DOI: http://dx.doi.org/10.33846/sf16420

Human Resources, Work Culture, Leadership and Infrastructure as Aspects of Readiness for Implementing Electronic Medical Records in Dental and Oral Hospital

Brilianti Haditya Lareshya
Faculty of Medicine, Dentistry and Health Science, Universitas Prima Indonesia, Medan, Indonesia
Ermi Girsang
Faculty of Medicine, Dentistry and Health Science, Universitas Prima Indonesia, Medan, Indonesia
Sri Lestari Ramadhani Nasution
Faculty of Medicine, Dentistry and Health Science, Universitas Prima Indonesia, Medan, Indonesia;
srilestariramadhaninasution@unprimdn.ac.id (correspondence)

ABSTRACT

Electronic medical records play a crucial role in the efficiency, accuracy, and quality of service, so its implementation requires readiness from various aspects. This study aimed to analyze the readiness of electronic medical records implementation at Dental and Oral Hospital of the University of North Sumatera based on four main aspects: human resources, organizational work culture, leadership governance, and information technology infrastructure. The study was conducted at Dental and Oral Hospital of the University of North Sumatera from November to December 2024 with a quantitative analytical approach using a cross-sectional design. A sample of 71 people was selected through purposive sampling, consisting of healthcare and non-healthcare workers directly involved with the electronic medical records system. The research instrument used a questionnaire based on the DOQ-IT method and was analyzed using SmartPLS. The results showed that the readiness for implementing electronic medical records at Dental and Oral Hospital of the University of North Sumatera was in the "very ready" category, with outer loading values >0.9, Average Variance Extracted >0.5, and Composite Reliability and Cronbach's Alpha values >0.7 for all variables. In conclusion, Dental and Oral Hospital of the University of North Sumatera has a high level of readiness in implementing electronic medical records, both in terms of human resources, work culture, leadership, and infrastructure.
Keywords: electronic medical records; implementation; readiness

INTRODUCTION

A hospital is a healthcare institution that provides optimal individual healthcare services, including inpatient, outpatient, and emergency care. Based on Regulation of the Minister of Health of the Republic of Indonesia (PERMENKES RI) Number 40 of 2022, as a healthcare institution, hospital service capabilities must be supported by the availability of buildings, infrastructure, and medical equipment that meet the technical requirements for providing optimal individual healthcare services for inpatient, outpatient, and emergency care, according to hospital classification. To improve service quality, hospitals need to be supported by adequate service systems and information and communication technology, one of which is good medical records services.(1)

According to Indonesian Minister of Health Regulation Number 24 of 2022 concerning Medical Records, a medical record is a document containing data, patient identity, examinations, treatments, procedures, and other services provided to the patient. Medical records must be managed properly to improve the quality of healthcare services. Medical records management is regulated and implemented by the medical records department of each healthcare facility, which is responsible for managing medical records and health information services. The data contained in medical records can form the basis for creating a robust information system that can improve the quality of existing services.(2)

Currently, the implementation of medical records in various healthcare facilities often faces problems, including poorly stored manual medical records, misplaced medical record files, and the potential for loss or damage to paper medical records. If allowed to continue, this will hinder medical record services and hospital quality. This demonstrates that medical records personnel hold the primary key to all patient data receiving healthcare services, and therefore, their performance will determine the quality of healthcare services. From this single problem, other issues arise, such as the loss of patient files due to human error, inadequate workload, and limited space for storing patient medical records.(3)

The current development of information technology allows for the development of a method of storing and managing data electronically. Improved technology and information can have a positive impact on the pattern of development and progress in the field of file storage or archives, one of which is electronic medical records (EMR). EMR is the use of electronic methods for collecting, storing, processing, and accessing patient medical records that have been stored in a multimedia database management that records all data that is very personal and contains information about identity, examination, treatment, actions, medical data, demographics and every service in patient management in hospitals or clinics.(4)

The Indonesian Ministry of Health has stated that all healthcare facilities are required to implement EMR. These include independent physician practices, community health centers (puskesmas), clinics, pharmacies, health laboratories, and especially hospitals. This also applies to healthcare facilities that provide telemedicine. The implementation of EMR is a form of health information technology transformation that can address various manual medical record issues, such as inefficiencies in storing and providing medical records. The implementation of EMR aims to improve the quality of healthcare services, particularly in the field of medical records, making them more efficient and integrated. Healthcare facilities implement EMR as an effort to improve service quality, increase patient satisfaction, improve documentation accuracy, reduce clinical errors, and accelerate access to patient data.(5)

Implementing EMR presents numerous challenges. A survey conducted by the Indonesian Hospital Association (PERSI) found that out of 3,000 hospitals in Indonesia, only 50% have implemented electronic medical records systems. Of that percentage, only 16% are ready to effectively manage electronic medical records. This indicates that many hospitals still need to transition to electronic medical records systems and optimize the existing ones.[6] Various preparations and challenges must be overcome to successfully transform from a manual to an electronic medical records system. The primary challenge faced by management when deciding to implement an electronic medical records system is a lack of human resources (HR). Optimal medical records management is crucial for effective use of information. Without the support of human resources competent in information technology, EMR implementation will not function effectively. Furthermore, a lack of needs assessment and planning during the EMR implementation process can result in the EMR not performing as expected.[7]

Several studies have highlighted challenges in implementing EMR. A 2018 study by Pribadi et al. showed that EMR users at Kartini Hospital Jakarta were not yet ready to implement EMR. Fifty-three percent of respondents stated that EMR was too complicated to teach to new staff. This was due to a lack of training on EMR usage. Furthermore, 58.9 percent of respondents stated that EMR errors were difficult to repair.(8) Research by Ika Sudirahayu et al. in 2018 showed that human resource readiness for RME implementation at Dr. H. Abdul Moeloek Regional Hospital was in range I, with 70% of respondents indicating a lack of strong understanding of RME and its benefits. Human resources in the field of information technology are still very limited, and most officers do not yet have knowledge of RME.[9]

In its implementation, the use of this technology requires readiness so that the system can run optimally and not cause problems in the health service process. Measuring the readiness of the implementation of EHR can be done, one of which is by using the Electronic Health Record (EHR) Assessment and Readiness Starter Assessment approach by Doctor's Office Quality Information Technology (DOQ-IT) which was created by MASSPRO 2009. This DOQ-IT provides assistance with a more detailed and easier picture in assessing the readiness of the implementation of EHR by measuring aspects of human resource readiness, organizational work culture, leadership governance, and infrastructure(10). One of the hospitals that has implemented it is the Dental and Oral Hospital of the University of North Sumatra which has developed an electronic medical record-based SIMRS, but it is still in the transition period and has not been utilized optimally. RSGM USU hasHospital Management Information System (SIMRS) for RMEHowever, in its implementation in the field, many obstacles remain for users. Therefore, researchers believe it is necessary to assess the readiness of RME implementation at RSGM USU. The focus of this research is to determine the hospital's readiness for RME implementation and optimize the system to serve as evaluation material and consideration for relevant parties.

METHODS

Based on the background that has been described, this research was a quantitative analytical type with a cross-sectional approach as the research design with the research instrument beingis a questionnaire based on the DOQ-IT method. The DOQ-IT method is one method for analyzing the level of readiness for implementing an electronic medical record-based information system.[11] Located at Dental and Oral Hospital of the University of North Sumatera, this research was conducted from November 2024 to December 2024.The population used was all healthcare and non-healthcare workers related to RME at RSGM USU, totaling 109 people. However, through a purposive sampling method, a sample of 71 people was obtained.

The types of data in this study consisted of primary and secondary data. Furthermore, the data that had been successfully collected will go through four stages of data processing which is carried out computerized using the help of smart PLS SEM (Partial Least Square - Structural Equation Modeling) software. PLS is able to explain the relationship between variables and is capable of conducting analyses in a single test. The variables that formed the basis for the researcher's assessment of Dental and Oral Hospital of the University of North Sumatera readiness to implement EMR were human resources, organizational work culture, leadership governance, and IT infrastructure.

This hospital management study has been conducted in full adherence to recognized health research ethical principles. All procedures were designed to respect participant rights, ensure confidentiality, and maintain scientific integrity throughout the research process. Ethical considerations were integrated into every stage of the study, reflecting a commitment to responsible and accountable health research practice.

RESULTS

At the time of this research, medical record keeping at Dental and Oral Hospital of the University of North Sumatera was still dominated by a manual, paper-based system. Each patient had a physical medical record stored in the medical records facility. Recording of examination results, diagnoses, and procedures was still handwritten by medical staff and student assistants. However, several areas were beginning to move towards partial digitization. For example, patient registration and daily visit administration records were computerized. However, this system was not yet integrated with patient medical records or other service units.

The lack of comprehensive electronic medical records limits the efficiency, accuracy, and availability of real-time data in healthcare services. This situation indicates that the implementation of EMR at Dental and Oral Hospital of the University of North Sumatera is still in the preparatory stage and requires further readiness analysis before optimal implementation.

Based on Table 1, 70.4% of respondents were female. In terms of age group, the majority of respondents were in the 26–34 age range (38%). Only a few respondents were young (17–25 years, 1.4%) or elderly (>53 years, 9.9%). In terms of profession, the majority of respondents were dentists (54.9%), followed by nurses (26.8%). Other professions such as medical records officers, pharmacists, management/administration, and IT

contributed in small numbers. In terms of length of service, the majority of respondents had more than 10 years of work experience (43.7%), followed by those in the 1–5 years group (32.4%). This indicates that most respondents have had considerable work experience in a hospital environment.

Tabel 1. The distribution of characteristics of respondents

Demographic characteristic	Category	Frequency	Percentage
Gender	Male	21	26.6
	Female	50	70.4
Age	17-25 years	1	1.4
	26-34 years	27	38
	35-43 years	24	33.8
	44-52 years	12	16.9
	>53 years	7	9.9
Profession	Dentist	39	54.9
	Nurse	19	26.8
	IT	1	1.4
	Medical record officer	4	5.6
	Pharmacy	1	1.4
	Management/administration	3	4.2
	Other	4	5.6
Years of service	<1 year	3	4.2
	1-5 years	23	32.4
	6-10 years	14	19.7
	>10 years	31	43.7

Table 2. The results of construct validity and reliability test

	Cronbach's Alpha	Composite Reliability (CR)	Average Variance Extracted (AVE)
Organizational work culture	0.990	0.991	0.906
IT infrastructure	0.964	0.974	0.903
Readiness for RME implementation	0.971	0.977	0.895
Human Resources	0.971	0.977	0.896
Leadership Governance	0.984	0.986	0.899

Based on Table 2, all constructs have AVE values above 0.50, with the highest value found in the Organizational Work Culture construct at 0.906, followed by IT Infrastructure (0.903), Leadership Governance (0.899), Human Resources (0.896), and Readiness for ERP Implementation (0.895). This indicates that all constructs have excellent convergent validity, meaning the indicator variables are able to explain the construct significantly. Furthermore, the reliability results show that all constructs have Cronbach's Alpha and Composite Reliability (CR) values that exceed the threshold value of 0.70. The Organizational Work Culture construct recorded the highest Cronbach's Alpha value of 0.990 and a CR of 0.991, indicating very strong internal consistency between indicators in the construct. Likewise, other constructs such as IT Infrastructure ($\alpha = 0.964$; CR = 0.974), EMR Implementation Readiness ($\alpha = 0.971$; CR = 0.977), Human Resources ($\alpha = 0.971$; CR = 0.977), and Leadership Governance ($\alpha = 0.984$; CR = 0.986) also showed high reliability. Thus, it can be concluded that all constructs in this study have met the validity and reliability criteria, making them suitable for use in further structural model analysis.

Table 3. The results of significance test of the influence between variables

	Original sample	Sample mean	Standard deviation	T statistics	p-Values	R-Squares	SRMR
Organizational work culture - readiness for RME implementation	0.251	0.246	0.100	2,508	0.012	0.543	0.038
IT infrastructure - RME implementation readiness	0.284	0.284	0.098	2,897	0.004		
Human resources - Readiness for RME implementation	0.273	0.267	0.109	2,504	0.013		
Leadership governance - Readiness for RME implementation	0.248	0.241	0.088	2,821	0.005		

The significance test of the influence between variables in this study aims to examine whether the independent variables, namely organizational work culture, IT infrastructure, human resources, and leadership governance, have a significant effect on the dependent variable, namely Readiness for Implementation of RME. The significance assessment was carried out based on the t-statistics value ($t > 1.96$) and p-value ($p < 0.05$) at a significance level of 5%.

The analysis results show that organizational work culture has a positive and significant effect on Readiness for Implementing EMR with an original sample (O) value of 0.251, a t-statistic value of 2.508, and a p-value of 0.012. This value indicates that an increase in a positive work culture — such as team collaboration, strong organizational values, and a good work ethic — can directly increase an organization's readiness to adopt an EMR system. This means that if the work culture in a healthcare facility improves, then readiness for implementing EMR also tends to increase.

The IT infrastructure variable showed a significant influence on EMR implementation readiness with an original sample value of 0.284, a t-statistic of 2.897, and a p-value of 0.004. These values indicate that the availability of hardware and software, internet networks, data security, and other information technology support systems play a significant role in driving organizational readiness. Adequate IT infrastructure not only improves work efficiency but also supports the digitalization process of healthcare services, including the implementation of the EMR system.

The test results show that human resources also have a significant influence on the readiness of EMR implementation, with an original sample value of 0.273, a t-statistic of 2.504, and a p-value of 0.013. This means that technical competence, experience, training, and individual readiness to accept technological changes are important elements in the success of EMR implementation. Employees who have sufficient abilities and understanding of information systems will be better prepared to adopt changes in digital-based work systems.

The leadership governance was also shown to have a significant influence on readiness for EMR implementation, with an original sample value of 0.248, a t-statistic of 2.821, and a p-value of 0.005. These results

indicate that an effective leadership style, leadership involvement in the digitalization process, strategic decision-making, and visionary leadership can create an organizational climate conducive to change. Strong leadership is a key driver in driving institutional readiness towards the digitalization of healthcare services.

Table 4. The outer loading of indicators of human resource readiness

Indicator	Outer loading
Involvement of staff and resources in contracts with third parties	0.929
Additional staff needs for RME implementation and use	0.933
Staff criteria for project management, change, and quality improvement	0.967
Formal training as part of planning and implementation	0.961
Training program for project managers and it staff	0.943

Table 5. The outer loading of indicators of organizational work culture readiness

Indicator	Outer loading
Views on electronic medical records	0.946
Stakeholder involvement in RME planning	0.970
Involvement of medical staff in the RME process	0.964
Discussion of the framework for RME priorities	0.962
Administrative and clinical processes in RME	0.964
Policies, procedures, and protocols in RME management	0.968
System optimization in patient service management	0.929
Utilization of RME data for reporting and quality improvement	0.969
Patient interaction with RME	0.929
Patient information access and release policies and procedures	0.946
Electronic referral and prescription process	0.921

Table 6. The outer loading of indicators of leadership governance

Indicator	Outer loading
Leadership attitudes towards electronic medical records	0.932
Decision-making team work related to RME	0.935
Views on information technology in RME strategic planning	0.949
experience in strategic planning regarding the definition of quality and efficiency of RME	0.961
Involvement in product analysis, contract negotiations, and vendor relations	0.944
Management of information technology requirements	0.945
Determination of IT staff in the implementation and maintenance of RME infrastructure	0.963
The role of IT staff in RME implementation	0.955

Table 7. The outer loading of indicators of IT Infrastructure

Indicator	Outer loading
Perceptions regarding technology in electronic medical records	0.948
Funding assumption for RME acquisition and ongoing maintenance	0.946
The planning process related to the equipment requirements needed for the implementation of RME	0.964
Planning process related to technical infrastructure	0.942

All indicators have outer loading values above 0.9, which means these indicators have very high indicator reliability and significantly reflect the construct of "HR readiness." Therefore, through the table it can be seen that overall, all HR indicators show very strong outer loading values (above 0.9), which means that the human resource aspect at Dental and Oral Hospital of the University of North Sumatera has a very significant contribution in supporting the readiness of the implementation of the electronic medical record system. This readiness includes not only the quantity of personnel, but also the quality, competence, and training system that supports the digital transformation of dental and oral health services.

The outer loading results on the organizational work culture construct show that all indicators have values above the minimum threshold of 0.70 with a value range between 0.921–0.970, indicating excellent convergent validity. The indicator with the highest value is stakeholder involvement in RME planning (BKO2) with an outer loading value of 0.970, indicating that stakeholder involvement in system planning is very optimal and is a manifestation of the principle of organizational participatory planning, where all parts of the organization are involved in strategic decision-making. This strengthens the foundation of a collaborative work culture and supports the successful implementation of the new system. Meanwhile, the indicator with the lowest value is the electronic referral and prescription process (BKO11) with an outer loading value of 0.921, although it still shows a significant contribution and can be influenced by external readiness such as inter-institutional integration or support from referral facilities and partner pharmacies. Overall, these results indicate that the organizational work culture has strongly supported the implementation of RME with a very good level of readiness in all aspects of work culture measured.

The outer loading on the leadership governance construct show that all indicators have values above the minimum threshold of 0.70 with a value range between 0.932–0.963, indicating excellent convergent validity. The indicator with the highest value is the assignment of IT staff in the implementation and maintenance of RME infrastructure (TK7) with an outer loading value of 0.963, which emphasizes the importance of leadership decisions in managing human resources in the IT sector. The right decisions in assigning IT staff have a direct impact on the smooth operation of the system, infrastructure resilience, and ease of end-user adaptation. Meanwhile, the indicator with the lowest value is the leadership attitude towards electronic medical records (TK1) with an outer loading value of 0.932, although it still shows a very strong contribution in reflecting the leadership's positive perception which is crucial for forming the institution's commitment and readiness in adopting the RME system. Overall, these results indicate that leadership governance has strongly supported the implementation of RME with a very good level of readiness in all aspects of leadership measured.

The outer loading results on the infrastructure construct show that all indicators have values above the minimum threshold of 0.70 with a value range between 0.942–0.964, indicating excellent convergent validity. The indicator with the highest value is the planning process related to the device requirements required for the implementation of RME with an outer loading value of 0.964, which confirms that hardware and software planning, starting from computer specifications, servers, networks, to input/output devices, greatly determines the

technical readiness of an institution in implementing the RME system. Thorough planning reflects good project management and an understanding of the operational needs of service units. Meanwhile, the indicator with the lowest value is the planning process related to technical infrastructure with an outer loading value of 0.942, although it still shows a very strong contribution in assessing the readiness of technical aspects such as internet network availability, data security systems, and other technological support. Overall, these results indicate that the infrastructure has strongly supported the implementation of RME with a very good level of readiness in all infrastructure aspects measured.

DISCUSSION

The characteristics of the respondents in this study describe the profile of healthcare workers and support staff working at Dental and Oral Hospital of the University of North Sumatera and who are part of the healthcare system, particularly those involved in medical record keeping. Based on gender, the majority of respondents were female (70.4%). This composition reflects the general reality in healthcare facilities, where females predominate, particularly in professions such as nursing and dentistry.

In terms of age, the largest number of respondents were in the 26–34 age range (38%). This composition indicates that the majority of respondents were in the productive age range, which generally has optimal work capacity and sufficient experience in understanding hospital work systems. This is important in the context of this study, as their perceptions and assessments of the institution's readiness to implement EMR are considered credible.

In terms of profession, the respondents were dominated by medical personnel, namely dentists (54.9%) and nurses (26.8%). The remainder came from other professions that also support hospital operations, such as medical records officers (5.6%), management/administration (4.2%), and IT and pharmacy professionals, each with 1.4%. The "other" group accounted for 5.6%. This composition reflects that the majority of respondents are directly involved in patient care and medical information management, thus having a close relationship with the EMR system.

Based on length of service, respondents with more than 10 years of work experience constituted the largest group, at 43.7%. This was followed by those with 1–5 years of work experience at 32.4%, and those with 6–10 years of work experience at 19.7%. Only 4.2% of respondents had less than a year of service. The majority of respondents with long service experience indicated that they had been involved in the hospital work system for a long time, understood operational dynamics, and potentially had a comprehensive perception of the organization's readiness to adopt digital systems such as EMR. Overall, the characteristics of the respondents in this study indicate that the data were obtained from relevant and representative sources. The diversity of professions, work experience, and age strengthened the quality of the data collected and supported the validity of the research results in describing the institution's readiness to implement Electronic Medical Records.

Human resource readiness is a fundamental aspect in the implementation of the EMR system. Without a workforce that is both technically and psychologically prepared, the digital transformation in recording and managing medical records will face many obstacles. Based on the results of the outer loading analysis, each indicator represents the construct very well. This is reinforced by the AVE and construct reliability which indicates very strong convergent validity and reliability. The HR readiness variable shows very good validity and reliability results. The Average Variance Extracted (AVE) value of 0.896 indicates that the indicators in this construct are able to explain almost 90% of the construct's variance, exceeding the minimum threshold of 0.50. This demonstrates that the Human Resource Readiness construct in this study is reliable in measuring respondents' perceptions of individual readiness to face the implementation of EMR.[12]

Discriminant validity was tested using the Fornell & Larcker approach. Based on Fornell & Larcker's results, the square root of the AVE of Human Resource Readiness was 0.947, higher than its correlation with other constructs such as RME Readiness (0.522) and Leadership Governance (0.327). This indicates that this construct is empirically distinct from the other constructs.[13] In testing the influence between variables, Human Resource Readiness had a path coefficient of 0.273 with a T-statistic of 2.504 and a p-value <0.05, indicating statistical significance. The results of this study indicate that the assessment of readiness for RME implementation using the DOQ-IT method at Dental and Oral Hospital of the University of North Sumatera yielded a moderately prepared result in the HR aspect. These results align with the research by Ningsih et al. in 2021, which obtained a moderately prepared result in the HR aspect. Human Resource readiness in RME implementation significantly influences RME development, as HR plays a role as both a user and a policy maker. The quality of human resources needs to be considered to maintain the quality of health services. These human resources include medical and administrative staff, as well as management staff.[14]

Factors influencing human resource quality include age and length of service. Age also influences the quality and readiness of human resources. The results of this study indicate that the characteristics of human resources based on age are highest, namely, those aged 26-34 years, at 27%, who are of productive age. This indicates that productive age has a significant influence on a person's performance, in this case, performance in implementing RME. The performance ability of staff or employees to operate a computer or adapt to technological advances is a crucial component to support the development and acceleration of RME implementation.24,8 Length of service, as a form of experience, will also influence the quality and readiness of human resources. In this study, the majority of respondents at the Dental and Oral Hospital of the University of North Sumatera had a service period of ≥10 years, namely 31 out of 71 respondents. Human resources with a service period of ≥5 years have better skills and experience compared to those with a service period of <5 years.28

This also indicates that technically and mentally prepared human resources will have a positive impact on the readiness of RME implementation.[15] These results align with prior research which found that individual readiness, including technological understanding and willingness to change, significantly influences the

acceptance of digital systems in hospitals.[16] Research by Azizah et al. (2019) also supports these findings, where digital training and experience for healthcare workers increased readiness and reduced resistance to new systems.[17] These findings emphasize the importance of hospital investment in human resource development through training, workshops, and organizational behavior change strategies. RME implementation is not only about the availability of technology, but also the readiness of the people who implement it. The management of RSGM USU needs to consider increasing digital literacy and active human resource involvement as key strategies in the comprehensive and sustainable implementation of RME.

Organizational work culture readiness is a crucial factor in supporting the successful implementation of EMR. Work culture encompasses the organization's perspective on digital change, stakeholder engagement, and procedural and administrative readiness to support the implementation of the new system. Measurement results show that all indicators strongly represent the construct. The highest loading value is found in the indicator stakeholder involvement in EMR planning, followed by utilization of EMR data for reporting and quality improvement and policies, procedures, and protocols in EMR management. This indicates that the organizational work culture has been well established to support digital information systems.

In terms of convergent validity, more than 90% of the indicator variance can be explained by this construct.[12] In addition, the results of construct reliability indicates that the indicators in this construct have very high internal consistency. For discriminant validity, the test results using the Fornell & Larcker criteria show that the square root of the AVE for organizational work culture is 0.952, higher than the correlation with all other constructs, including the readiness for implementation of ERM (0.507).

In testing the influence between variables, organizational work culture readiness had a path coefficient of 0.251 with a T-statistic of 2.508 and a p-value <0.05, indicating statistical significance. The results of this study indicate that the assessment of readiness for implementing RME using the DOQ-IT method yielded a moderately prepared result in terms of organizational work culture. This finding aligns with a study by Bhayza et al. in 2024, which found a moderately prepared result in terms of culture. The study found that RSUD Kajen already has a SIMRS (Symposium on Health Services) for its health services and has involved PPA (Public Health Officers) in completing the RME.[2] This research aligns with previous studies showing that an organizational culture that supports digital transformation will facilitate the adoption of health technology. According to Alami et al. (2021), active stakeholder involvement, internal policy formation, and a shared understanding of digitalization goals are essential foundations for organizational cultural readiness to implement an RME system.[18] Another study by Ratna & Budi (2022) also emphasized the importance of medical staff participation and strengthening administrative processes as part of organizational readiness in the era of digitalized healthcare services.[19]

Overall, the high scores obtained from all measurement tests indicate that the organizational work culture at Dental and Oral Hospital of the University of North Sumatera is well prepared to support the implementation of RME, both in terms of structure, process, and collaborative values. This provides a strong foundation for the continued implementation of an effective and efficient RME system.[12] Staff have understood that the implementation of RME will provide benefits and support the quality of health services. Staff understand that RME will integrate data from all departments to support clinical decision-making. In the RME planning process, all staff have been involved, especially the PPA who will fill out the RME has been involved in planning the RME content. Staff must adapt and improve their skills in using technology. Training and familiarization with computer entry need to be carried out over time to change the work culture or work habits.

Leadership governance is a critical component in organizational readiness to implement EMR. Effective leadership can direct the digital vision, create cross-functional coordination, and ensure commitment to the use of technology in healthcare. All indicators in this construct have outer loading values above 0.90, indicating the indicator's strength in representing the variable. The highest value was found in the indicator of IT staff assignment in the implementation and maintenance of EMR infrastructure, followed by experience in strategic planning regarding the definition of EMR quality and efficiency, and the role of IT staff in EMR implementation. This indicates that managerial aspects and leadership involvement in strategic and technical activities play a significant role in governance readiness.

From the results of construct validity and reliability testing, all of values exceed the ideal threshold, indicating that this construct has excellent convergent validity and reliability. Internal consistency between indicators is very high, meaning all items coherently measure the same dimension. In terms of discriminant validity, the square root of the AVE is higher than the correlation with all other constructs, for example, the highest correlation with the EMR implementation readiness variable of 0.494. This confirms that this construct can be clearly distinguished from other variables.

The results of this study indicate that the assessment of readiness for EMR implementation using the DOQ-IT method obtained a fairly ready result in the leadership governance aspect. This study is in line with the research of Ningsih et al. in 2021, which obtained a fairly ready result and the highest score in the leadership governance aspect. This indicates that there is support from hospital leadership for developing EMR. In compliance with the Minister of Health Regulation Number 24 of 2022 concerning Medical Records, Dental and Oral Hospital of the University of North Sumatera has committed to implementing EMR.[20] This study is inconsistent with the research of Susilo et al. in 2024, which obtained a very ready result in leadership governance. The study explained that the leadership of RSUD dr. Rasidin Padang had conducted socialization and training before implementing EMR. Active support and leadership involvement are considered crucial to the success of RME implementation.[21] The role of leadership in the success of health information systems has been emphasized in various literature. According to Kruse et al. (2016), leadership involvement in strategic decision-making, vendor relationships, and IT infrastructure oversight is crucial in accelerating the successful adoption of EMR.[22] Furthermore, a study by Al-Kahtani and Alshahrani (2021) also stated that the success of EMR implementation is greatly influenced by the level of support, understanding, and initiative from organizational leaders.[23]

During the planning process, the Director of RSGM USU, as the leader, had set goals. However, the planning process was not optimal, such as scheduling meetings and training for staff. Staff training was still less than optimal because it was only conducted as a socialization session without any training, resulting in some staff not fully understanding the preparation for EMR implementation. According to Faida & Ali (2021), leadership support and commitment will influence the EMR implementation process. Leadership must be involved throughout the implementation process, and strong managers and clinical staff leaders are needed. Leadership with a policy will influence the success of EMR implementation. This is due to the strong motivation and enthusiasm of staff in implementing EMR.[24]

Information technology (IT) infrastructure is a crucial foundation for the readiness of implementing an EMR system. Adequate infrastructure includes hardware, software, networks, as well as financial resources and supporting policies that can ensure the smooth operation of the health information system. The indicators in the IT Infrastructure construct show very strong outer loading results, all above 0.94. The indicator with the highest value is the planning process related to equipment requirements, followed by Perceptions related to technology in the EMR, perceptions of funds for acquisition and ongoing maintenance and technical infrastructure planning. This indicates that all four indicators significantly represent the IT infrastructure construct, with significant attention paid to planning and funding readiness.

The results of the validity and reliability tests show that all of these values meet the threshold which indicates that the indicators have high internal consistency and are able to explain the construct convergently very well. The IT infrastructure construct can be empirically distinguished from other constructs. In testing the influence between variables, IT infrastructure readiness had a path coefficient of 0.284 with a T-statistic of 2.897, indicating statistical significance. The results of this study indicate that the assessment of the readiness of RME implementation using the DOQ-IT method obtained a fairly ready result in the IT infrastructure aspect. This study is consistent with the research of Ningsih et al. in 2023, which obtained a fairly ready result in the information technology infrastructure aspect. This study indicates the availability of a form of commitment from the leadership in the RME infrastructure development stage, by considering infrastructure development requirements to ensure data security, privacy, and data interoperability.[13]

Readiness in information technology infrastructure aspects relates to finances and budgets, as well as the IT infrastructure in healthcare facilities. According to Faida & Ali (2021), implementing EMR requires significant costs and a lengthy planning process. Financial aspects are a crucial element in preparing technological infrastructure, such as computers, networks, electricity, security systems, training, and so on. Limited finances or budgets will impact the development of IT infrastructure.[11] For EMR to improve the quality of healthcare services, adequate and optimal information technology infrastructure is required. IT infrastructure development must address data security, privacy assurance, and accountability. According to Praptana et al. (2021), this can be supported by establishing a security team, assessing risks, developing standard operating procedures, conducting training, and conducting monitoring. An interface design process is necessary to ensure user-friendly RME applications. Data and power backup systems, including redundant or uninterruptible power supplies, should also be prepared to anticipate data loss.[25]

Previous research also emphasized the importance of infrastructure readiness as a determining factor in the success of EMR adoption. According to Boonstra et al. (2014), infrastructure constraints are often a major obstacle in the initial phase of digital system implementation in hospitals, particularly in terms of networks, devices, and funding sustainability.[26] Furthermore, Bahadori et al. (2021) emphasized that management's understanding of the importance of IT planning and investment significantly influences the success of electronic system implementation.[27] These results indicate that Dental and Oral Hospital of the University of North Sumatera has a very positive perception of IT infrastructure readiness for EMR implementation. In terms of budget, Dental and Oral Hospital of the University of North Sumatera has allocated a special budget to ensure optimal planning and implementation of EMR. Staff understand that EMR is an investment and requires long-term maintenance. In terms of information technology infrastructure, Dental and Oral Hospital of the University of North Sumatera has prepared computers and hardware components as needed, such as keyboards, mice, CPUs, and so on. For software components, such as the RME application, Dental and Oral Hospital of the University of North Sumatera collaborates with a third party or vendor to create and develop its RME application. The vendor that collaborates with RSGM USU is cek.id.

Readiness for EMR implementation is the primary dependent variable in this study and is the focus of the evaluation to assess the extent to which the Dental and Oral Hospital of the University of North Sumatera is ready to implement an EMR system comprehensively and sustainably. Statistical analysis results indicate that this variable has very high validity and reliability. Each indicator is able to explain this variable very strongly. The measurement instrument for this variable is highly reliable and consistent in measuring EMR implementation readiness. In general, the indicators used successfully reflect organizational readiness in various aspects, ranging from system readiness, managerial structure, policies, and human resource involvement in the digital transformation of medical records. The EMR implementation readiness variable has a unique identity and does not overlap conceptually with other variables such as human resource readiness, organizational work culture, leadership governance, and information technology infrastructure. Thus, statistically and conceptually, EMR implementation readiness can be said to be a valid and stand-alone construct as the end result of the contribution of various dimensions of organizational readiness. Path analysis shows that all independent variables have a significant influence on EMR implementation readiness, with the greatest influence being given by the IT infrastructure variable, followed by organizational work culture, human resource readiness, and leadership governance. This finding confirms that a healthcare institution's readiness to adopt an EMR system is highly dependent on managerial strength and strong leadership commitment, which is then strengthened by an organizational culture that supports innovation, staff readiness to use new systems, and adequate technological infrastructure support. In the context of Dental and Oral Hospital of the University of North Sumatera, high values

of the indicators in this variable reflect that the organization has a strong enough foundation to continue the RME implementation process, although of course continuous evaluation and strengthening are still needed.

Theoretically, these findings align with previous studies that emphasize the importance of systemic readiness in implementing health information systems. Kruse et al. (2016) in their systematic review stated that the success of EMR adoption is highly dependent on overall organizational readiness, not just technological readiness. They also highlighted the importance of management involvement and the existence of policies that support digital change as driving factors for successful EMR implementation.[22] Meanwhile, Cresswell and Sheikh (2013) emphasized that organizational aspects and institutional adaptation processes are crucial factors in ensuring the sustainability and success of digital systems in the healthcare sector, including EMR.[28] Similar support was provided by Gagnon et al. (2012), who found that top management support and staff involvement were significant predictors of organizational readiness to adopt health information systems.[29]

Furthermore, this aspect of implementation readiness is also influenced by external factors such as the regulatory environment, market pressures, and vendor readiness to provide appropriate system support. A study by Khoja et al. (2012) highlighted the importance of holistic institutional readiness in the context of developing countries, where resource constraints are often a major challenge.[30] Furthermore, the HOT-fit (Human, Organization, Technology-fit) evaluation framework developed by Yusof et al. (2008) supports that organizational readiness for health information systems must consider the fit between people, organization, and technology in an integrated manner. Based on quantitative data and strong theoretical support, it can be concluded that Dental and Oral Hospital of the University of North Sumatera demonstrates excellent readiness in the aspect of implementing EMR. However, this readiness is not the final goal, but rather the starting point for an implementation process that must be carried out in stages, structured, and oriented towards sustainability. To maintain and improve this readiness, a strategic approach is needed to strengthen IT governance, continuous HR training, and periodic evaluation of systems and procedures that support the effective and efficient use of EMR. The current readiness can serve as a strong foundation for Dental and Oral Hospital of the University of North Sumatera in realizing digital transformation in the field of comprehensive dental and oral health services.

CONCLUSION

Based on the research results regarding the readiness of EMR implementation at Dental and Oral Hospital of the University of North Sumatera, it can be concluded that the organization generally demonstrates a good level of readiness. This is demonstrated by the results of construct validity and reliability testing, which show that all indicators in the variables of human resources, organizational work culture, leadership governance, and IT infrastructure have high validity and reliability. It is also known that the four variables have a significant effect on the readiness of RME implementation.

REFERENCES

1. Yoga V. Analisis kesiapan penerapan rekam medis elektronik di RSUP dr. M. Djamil Padang. Universitas Andalas; 2020.
2. Bhayza EZP, Subinarto S. Analisis kesiapan pelaksanaan rekam medis elektronik dengan metode Doctor's Office Quality-Information Technology (DOQ-IT) di Rumah Sakit Umum Daerah Kajen Kabupaten Pekalonga. J Rekam Medis dan Inf Kesehat. 2024;7(1):40–52.
3. Larasugiharti T. Persiapan integrasi sistem rekam medis manual ke sistem rekam medis elektronik di RS Puri Asih Karawang. J Manaj Kesehat Yayasan RS Dr Soetomo. 2023;9(2):2019–231.
4. Pujihastuti I. Prinsip penulisan kuesioner penelitian. CEFARS: Jurnal Agribisnis dan Pengembangan Wilayah. 2010;2(1):43-56.
5. Habibah AN. Penerapan rekam medis elektronik di fasilitas kesehatan di Indonesia. Jakarta: Kemenkes RI; 2023.
6. Kemenkes RI. Penerapan rekam medis elektronik di fasilitas kesehatan di Indonesia. Jakarta: Kemenkes RI; 2023.
7. Wirajaya MKM, Dewi NMUK. Analisis kesiapan Rumah Sakit Dharma Kerti Tabanan Menerapkan Rekam Medis Elektronik. J Kesehat Vokasional. 2020;5(1):1–9.
8. Pribadi Y, Dewi S, Kusumanto H. Analisis kesiapan penerapan rekam medis elektronik di Kartini Hospital Jakarta. J Bid Ilmu Kesehat. 2018;8(2):19.
9. Sudirahayu I, Harjoko A. Analisis kesiapan penerapan rekam medis elektronik menggunakan DOQ-IT di RSUD Dr. H. Abdul Moeloek Lampung. J Inf Syst Public Heal. 2016;1(3).
10. Khumaira NF, Wahyuni A, Mardi Y. Analysis of preparations for the implementation of electronic medical records at RSJ Prof HB Saanin Padang using THE DOQ-IT Method. Iris J Heal Inf Manag. 2023;3(2):21–9.
11. Faida EW, Ali A. Analisis kesiapan implementasi rekam medis elektronik dengan pendekatan DOQ-IT (Doctor's Office Quality-Information Technology). J Manaj Inf Kesehat Indones. 2021;9(1):67.
12. Hair JF. A primer on partial least squares structural equation modeling (PLS-SEM). Sage. 2014;8(2):42-48.
13. Henseler J, Ringle CM, Sarstedt M. A new criterion for assessing discriminant validity in variance-based structural equation modeling. J Acad Mark Sci. 2015;43(1):115–35.
14. Ningsih KP, Pramono AE, Prahesti R, Purwanti E, Santoso S. Pendampingan kesiapan pengembangan rekam medis elektronik dengan pendekatan DOQ-IT di RSUD Wates. Metode. Report. 2021;8(2):%2-58.
15. Ghozali I, Latan H. Partial least squares: konsep, teknik dan aplikasi menggunakan program SmartPLS 3.0.. Semarang: Badan Penerbitan Universitas Diponegoro; 2015.
16. Setiawan D, Alamsyah D, Hartati S. Human resource readiness in the implementation of electronic medical records in health services. J Sist Inf Kesehat Indones. 2020;8(2):135–44.

17. Azizah LN, Rahayu D, Nugroho HSW. The role of training in improving the readiness of medical staff in implementing electronic medical record systems. J Adm Kesehat Indones. 2019;7(1):25–33.
18. Alami H, Lehoux P, Gagnon MP. Organizational readiness for change in the implementation of electronic medical records in healthcare: A systematic review. BMC Health Serv Res. 2021;21(1):1–14.
19. Ratna, S. M., & Budi EP. Kesiapan budaya organisasi dalam implementasi rekam medis elektronik di rumah sakit. J Manaj Inf Kesehat Indones. 2022;10(1):45–53.
20. FKG USU. Rumah sakit gigi dan mulut USU. Medan: FKG USU; 2023.
21. Hair JF, Hult GTM, Ringle CM, Sarstedt M. A primer on Partial Least Squares Structural Equation Modeling (PLS-SEM). SAGE Publications; 2020.
22. Kruse CS, Kristof C, Jones B, Mitchell E, Martinez A. Barriers to electronic health record adoption: a systematic literature review. J Med Syst. 2016;40(12):252.
23. Al-Kahtani NH, Alshahrani MA. Leadership factors influencing successful implementation of health information systems: A systematic review. Heal Inf Sci Syst. 2021;9(1):1–10.
24. Faida EW, Ali A. Analisis kesiapan implementasi rekam medis elektronik dengan pendekatan DOQ-IT (Doctorâ€™s Office Quality-Information Technology). J Manaj Inf Kesehat Indones. 2021;9(1):67.
25. Praptana, Ningsih KP, Santoso S, Sevtiyani I. Pendampingan penilaian kesiapan penerapan rekam medis elektronik menggunakan metode DOQ-IT di RS Condong Catur Sleman. J Innov Community Empower. 2021;3(2):98–104.
26. Boonstra A, Versluis A, Vos JFJ. Implementing electronic health records in hospitals: a systematic literature review. BMC Health Serv Res. 2014;14(1):370.
27. Bahadori, M., Ravangard, R., Asgari, H., & Hosseini SM. Assessment of readiness of hospitals affiliated to Tehran University of Medical Sciences in using electronic health records. Acta Inform Medica. 2021;29(2):132–6.
28. Cresswell K, Sheikh A. Organizational issues in the implementation and adoption of health information technology innovations: an interpretative review. Int J Med Inform. 2013;82(5):e73–86.
29. Gagnon MP, Desmartis M, Labrecque M, Car J, Pagliari C, Pluye P, et al. Systematic review of factors influencing the adoption of information and communication technologies by healthcare professionals. J Med Syst. 2012;36(1):241–77.
30. Khoja S, Scott RE, Casebeer AL, Mohsin M, Ishaq AFM, Gilani S. e-Health readiness assessment tools for healthcare institutions in developing countries. Telemed e-Health. 2007;13(4):425–32.