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Analysis of factors influencing the readiness of implementing electronic medical records at Oputa Yi Koo Heart and Blood Vessel Hospital Southeast Sulawesi Province

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Abstract

Introduction: Analysis related to the readiness of the implementation of Electronic Medical Records (EMR) needs to be carried out, because the readiness assessment will help identify the process and priority scale, as well as help establish operational functions to support the optimization of the implementation of electronic medical records in hospitals.

Objective: To analyze factors influencing the readiness of implementing electronic medical records using the DOQ-IT method at Oputa Yi Koo Heart and Blood Vessel Hospital.

Method: Quantitative research type with *cross sectional research design* . The study population consisted of 154 employees of Oputa Yi Koo Heart and Blood Vessel Hospital who already had RME *user ID* . The research sample was taken using *simple random sampling technique* totaling 111 respondents. Data collection was carried out by distributing questionnaires, and data were analyzed using univariate, bivariate (using the *Pearson correlation test*), and multivariate (multiple linear regression) techniques.

Results: The results of the study indicate that the human resources aspect, organizational work culture aspect, leadership governance aspect, and infrastructure aspect have a positive and significant effect on the readiness variable for implementing electronic medical records at the Oputa Yi Koo Heart and Blood Vessel Hospital, Southeast Sulawesi Province. Based on the results of the regression analysis, the variable that has the most influence on the readiness for implementing electronic medical records (EMR) is the infrastructure aspect as indicated by the largest regression coefficient value (r) compared to other variables, namely r = 0.692.

Conclusion: The aspects of human resources, organizational work culture, leadership governance, and infrastructure have a positive and significant effect on the readiness of implementing electronic medical records at the Oputa Yi Koo Heart and Blood Vessel Hospital, Southeast Sulawesi Province. The infrastructure aspect has a greater influence compared to the other three aspects.

Keywords: Readiness; Electronic Medical Records; DOQ-IT (Doctor's office Quality information Technology); Hospital; Information Technology

1. Introduction

The development of science and technology has driven transformation in various areas of human life, including the health sector. The use of electronic information and communication technology (ICT) in the health service system is

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increasing globally. One of them is the implementation of the electronic medical record (EMR) system [1] . Electronic Medical Records is one of the electronic medical care applications as a step in the digital transformation of health, currently the focus of transformation of various medical institutions around the world.

Electronic medical records are a data collection system based on recording patient and health information run by computer software applications. Computerized files will facilitate the process of searching, retrieving, and managing data. The process carried out will benefit health services quickly and accurately, so that if you need a history of patient health data for medical action, it can be carried out quickly [2] . Electronic medical records are referred to as a way to improve the quality of health services with workflow, reduce medical errors, reduce costs and treatment time, increase revenue, improve patient care by creating better relationships with all health workers, and reduce the need for file space, equipment, and workers for retrieval and archiving of medical records [3] .

The development of electronic medical records in the world, especially in developed countries, is very rapid. Electronic medical records were first used in a hospital in America in 1967, then developed in other countries including Asian countries, especially Southeast Asia [4] . In 2004, all American states had used electronic systems for documenting public health with an adoption rate of 93% [5] . Denmark has implemented electronic medical records since the mid-1990s [6] . The adoption of electronic medical records in Japan was implemented starting in 2000 [7] . Meanwhile in South Korea, since 2015 to 2022, most hospitals have implemented electronic medical record systems [8] .

Realizing the great potential of electronic medical records in improving the quality of health services, on September 12, 2022, the Ministry of Health of the Republic of Indonesia issued the Minister of Health Regulation (PMK) Number 24 of 2022 concerning Medical Records. This regulation stipulates that all health care facilities must implement electronic medical records no later than December 31, 2023. In addition, the electronic medical record system in each health care facility is required to be integrated with the Satu Sehat application. Through Satu Sehat, data recorded electronically through electronic medical records in the Health Center Management Information System (SIMPUS) and the Hospital Management Information System (SIMRS), ranging from visit information to patient diagnosis, can be transferred between health institutions with the consent of the data owner (Ministry of Health of the Republic of Indonesia, 2022). Administrative sanctions will be given, either a written warning or a recommendation to revoke or revoke accreditation status if the health care facility does not implement these regulations [9] .

Based on the results of the Indonesian Hospital Association (PERSI) Survey in March 2022, it showed that of the 3,000 hospitals in Indonesia, 50% had implemented electronic medical records, but only 16% had implemented them comprehensively. In terms of technology, infrastructure readiness was only 40% of hospitals that felt their condition was good [10] . In 2023, 768 hospitals had implemented electronic medical records in six services (Registration, Inpatient, Outpatient, Emergency Installation, Support Unit, Pharmacy). There were eight provinces that had not implemented electronic medical records, namely NTT, West Sulawesi, Maluku, North Maluku, Papua, South Papua, Central Papua, and Papua Pegunungan. Of the 3.138 hospitals surveyed, 768 (24.5%) hospitals have fully implemented EMR, 1.225 (39%) hospitals have partially implemented EMR, that is, EMR is used in at least three services out of a total of six services, and 1.145 (36.5%) hospitals have not implemented EMR [11] . Based on data from the Southeast Sulawesi provincial health office, of the total 39 hospitals, 9 (23%) hospitals have fully used EMR, 29 (74%) hospitals have partially implemented EMR and 1 (3%) hospital has not implemented EMR because it is a new hospital and is still in the planning process [12] .

To carry out the mandate in PMK Number 24 of 2022 concerning Medical Records, maximum preparation is needed so that the implementation of RME can avoid obstacles or problems in its implementation [10] . The aspects that need to be analyzed related to the implementation of RME such as aspects of human resources (HR), organizational work culture, leadership governance, and information technology infrastructure [13] . These aspects can be analyzed using *the Doctor's Office Quality-Information Technology* (DOQ- IT) method. DOQ-IT is an appropriate method to use, this is because DOQ-IT was developed to support the implementation of an electronic health information system . DOQ-IT is a method to measure the readiness of a health service facility or region in implementing electronic medical records. This method was developed by MASSPRO since 2009. Readiness assessment will help identify processes and priority scales, as well as help form operational functions to support the optimization of the implementation of electronic medical records. Measurement of readiness for implementation of electronic medical records using the DOQ-IT method is carried out on four main aspects of the organization, namely human resources, organizational work culture, leadership governance, and information technology infrastructure, where if there is a lack of readiness in these aspects, the implementation of electronic medical records will not be optimal [14] .

RSJPD Oputa Yi Koo continues to develop information technology support to support the Ministry of Health's Strategic Plan for 2020-2024, one of which is to organize the digitization of medical records so that it can provide effective and

efficient health services to patients. In line with the Regulation of the Minister of Health Number 24 of 2022 which requires all hospitals in Indonesia to implement RME, in August 2024 RSJPD Oputa Yi Koo collaborated with one of *the vendors* , namely SIMRS RME Khanza. SIMRS RME Khanza was developed by the Khanza Foundation using open source code, so that it can be developed independently by the hospital's IT team. As an initial step, on August 31, 2024, socialization and training of SIMRS RME was carried out for *users*, followed by an initial trial of SIMRS RME on September 27, 2024.

The implementation of SIMRS based on EMR will be able to help improve services if it is well designed, but it can also worsen services if it is not prepared properly. Readiness analysis is one way to explore the potential causes of failure of an innovation. Therefore, it is necessary to carry out a readiness assessment before implementing EMR. This will help identify processes based on priorities and be useful in forming operational functions to create optimal EMR. Readiness assessments must include human resources, organizational work culture, governance and leadership, and infrastructure. In this regard, researchers are interested in conducting a study entitled " Analysis of Factors Influencing the Readiness of Implementing Electronic Medical Records (EMR) Using the DOQ-IT Method at the Oputa Yi Koo Heart and Blood Vessel Hospital, Southeast Sulawesi Province in 2024"

2. Material and methods

The type of research used is quantitative research using a *cross-sectional research design* . This research was conducted at the Oputa Yi Koo Heart and Blood Vessel Hospital, Southeast Sulawesi Province from October to December 2024. The population in this study were all employees of the Oputa Yi Koo RSJPD who had an RME *user ID,* which was 154 people. The determination of the sample size was determined using the Slovin formula, so that a sample of 111 respondents was obtained. The sampling technique used in this study was the *simple random sampling technique,* namely the technique of determining the sample using a random system or in lots, so that all RME *users* at the Oputa Yi Koo RSJPD have an equal opportunity to be selected as samples. With the inclusion criteria, namely employees of the Oputa Yi Koo RSJPD and have *a user ID,* while the exclusion criteria were if they were not willing to be respondents and respondents were on leave or sick when this study was conducted.

This study uses primary and secondary data sources. Primary data were obtained through the distribution of questionnaires to respondents. The questionnaire is a modification of the DOQ-IT (*Doctor's Office Quality- Information Technology*) which has been valid and reliable to measure hospital readiness in implementing electronic medical records. The questionnaire used consists of 2 (two) parts, the first part is about the respondent profile, the second part contains statements that have been adjusted to the scoring of *the Electronic Health Record (EHR) Assessment and* readiness assessment *by* DOQ-IT, with indicators including HR readiness, organizational work culture readiness, leadership governance readiness and infrastructure readiness. The higher the score, the higher the level of readiness for each element.

3. Results

This study used 111 research respondents to assess the readiness of Oputa Yi Koo Heart and Blood Vessel Hospital in implementing electronic medical records. The description of the socio-demographic characteristics of the respondents will be shown in the following table.

Table 1 Socio-Demographic Characteristics of Research Respondents

No.	Socio-Demographic Characteristics	Frequency	%
1	Gender		
	Man	27	24 %
	Woman	84	76%
2	Age		
	17-25 years	14	13 %
	26-34 years	44	40%
	35-43 years	43	39%

	44-52 years	8	7 %
	53-60 years	2	1 %
3	Level of education		
	Diploma	29	26.1 %
	S1	78	70.3 %
	S2	4	3.6 %
4	Profession		
	Doctor	9	8.1 %
	Nurse	46	41.4 %
	Midwife	8	7.2 %
	Pharmacy Officer	10	9 %
	Radiology Officer	3	2.7 %
	Laboratory Officer	5	4.5 %
	Nutrition Officer	7	6.3 %
	Medical Records/Admissions Officer	16	14.4 %
	IT Officer / Sisfo (Information Systems)	7	6.3 %
5	Years of service		
	< 1 year	3	3 %
	1-5 years	51	46 %
	> 5 years	57	51%

Based on Table 1 above, it can be seen that most of the research respondents are women, namely 76% and most are also in the age range of 26 to 34 years, namely 40%. In terms of education level, most of them are from the Bachelor's degree (S1) level, namely 70.3% and in terms of profession, most are nurses, namely 41.4%. In terms of work period, most of the respondents' work period is more than 5 years, namely 51%.

The results of hospital readiness reviewed from each variable are as follows:

Table 2 Readiness for Implementing Electronic Medical Records

No.	**Readiness for RME Implementation**	**Frequency**	**%**
1	Human Resources Readiness		
	Not ready	1	0.9 %
	Enough Ready	33	29.7 %
	Very ready	77	69.4 %
2	Organizational Work Culture Readiness		
	Not ready	8	7.2 %
	Enough Ready	46	41.4 %
	Very ready	57	51.4 %
3	Leadership Governance Readiness		
	Not ready	0	0 %

	Enough Ready	35	31.5 %
	Very ready	76	68.5 %
4	Infrastructure Readiness		
	Not ready	2	1.8 %
	Enough Ready	34	30.6 %
	Very ready	75	67.6 %

Based on table 2 above, it can be seen that RSJPD Oputa Yi Koo is very ready in terms of human resources (HR) related to the readiness of implementing electronic medical records, namely 69.4%. Judging from the components of organizational work culture readiness, RSJPD Oputa Yi Koo is very ready in terms of the readiness of implementing electronic medical records, namely 51.4% and in terms of leadership governance, RSJPD Oputa Yi Koo is very ready in terms of leadership governance related to the readiness of implementing electronic medical records, namely 68.5%. In addition, in terms of infrastructure, RSJPD Oputa Yi Koo is very ready in terms of infrastructure related to the readiness of implementing electronic medical records, namely 67.6%.

The readiness of the implementation of electronic medical records must also be seen from the value of each component which is then depicted in the form of a graph so that more prominent areas or components that are more ready and components that are less ready can be seen so that recommendations can be provided for the development of the implementation of electronic medical records. The value of each component is as follows:

Table 3 Readiness Assessment of Oputa Yi Koo RSJPD

No	Readiness Area	Average
1	Human resources (HR)	3.89
2	Leadership governance	3.79
3	Infrastructure	3.75
4	Organizational work culture	3.62

Based on table 3 above, it can be seen that of the four areas of readiness assessed, the human resources aspect has a higher level of readiness compared to other aspects, namely with an average value of 3.89. Furthermore, the leadership governance aspect with an average value of 3.79, then the infrastructure aspect with an average value of 3.75 and the organizational work culture aspect with an average value of 3.62.

4. Discussion

4.1. Influence human resource aspects of RME implementation readiness

The results of the study indicate that Hypothesis 1 (H1) is accepted, where the human resource aspect influences the readiness of the implementation of electronic medical records (EMR). Based on the results of the correlation test for the relationship between the variable (X) of human resources and the variable (Y) of the readiness of the implementation of EMR, it has a positive correlation of 0.642 which indicates a strong and unidirectional relationship, reinforced by a *p-value* of 0.000 (<0.05). With a *p-value* in the statistical test of 0.035 (<0.05). So it can be said that there is a significant influence between the human resource variable (X) on the readiness of the implementation of EMR (Y). Reviewed in terms of the readiness of the human resource aspect which includes the availability of clinical and administrative staff supported by formal training, as many as 77 people (69.4%) stated that they were very ready in the implementation of electronic medical records.

In terms of the involvement of clinical and administrative staff, at RSJPD Oputa Yi Koo a staffing structure has been created for the needs of staff in the implementation and use of electronic medical records . In addition, IT staff dedicated to the electronic medical record project have been experienced and educated about the functions of electronic medical records. The participation of administrative and clinical personnel in the design and planning process of implementing electronic medical records is one of the keys to the success of implementing electronic medical records. [15] . This

theory is in line with research by Fitriyandina *et al* . (2024) which states that readiness to implement electronic medical records includes medical, administrative and management staff who will act as *users* and are important components of policy makers to support the success of implementing electronic medical records. [16] .

Human resources are a strategic factor in activities that make other resources work well and are able to achieve goals effectively and efficiently. This shows that planning must be well documented [17] . Technical training for health workers is very necessary in the smooth implementation of the use of electronic medical records, increasing the capacity of officers with training can add skills and change attitudes [16] .

4.2. Influence aspects of organizational work culture towards readiness for RME implementation

The results of the study indicate that Hypothesis 2 (H2) is accepted, where the aspect of organizational work culture influences the readiness of implementing electronic medical records (EMR). Based on the results of the *Pearson correlation test* for the relationship between the variable (X) organizational work culture and the variable (Y) readiness for implementing EMR, it has a positive correlation of 0.547 which indicates a sufficient or moderate relationship strength and is unidirectional, reinforced by a *p-value* of 0.000 (<0.05). With a *p-value* in the t-test of 0.013 (<0.05). So it can be said that there is a significant influence between the variable of organizational work culture (X) on the readiness of implementing electronic medical records (Y). Based on the results of the study, as many as 57 people (51.4%) stated that they were very ready in terms of organizational work culture.

From the perspective of organizational culture, the majority of officers at RSJPD Oputa Yi Koo showed readiness to accept change and participate in decision making. This can be seen from their willingness to provide identity numbers to the IT team for the *user ID creation process.* The right to access and input patient data into the RME is only given to officers who already have *the user ID* . Hospital staff have the motivation and enthusiasm to learn the system of using and operating electronic medical records . However, because not all staff have received formal training, so that trained staff will share knowledge with other staff who have not received training, so that understanding and skills in using electronic medical records can be spread evenly throughout the team. The implementation of electronic medical records will result in a cultural shift from manual to electronic so that it can have physical and physiological effects, related parties must be able to motivate staff or employee acceptance of the implementation of electronic medical records which is a determinant of the success of the implementation of electronic medical records [16] .

From the aspect of patient involvement, RSJPD Oputa Yi Koo is considered quite ready. This is reflected in patient interaction with electronic medical records, referral procedures and electronic prescriptions have been integrated into the documentation of electronic medical records. However, currently the Hospital does not have policies and procedures that allow patients to access their electronic medical records and regulate the release of information to patients.

In terms of patient involvement, it was found that There are many benefits or advantages obtained, one of which is the speed of service to patients so that patients do not have to wait too long and patient history can be searched more easily, thus also affecting patient satisfaction with the use of electronic medical records [17] . It is very important to prioritize ongoing patient involvement. Patient involvement can be measured by patient assessment of the services received by patients. Readiness for the implementation of electronic medical records not only involves health workers, but also involves patient views on services which will ultimately be used as consideration and evaluation in the readiness for the implementation of electronic medical records [18] .

In terms of the workflow process, it shows that the majority of officers agree that discussions of clinical and administrative work processes have been included in the proposal related to electronic medical record planning. However, from the researcher's findings, the hospital does not yet have a work procedure or standard operating procedure (SOP) related to the implementation of electronic medical records. The next electronic medical record implementation procedure is determined by the workflow process. The unpreparedness of the workflow process is caused by the lack of new procedures to address the transition from conventional medical records to electronic medical records [19] . The ability of leaders to create policies, SOPs and business procedures that must be followed and the ability to encourage employees to participate in the implementation of the electronic medical record system is a sign of a good organizational work culture. The success of implementing electronic medical records is seen from the preparation of a framework that involves all staff. The workflow of the electronic medical record planning process will facilitate documentation if there is a need in terms of the electronic medical record workflow procedure [20] .

Although most respondents stated that they were very ready in terms of organizational work culture, there were still 8 people (7.2%) who stated that they were not ready. To overcome this, hospitals need to take several strategic steps.

One important step is to prepare and socialize Standard Operating Procedures (SOP) related to the implementation of electronic medical records . This SOP must include a clear workflow, the responsibilities of each party, and a guide to steps in overcoming obstacles that may arise. With a structured SOP, all staff can understand their roles and have guidance that helps them carry out their duties with more confidence.

In addition, training and socialization need to be carried out routinely to improve staff understanding of the importance of a work culture that supports the implementation of electronic medical records . This training can be supplemented with practical simulations, so that staff can directly apply the knowledge gained in real work situations. A communication forum is also needed for monitoring and evaluation to hear input from staff, explain the benefits of implementing electronic medical records , and identify obstacles faced by those who feel less prepared. Active support from leadership, such as providing clear direction and providing adequate facilities, is also needed to build staff confidence in the implementation process. With this integrated approach, it is hoped that all staff can improve their readiness, so that the implementation of electronic medical records in hospitals can run more effectively and optimally.

4.3. Influence aspects of leadership governance towards the readiness of RME implementation

The results of the study indicate that Hypothesis 3 (H3) is accepted, where aspects of organizational work culture have an effect on the readiness of implementing electronic medical records. Based on the results of the *Pearson correlation test* for the relationship between the variables (X) of leadership governance and the variable (Y) readiness for RME implementation has a positive correlation value of 0.631 which indicates a strong and unidirectional relationship, reinforced by a *p-value* of 0.000 (<0.05). With a *p- value of* on the t-test of 0.001 (<0.05). So it can be said that there is a significant influence between the variables of leadership governance (X) on the readiness of implementing electronic medical records (Y). Where respondents who stated that they were very ready in this aspect of leadership governance were 76 people (68.5%), and there were no respondents who stated that they were not ready.

In terms of leadership governance, it shows that the leadership at RSJPD Oputa Yi Koo has understood the benefits of implementing electronic medical records for the purpose of increasing efficiency and quality of service. In addition, the decision-making team has scheduled time for the implementation of electronic medical records. Leaders are the highest ranks in decision-making, therefore leadership and management responsibilities greatly influence the adoption of technology [16] .

In terms of accountability, it shows that top management has a high commitment to the implementation of electronic medical records. One of the roles and responsibilities is negotiating or collaborating with system provider vendors to analyze the implementation of electronic medical records. Accountability usually refers to the obligation to be responsible for the operations of an organization to parties who have the right to request information and accountability [21] . Similar to electronic medical record planning, top management has responsibility for further movements. This is in line with the opinion of Hapsari *et al.* (2023) who stated that the existence of a special section that regulates the information system for the implementation of electronic medical records shows management's commitment to its implementation [22] . This is indicated by the presence of an IT team at RSJPD Oputa Yi Koo who has experience and has been trained in system integration, data conversion, and expert resource management to complement the skills and knowledge of officers.

4.4. Influence infrastructure aspects of readiness for RME implementation

The results of the study indicate that Hypothesis 4 (H4) is accepted, where the infrastructure aspect influences the readiness of implementing electronic medical records. Based on the results of the *Pearson correlation test* for the relationship between the variable (X) infrastructure and the variable (Y) readiness of implementing electronic medical records, it has a positive correlation value of 0.692 which indicates a strong and unidirectional relationship, reinforced by the *p-value* of 0.000 (<0.05). With a *p-value* in the t-test of 0.000 (<0.05). So it can be said that there is a significant influence between the infrastructure variable (X) on the readiness of RME implementation (Y). A total of 75 respondents (67.6%) stated that the hospital was very ready in terms of infrastructure. However, there were still 2 respondents (1.8%) who thought that the hospital was not fully ready in terms of infrastructure.

In terms of IT infrastructure, *hardware* and *software* at RSJPD Oputa Yi Koo have met the needs for the implementation of electronic medical records. Although currently the number of available computers is still limited and the network at RSJPD Oputa Yi Koo still sometimes experiences error problems, the hospital's management and IT continue to strive to improve the information technology infrastructure, provide adequate devices, and ensure network stability and reliability to support the smooth implementation of electronic medical records optimally. Electronic medical records can improve the quality of health services, but in this case it requires adequate information technology infrastructure [14] .

In the readiness stage of implementing electronic medical records, it does not only rely on human resources, but also on IT infrastructure as a means and infrastructure to support electronic medical records. IT infrastructure in a health care facility is considered ready if it has high-level security standards and data integration.

In terms of finance and budget, the development of electronic medical records at RSJPD Oputa Yi Koo is considered quite ready, this is indicated by the implementation of cooperation between the hospital and the system provider or *vendor* . Electronic medical record technology is considered a long-term investment and can generate high profits. Basically, the obstacles that often occur when developing electronic medical records are financial or budget problems to provide information technology infrastructure, which results in a limited amount of IT infrastructure [17] .

5. Conclusion

Human resources, organizational work culture, leadership governance, and infrastructure aspects have a positive and significant effect on the readiness of electronic medical record implementation at the Oputa Yi Koo Heart and Blood Vessel Hospital, Southeast Sulawesi Province. The infrastructure aspect has a greater influence compared to the other three aspects. Hospital management is expected to be able to create supportive conditions by implementing activities to improve the knowledge and skills of officers in the use of electronic medical records, establishing clear SOPs and workflows related to its implementation, providing support from the implementation team to overcome obstacles, and ensuring the availability of adequate equipment.

Compliance with ethical standards

Disclosure of conflict of interest

The authors have no conflict of interest in this research.

Statement of ethical approval

This research received a permit or recommendation from the Health Research Ethics Committee (KEPK) of the Regional Management of the Indonesian Public Health Experts Association (IAKMI) of Southeast Sulawesi Province with Number 25 9/KEPK-IAKMI/XII/2024.

Statement of informed consent

"Informed consent was obtained from all individual participants included in the study."

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