioritizing issues using USG analysis, and proposing strategies such as digitizing medical records and integrating application modules
Pengembangan Kapasitas Organisasi Melalui Penerapan Sistem Informasi Manajemen Rumah Sakit (SIMRS) Untuk Meningkatkan Mutu Pelayanan Kesehatan di RSUD dr. Mohamad Soewandhie Surabaya (Evi Maya Odelia, 2018)	The aim of the study is to describe the development of organizational capacity through the hospital management information system (SIMRS) to enhance the quality of healthcare services	The study involved internal hospital officers and patients at RSUD dr. Mohamad Soewandhie Surabaya as the samples for the research	The study utilized a qualitative research approach with a descriptive research type, involving data collection through interviews, observations, and document analysis	The study highlighted challenges in organizational capacity building, particularly in facilities and infrastructure, emphasizing the need for optimal implementation of the hospital management information system
Analisis SIMRS dengan Metode PIECES di RSU Dr. H. Koesnadi Bondowoso (Finno Harta Dinata, Atma Deharja, 2020)	The aim of the research is to analyze the implementation of the Hospital Information System (HIS) using the PIECES method at General Hospital Dr. H. Koesnadi Bondowoso to provide recommendations for system development and improvement	The samples in the research included 12 main informants who were users of the Hospital Information System (HIS) from various units at the hospital	The research used qualitative methods, including data collection through in-depth interviews, observations, documentation, and focus group discussions to analyze the HIS implementation at General Hospital Dr. H. Koesnadi Bondowoso	The results of the research showed that the Hospital Information System (HIS) at General Hospital Dr. H. Koesnadi Bondowoso performed according to user needs but had various problems, requiring efforts for improvement and development
Implementasi Sistem Informasi Manajemen	The aims of implementing Hospital Management	The study was conducted at Dr. Soebandi Regional	The research used a descriptive qualitative method, with data	The implementation of the Hospital Management Information





Title, Author, Year	Aims	Sample	Method	Result
Rumah Sakit (SIMRS) di Instalasi Rawat Jalan Penyakit Dalam RSD Dr. Soebandi Jember (Maretha Anggraeni, Ibnu Supriyadi, 2019)	Information System (HMIS) at RSD Dr. Soebandi Jember include improving electronic recording in various hospital processes through specific modules, such as Patient Management, Pharmacy, Medical Records, Nursing Care, Inpatient Care, Emergency Room, Radiology, Patient Safety, Room Management, and Asset Management	Hospital in Jember from July to September 2017	collection through interviews, documentation, and literature review, focusing on factors influencing the implementation of Hospital Management Information System (HMIS)	System (HMIS) at RSD Dr. Soebandi Jember faced challenges related to resources, including human resources and facilities. Training and education were provided to system users upon installation
Analisis Kinerja SIMRS RSU Bhakti Husada Banyuwangi Menggunakan IT Balanced Scorecard dan Model for Mandatory Use of Software Technologies (Vivi Sefrinta Izza Afkarina, Rudi Wibowo, Saiful Bukhori, 2021)	The aims of the study were to develop the SIMRS application for effective and efficient management system and to assess the performance of SIMRS at RSU Bhakti Husada Banyuwangi using IT Balanced Scorecard and Model for Mandatory Use of Software Technologies.	The study included 45 respondents who were users of the SIMRS system at RSU Bhakti Husada Banyuwangi.	The study utilized a quantitative cross-sectional approach to analyze the performance of SIMRS using IT Balanced Scorecard and determine the implementation determinants based on the Model for Mandatory Use of Software Technologies framework at RSU Bhakti Husada Banyuwangi.	The results showed that the performance of SIMRS at RSU Bhakti Husada Banyuwangi was categorized as good, with significant influences from variables such as information quality, information satisfaction, ease of use, and attitudes.
Evaluasi Keberhasilan Implementasi SIMRS di Rumah Sakit X Kabupaten Jember Dengan Pendekatan Metode TTF (Suhartatik, Doni Setiawan Hendyca Putra, Sustin Farlinda, Andri)	The aim of the study was to evaluate the success of SIMRS implementation at X Hospital in Jember regency using the Task Technology Fit (TTF) theory.	The study involved 54 respondents who were hospital staff using SIMRS at X Hospital in Jember regency. Sampling was done using Non-Probability Sampling with a quota sampling technique.	The study utilized a quantitative research approach with data collected through questionnaires from 54 respondents.	The results showed high scores in Task Characteristic (TAC), Technology Characteristic (TEC), Task Technology Fit (TTF), Performance Impact (PI), and Utilization (U) variables, indicating a successful implementation of SIMRS at X Hospital in Jember regency.





Title, Author, Year	Aims	Sample	Method	Result
Permana Wicaksono, 2022) Analisis Kinerja Sistem Informasi Manajemen Rumah Sakit (SIM-RS) Pada RSUD dr. Soebandi Menggunakan IT Balanced Scorecard (Afkarina, V. S. I., Wibowo, R., & Bukhori, S., 2021)	The aims of the study on the performance analysis of the Hospital Management Information System (SIM-RS) at RSUD Dr. Soebandi using IT Balanced Scorecard are to evaluate the effectiveness of the system in improving hospital services and to identify areas for enhancement in the future.	The study samples included data from the Hospital Information System (SIM-RS) at RSUD Dr. Soebandi in Jember Regency, Indonesia, focusing on emergency services performance analysis using the IT Balanced Scorecard methodology.	The study utilized a qualitative research approach, involving data collection through observation, interviews, document analysis related to the hospital's Information System (SI/TI), and literature review on SI/TI performance analysis.	The results of the study indicated that the performance of the Hospital Information System (SIM-RS) at RSUD Dr. Soebandi in emergency services was quite good, as assessed through the IT Balanced Scorecard measurement from various perspectives.
Evaluasi Kesuksesan Sistem Pendaftaran Online di RSI Surabaya dengan Menggunakan Metode Delone & Mclean (Bagus Alferi, Tri Deviasari Wulan, Fajar Annas Susanto, 2020)	The aim of the evaluation of the online registration system at RSI Surabaya using the Delone & McLean method is to assess the success factors of the system and its impact on user satisfaction, system quality, information quality, and overall benefits for both users and the organization.	The samples in the study evaluating the success of the online registration system at RSI Surabaya were patients who used the online registration system.	The study utilized the Delone & McLean method to evaluate the success of the online registration system at RSI Surabaya, focusing on system quality, information quality, service quality, system usage, user satisfaction, and net benefits.	The results of the evaluation showed that the quality of information and system usage positively affected user satisfaction and net benefits in the online registration system at RSI Surabaya.
Metode Hot Fit untuk Mengukur Tingkat Kesiapan SIM RS dalam Mendukung Implementasi E-Health (Titin Wahyuni, Anif Parasetorin, 2019)	The aim of the study is to identify the readiness of SIM RS in the application of E-Health using the HOT Fit model.	The study included all registration officers and filing officers of RSUD Dr. M. Soewandhi as the sample population.	The study used descriptive data analysis with cross-sectional data collection, utilizing questionnaires as the research instrument.	The results showed that the variables of human, technology, organization, and net benefits play crucial roles in the success of E-Health implementation in hospitals.





Title, Author, Year	Aims	Sample	Method	Result
Evaluasi Penerapan SIMRS di Rumah Sakit Putra Waspada dengan Metode HOT-FIT (Ana Fitriani, Fita Rusdian Ikawati, Achmad Jaelani Rusdi, 2022)	The aim of the study was to evaluate the impact of the Hot-Fit method on the implementation of SIMRS at Putra Waspada Hospital.	The study involved a sample of 39 SIMRS users at Putra Waspada Hospital in Tulungagung.	The study utilized a quantitative research method at Putra Waspada Hospital, involving 39 SIMRS users and testing 10 hypotheses related to System Quality, Information Quality, Service Quality, System Use, User Satisfaction, Structure, and Net Benefit.	The study found that various factors such as System Quality, Information Quality, Service Quality, System Use, and User Satisfaction had a positive influence on the implementation of SIMRS at Putra Waspada Hospital.
Audit Sistem Informasi Instalasi Rawat Inap pada Rumah Sakit Islam Jemursari Surabaya Berdasarkan Cobit 4.1 (Anggy Pranindya Sudarmadji, 2018)	The aims of the audit in the SIMRS implementation at RSIJS include assessing the maturity level in responding to changing business demands, identifying performance issues such as complex service flow and security breaches, and providing recommendations for improving efficiency based on COBIT 4.1 guidelines.	The samples in the audit report include findings related to ensuring continuous service, meeting information system resource needs, and integrating overall business procurement in the context of COBIT 4.1 maturity levels.	The methods used in the audit process include data and evidence examination, interviews, observations, maturity assessments, and recommendation determinations based on COBIT 4.1 guidelines	The results of the audit process include data and evidence collected, findings from interviews and observations, maturity level assessments, and recommendations for improving the information system audit at RSIJS based on COBIT 4.1



RESULTS AND DISCUSSION

Barriers to HMIS and EMR Implementation Based on Human Factors

Barriers to implementing HMIS and EMR in several hospitals in East Java can be seen based on Human factors. Based on research results at Dr. Soebandi Hospital Jember and Jemursari Islamic Hospital Surabaya, barriers to implementing HMIS were caused by limited capabilities, knowledge, and accuracy of Hospital IT personnel in data input, development and implementation of HMIS and EMR (Sudarmadji, 2018; Anggraeni and Supriyadi, 2019). Some Jemursari Islamic Hospital Surabaya employees also did not understand the code of work ethics, especially in the digital sector (Sudarmadji, 2018). Based on the research results at Dr. Soeparoen Hospital Malang, the delay in implementing HMIS and EMR was due to the limited number and ability of health workers who can use HMIS and EMR (Indasah *et al.*, 2023).

This is in line with other research stating that the barriers to implementing HMIS and EMR based on Human factors include users' resistance to change, and unpreparedness of officers at health facilities (Raut *et al.*, 2017; Mardi, 2022). Additionally, using a particular technology from an organizational perspective is problematic since individual users have different worldviews (Mardi, 2022).

Several strategies can be considered to overcome barriers in implementing HMIS and EMR based on human factors: 1) Providing comprehensive training programs to enhance health professionals' ICT literacy and knowledge, addressing resistance to change, and ensuring readiness for EMR adoption (Oo *et al.*, 2021). 2) Involving healthcare professionals in the design and implementation process, considering their perspectives, and addressing their concerns to enhance user acceptance and satisfaction (Top *et al.*, 2015; Thit *et al.*,

2020). 3) Understanding user perceptions and insights to predict acceptance, evaluate performance, and guide EMR implementation in hospitals (Ojo and Popoola, 2015; Top *et al.*, 2015).

Barriers to Implementing HMIS and EMR Based on Organization Factors

Barriers to implementing HMIS and EMR in several hospitals in East Java can be seen based on organizational factors. Based on the research results at Jemursari Islamic Hospital Surabaya and dr. Iskak General Hospital Tulungagung stated that obstacles occurred because there was no regulation/SOP/policy regulating the obligation to fill HMIS and EMR at the hospital level (Sudarmadji, 2018; Aini *et al.*, 2022). In addition, the research results at Hospital X in Jember stated that this obstacle occurred due to the lack of training and socialization for hospital employees in using HMIS and EMR (Suhartatik *et al.*, 2022).

Other research stated that obstacles in implementing HMIS and EMR in hospitals related to program structure, organizational structure, beliefs, justice, top management support, perceived cost, competitive pressure, communication issues, implementation cost, and lack of leadership skills (Gyamfi *et al.*, 2017; Boshnak *et al.*, 2019; Windari *et al.*, 2023). Additionally, the barriers encompass funding, full-time information technology expertise, and the organization's existing culture, particularly if there is a lack of trust and cooperation (Gyamfi *et al.*, 2017; Boshnak *et al.*, 2019).

Several strategies can be considered to overcome barriers in implementing HMIS and EMR based on organizational factors: 1) Assessing the organization's readiness for change, including leadership commitment, resource allocation, and staff engagement, to ensure a smooth transition to HMIS and EMR (Taiwo, 2019). 2) Implementing change management strategies to create a sense of urgency, building a guiding team, developing a



change vision and strategy, and removing barriers to facilitate the successful adoption of HMIS and EMR (Cucciniello *et al.*, 2015). 3) Providing adequate financial resources to overcome implementation costs and ensure the efficient utilization of resources for HMIS and EMR implementation (Cotrina-Aliaga *et al.*, 2021).

Barriers to HMIS and EMR Implementation Based on Technology Factors

Barriers to implementing HMIS and EMR in several hospitals in East Java can be seen based on Technology factors. Based on the results of research at Bhakti Husada General Hospital Banyuwangi, this obstacle was caused by limited features in HMIS and EMR software that were unable to accommodate the needs of hospitals (Afkarina, Wibowo and Bukhori, 2021). Another study conducted at Hospital X in Jember stated that this obstacle was caused by the lack of integration of HMIS between units, so the data produced was incomplete (Suhartatik *et al.*, 2022). The research results at Dr. Iskak Tulungagung Hospital stated that the data generated from HMIS and EMR also could not be used as a decision support system (Aini *et al.*, 2022). In addition to software, limitations on the number and quality of hardware (Aini *et al.*, 2022), network connection instability (Odelia, 2018) as happened at Dr. Mohamad Soewandhie Hospital Surabaya, HMIS and EMR maintenance are not carried out routinely (Maulana, 2021) at Dr. Soebandi Regional General Hospital Jember. The collaboration between Dr. Soebandi General Hospital Jember and HMIS and EMR provider vendors could not overcome barriers to implementing HMIS and EMR in hospitals (Maulana, 2021).

Other in-line studies stated that the barriers to implementing HMIS and EMR based on technology factors include data quality, interoperability, security and privacy vulnerabilities, high computing

power requirements, implementation costs, and integration with existing health information technology (Durneva, Cousins and Chen, 2020; Lemma *et al.*, 2020). In addition, other inhibiting factors in the field of technology, for example, are IT infrastructure, interoperability, initial and maintenance costs, security concerns, lack of technical support, and lack of infrastructures (Wikansari and Santoso, 2022). Additionally, funding, full-time information technology expertise, and automatic data and power backups are identified as implementation barriers (Gyamfi *et al.*, 2017).

Several strategies can be considered to address barriers in implementing HMIS and EMR based on technology factors: 1) Providing adequate technical support and training to address system quality, information quality, and service quality concerns (Kruse *et al.*, 2016; AlSadrah, 2020). 2) Ensuring interoperability between different healthcare systems and EMR platforms to facilitate seamless data exchange and integration (Boonstra, Versluis and Vos, 2014; Durneva, Cousins and Chen, 2020). 3) Implementing robust security measures to address security concerns and ensure the confidentiality and integrity of medical records (Fan *et al.*, 2018; Mayer, Costa and Righi, 2019). 4) Exploring the potential of blockchain technology to enhance data security, privacy, and interoperability in EMR and health information management (Birkhead, Klompas and Shah, 2015; Bhattacharya, Singh and Hossain, 2019). 5) Utilizing smart contracts to ensure patient privacy and verify patient preferences before sharing health records (Chen *et al.*, 2021; Mani *et al.*, 2021). 6) Leveraging decentralized networks to store and manage medical records, reducing reliance on centralized organizations for data storage (Román-Belmonte, Corte-Rodríguez and Rodríguez-Merchán, 2018; Zhang, 2023). 7) Ensuring that EMR systems are user-friendly and customizable to meet the



specific needs of healthcare organizations (Folio, Machado and Dwyer, 2018; Wikansari and Santoso, 2022). 8) Implementing measures to improve the quality of clinical documentation and ensure the completeness and accuracy of medical records (Adler-Milstein *et al.*, 2015; Gyamfi *et al.*, 2017). 9) Addressing infrastructure and connectivity challenges to support the efficient operation of EMR and health information systems (Sharifi *et al.*, 2021; Ngutshane and Magida, 2022).

Impact If the Barriers Are Not Resolved

Some of the impact if these barriers are not resolved are:

- a. Delays in the mandatory implementation process of EMR for Hospitals on December 31, 2023 (Kemenkes RI, 2022b).
- b. The vulnerability of ethical and legal problems in health services in the digital era is due to unclear and lack of clear policies related to the obligation to fill HMIS and EMR. This can result in confusion and non-compliance among hospital employees. If there is a problem, hospital employees also need clear legal protection.
- c. The inability of the Hospital to integrate health data hinders coordination between units in the Hospital or with other Health Facilities, which can result in inefficiencies and redundancy of data in the process of service and management of health data.
- d. Data-driven decision-making is low due to difficulties in data access and can hinder the ability of hospitals to use data as a basis for decision-making. This can interfere with strategic planning and risk management in the health sector.
- e. Data quality limitations: Lack of data standards and interoperability and poor data quality can result in inaccurate information, harm patients, and reduce the effectiveness of treatments.

CONCLUSIONS

The conclusions that can be drawn from this research are that implementing Hospital Management Information Systems (HMIS) and Electronic Medical Records (EMR) in East Java's Hospitals offers substantial benefits. Still, there are significant human resources, organizational, and technological challenges. To overcome these Barriers, a multifaceted approach is necessary. This includes comprehensive training programs to enhance the digital skills of healthcare professionals, involving them in the design and implementation process of HMIS and EMR, and establishing regulations that mandate the use of these systems. Addressing technological limitations, ensuring system integration, improving data quality, and solving interoperability issues are also critical. Providing technical support, implementing robust security measures, and improving infrastructure and connectivity will further facilitate the adoption of these systems.

Moreover, the customization and user-friendliness of EMR systems are essential to encourage their use among healthcare providers. A commitment from all stakeholders, including hospital management and staff, is crucial for successfully implementing HMIS and EMR. Regular self-assessment of digital maturity and ongoing training for hospital staff will ensure that the systems are used effectively and continue to evolve with the changing healthcare landscape.

Some suggestions that can be given to support digital transformation in healthcare facilities, especially hospitals, are:

1. There is a joint commitment from stakeholders, namely the Ministry of Health, Ministry of Communication and Information, Local Government, Hospital Association, and Hospital Directors in the obligation to implement HMIS and EMR.
2. The hospital conducts DMI assessments independently. The results of this DMI

assessment can be used as a reference by stakeholders in providing assistance and support for accelerating the implementation of HMIS and RME in hospitals.

3. Hospitals with limited funding can use HMIS, which is free (open source). Examples of open source HMIS are the Ministry of Health's (HMIS GOS) (Kemenkes RI, 2021) or HMIS Khanza (Yaski, 2023), which has complied with interoperability standards with SatuSehat.
4. For those with sufficient funding, the Hospital can work with one of 178 vendors who have provided EMR according to interoperability standards with SatuSehat. The list of vendors can be seen at the link: <https://satusehat.kemkes.go.id/platform/system-EMR-list>

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