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Readiness Analysis of Electronic Medical Record System (RME): A Case Study of Secondary Hospitals in Surabaya

Eka Wilda Faida[1], Pipit Festi Wiliyanarti[2], Maria Magdalena Dwi Wahyuni[3]

[1]*Medical Record and Health Information Department, STIKES Yayasan Rumah Sakit Dr. Soetomo, Surabaya, Indonesia*
[2]*Faculty of Health Sciences, Muhammadiyah University of Surabaya, Surabaya, Indonesia*
[3]*Public Health Department, Nusa Cendana University, Nusa Tenggara Timur, Indonesia*

Correspondence should be addressed to:
Eka Wilda Faida
ekawildafaida@gmail.com

Abstract:
The Indonesian Minister of Health Regulation requires all hospitals to no longer use manual medical records by 2023. Electronic Medical Records (RME) have many benefits and uses, especially in improving the quality of health services related to patient data as one of the Clinical Decision Support (DCS). But in fact, there are still many hospitals that have not used RME according to the rules that have been launched by the government. This study aimed to analyze hospital readiness in the use of RME in several secondary hospitals in Surabaya, East Java Indonesia. Observational with descriptive study, analysis using score categories based on the DOQ-IT theoretical framework. Samples were randomly drawn at 228 out of a total population of 562. The study used a survey that was analyzed using SPSS. Before calculating readiness, each question item is tested for validity and reliability to determine the feasibility of the instrument. Organizational culture preparation 81.82% (mean 43.42), leadership governance 80.52% (mean 32.09), human resources 66.23% (mean 21.19), infrastructure 75.32% (mean 15.44) with a total readiness of 112.14 in the score category in the range I (98-145) which is very ready. Aspects of organizational culture, leadership governance, human resources, and infrastructure as a whole have a highly prepared category. The role of Human Resources is very important in the use of EMR implementation by maintaining staff education and training and emphasizing the importance of the role of technological advances in improving the quality of health. Skill and experience in using EMR should be applied consistently, and core competencies should be strictly designed as a form of professionalism.

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INTRODUCTION

The development of information technology is currently developing so rapidly and has penetrated various sectors of life. One of them that is becoming a global trend in the health sector is document management using a computer/ electronic-based system. As a form of encouraging the realization of sustainability development goals (SDG's) until 2030 (Buse & Hawkes, 2015); (WHO, 2017), the Indonesian government through the Ministry of Health's Strategic Plan for 2020-2024 said that one of the strategic goals that the government will achieve is to increase the availability of quality health service facilities through one of its efforts by organizing the digitization of medical records and online medical records and health service facilities is required to use RME (Menteri Kesehatan RI, 2020). One of the benefits of RME is to increase the speed of providing

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medical records with electronic media, which of course will also have an impact on improving the efficiency of the patient service process (Wilcox, 2010); (Coffman et al., 2016). The existence of electronic medical records will also make it easier to retrieve patient information (Schnipper et al., 2008). In implementing RME, there are many challenges that must be faced. Some of them are the lack of a uniform definition of the concept of information technology development, the lack of assessment of needs before implementation, the existence of concerns about privacy violations and legal cases (Awa & Ukoha, 2020); (Maha Wirajaya & Made Umi Kartika Dewi, 2020).

Clinical Decision Support (CDS) can have an impact on treatment outcomes when used at the point of care in electronic medical records. CDS has been shown to improve patient quality and safety, improve adherence to guidelines for prevention and treatment, and avoid treatment errors (Amatayakul, 2004). Systematic reviews show that CDS can be useful across a variety of clinical purposes and topics (Middleton, 2009). CDS is very effective in the implementation of EMR, Computerized Provider Order Entry (CPOE), and Personal Health Record (PHR) (Garavand et al., 2016). This research needs to be carried out to answer the demands made by the government that in 2023 all hospitals in Indonesia must carry out integrated RME at 80% from 2022 which is only 60% with 100% completeness. This government effort is a form of supporting the Sustainable Development Goals (SDGs) in point 3 regarding health and welfare, the Indonesian government. By using good information technology, it is hoped that good quality health services will also be achieved. The novelty of this research is the involvement of organizational culture, leadership governance, human resources and infrastructure as variables whose analysis results can be used to develop new research by adding other variables through synthesis using the technology readiness index method which has been previously researched by the author (Eka Wilda Faida, 2020)

Several secondary hospitals in the Surabaya city area of East Java Indonesia still often have problems in medical record activities including manual medical records not stored neatly, misplaced in the storage of medical record files, there are often delays in returning medical record files, and medical record data stored in paper form may be lost or damaged, medical record information has become ineffective and efficient. RME is so significant in reducing workloads, errors and saving costs that it is very important to need (Kemkar & Kalode, 2015). Hospitals need to transition from \ manual to electronic medical records which are expected to minimize the problems that occur. However, to implement RME found a lot of such complex challenges and needs that had to be prepared in advance. The readiness assessment will help identify processes and priority scales, as well as assist in the establishment of operational functions to support the optimization of RME implementation (Ghazisaeidi et al., 2014)(Ghazisaeidi et al., 2014). Based on this, the researcher wants to identify the readiness of RME implementation in hospitals using the DOQ-IT (Doctor's Office Quality Information Technology) method. This DOQ-IT provides more detailed and easier overview assistance in conducting an assessment of the readiness of RME implementation by measuring aspects of organizational culture readiness, leadership governance, human resources, and infrastructure (Foundation et al., n.d.); (Lower et al., 1998) especially in the outpatient department (Massing & Schenck, 2008). This study aimed to analyze hospital readiness in the use of RME in several secondary hospitals in Surabaya, East Java Indonesia.

METHOD

This research is an observational study with a descriptive study. The sampling method is to use simple random sampling with the sample size determination formula (Chadha, 2006). The study was 228 respondents out of a total population of 562 out of all health professionals

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associated with the use of RME. The Letter of Exemption (LOE) number is 0391/SB/DIR/RSWS/2022 secondary hospital in the city of Surabaya, East Java, Indonesia.

Instrument indicators based on (MASSPRO, 2009) there are three categories according to DOQ -IT tools, namely: Not Ready (III) with a score value (0-49), Quite Ready (II) with a score value (50-97) or Very Ready (I) with a score value (98-145). Measure validity and reliability using SPSS software. validity using Item Correlation Coefficient. reliability using Cronbach's Alpha Coefficient. Valid if the Item-Total correlation coefficient (r-count) > (0.227 (r-table). Reliable if Cronbach's Alpha coefficient > 0.600. Data were analyzed using frequency tabulation, percentage and mean.

Instrument Code and Statement

Several stages in the RME readiness analysis process using DOQ-IT tools:

Stage 1: This stage is in the form of translating statements on DOQ-IT tools into Indonesian which are translated by two people, namely the first subject is an English expert, and the second subject is an expert in the field of Health Information Systems with both categories having at least a master's degree in education.

Stage 2: Preparation of questionnaires and scoring based on DOQ-IT tools. Each statement has 6 answers in the form of statements that are scored with a score of 0-5 (0-1 is less prepared, 2-3 is just ready, 4-5 is well prepared), then 5 is the highest score.

Stage 3: Categorizing the characteristics of respondents based on gender, age, service life, recent education, profession. Furthermore, it is calculated descriptively quantitatively with frequency and percentage.

Stage 4: Testing the validity and reliability of the questionnaire using SPSS. Respondents in this test are officers in implementing RME in several secondary hospitals in Surabaya. Determination of the validity and reliability of a questionnaire if r-count is greater than r-table (using Pearson correlation). While the reliability test using the Cronbach Alpha test the instrument is said to be reliable if the Cronbach Alpha is > 0.6.

Stage 5: Categorizing statement items to be calculated descriptively quantitatively.

Stage 6: Calculation of the mean is used to determine the position of the overall readiness category of the 4 IT DOQ variables. Calculate the maximum score, which is 5 times the number of statement items in each variable, minus the minimum score, 0 times the number of statement items in each variable. Then, the multiplication result on the maximum score is reduced by the multiplication result on the minimum score. The result is divided by 3 (less prepared, just ready, well prepared). It was found that the size of the class or interval was used as the basis for determining the mean category of readiness to use RME in hospital (Garavand et al., 2016).

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RESULT

Characteristics of Respondents

Table 1. Characteristics of Respondents at Surabaya Secondary Hospital

Variable	Frequency (f)	Percentage (%)
Gender		
Man	66	28.6
Woman	162	71.4
Age		
≤ 30 years	153	67.5
31-40 years	63	27.3
> 40 years	12	5.2
Service Life		
≤10 years	201	88.3
11-20 years	24	10.4
> 20 years	3	1.3
Recent Education		
High school or Equivalent	6	2.6
Diploma	162	71.4
Bachelor	57	24.6
Ners Profession	3	1.3
Profession		
Nurse	120	52.6
Midwife	30	13.1
Medical records staff	15	6.5
Expert staff of information technology	12	5.2
Administration	12	5.2
Other health workers	39	17.4

In the results of the study from the total respondents, as many as 228 respondents that participated in the study were the most women (71.4%), aged ≤30 years (67.5%). The highest service life is ≤ 10 years (88.3%). When viewed from the last education, the most was Diploma (71.4%). In accordance with the study (Aldosari et al., 2018) that demographic characteristics with a productive age of > 30 years, female gender, working period < 10 years, and have an important influence in the implementation of RME in addition to leadership governance and IT support.

Based on table 2 shows that the results of the validity test, the entire item has a value of the item-total correlation coefficient (r-count) > 0.227 (r-table), so it is concluded that the entire indicator is valid for measuring the indicator in question. The reliability test results show that the value of the Cronbach's Alpha coefficient for each item device, entirely > 0.600 so it can be concluded that each item device is reliable for measuring the indicator in question.

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Validity and Reliability Test Results

Table 2. DOQ-IT Validity and Reliability Test

Construct	Indicator	Item	Validity		Reliability	
			Item Correlation Coefficient-Total	Conclusion	Coefficient Cronbach's Alpha	Conclusion
Organizational Culture	Culture	BO-B1	0.504	Valid	0.900	Reliable
		BO-B2	0.516	Valid	0.896	
		BO-B3	0.651	Valid	0.891	
		BO-B4	0.752	Valid	0.879	
		BO-B5	0.761	Valid	0.879	
	Flow	BO-A1	0.710	Valid	0.880	
		BO-A2	0.766	Valid	0.879	
		BO-A3	0.409	Valid	0.906	
		BO-A4	0.625	Valid	0.888	
	Patient engagement	BO-K1	0.748	Valid	0.886	
		BO-K2	0.641	Valid	0.892	
Leadership Governance	Leadership	TKP-P1	0.730	Valid	0.865	Reliable
		TKP-P2	0.750	Valid	0.875	
	Strategy	TKP-S1	0.808	Valid	0.863	
		TKP-S2	0.737	Valid	0.873	
		TKP-S3	0.736	Valid	0.874	
	Accountability	TKP-A1	0.598	Valid	0.906	
	Information management	TKP-M1	0.663	Valid	0.876	
		TKP-M2	0.683	Valid	0.876	
Human Resources	Staff availability	SDM-KS1	0.420	Valid	0.848	Reliable
		SDM-KS2	0.776	Valid	0.821	
		SDM-KS3	0.585	Valid	0.858	
	Training	SDM-P1	0.684	Valid	0.812	
		SDM-P2	0.661	Valid	0.816	
		SDM-P3	0.667	Valid	0.817	
Infrastructure	IT availability	I-IT1	0.641	Valid	0.763	Reliable
	IT Management	I-MIT1	0.687	Valid	0.806	
		I-MIT2	0.795	Valid	0.738	
	Budget	I-A1	0.613	Valid	0.777	

RME Implementation Readiness Assessment

Table 3. Frequency Distribution of Statement Item

Code Indicator	Description	Result					
Organizational Culture Readiness Variables		Less Prepared		Just Ready		Well Prepared	
		f	%	f	%	f	%
	Culture						
BO-B1	Electronic medical records (EMRs) as a solution to reduce paper use	1	1.3	10	12.9	66	85.7
BO-B2	Planning of electronic medical records requires the involvement of all parties (management, medical personnel, administration, other health workers) in the hospital	0	0.0	4	5.2	73	94.8
BO-B3	Electronic medical records can make it easier to work in service	2	2.6	8	10.4	67	87
BO-B4	I learned that the hospital has plans to implement EMR	2	2.6	20	25.9	55	71.4
BO-B5	The framework for organizing the RME has been discussed	3	3.9	26	33.8	48	62.3
	Flow						
BO-A1	Hospitals have conducted RME workflow analysis	3	3.9	32	41.6	42	54.6
BO-A2	The hospital has conducted discussions to prepare human resources that will carry out the RME	3	3.9	27	35.0	47	61.0
BO-A3	Hospitals have prepared policies related to the implementation of RME	2	2.6	50	64.9	20	25.9
BO-A4	The hospital has planned to prepare standard procedures in the implementation of the RME	2	2.6	49	63.6	26	33.8
	Patient Engagement						
BO-K1	Hospitals have discussed maintaining the security of patient data and the accountability of patient data	0	0	23	29.8	54	70.1
BO-K2	Hospitals have developed policies on the utilization of patient data (reporting, research)	0	0	24	31.1	53	68.8
Mean of Organizational Culture Readiness Variables					43.42		
Leadership Governance Readiness Variables		Less Prepared		Just Ready		Well Prepared	
		f	%	f	%	f	%
	Leadership						
TKP-P1	The leader or director wants the implementation of the RME as soon as possible	1	1.3	18	23.3	58	75.3
TKP-P2	The leader has discussed the plan to implement RME in the hospital to all staff in the hospital	2	2.6	23	29.8	52	67.5
	Strategy						
TKP-S1	RME is currently included in the strategic planning of hospital development	0	0	21	27.3	56	72.2
TKP-S2	Hospitals have collaborated with third parties (vendors) in an effort to implement RME	2	2.6	22	28.6	53	68.8
TKP-S3	The implementation of the current RME is effective in solving problems that exist in hospitals today	3	3.9	26	33.8	48	62.3
	Accountability						
TKP-A1	The hospital has formed a working team in organizing the RME	5	6.5	46	59.7	26	33.7

Cont.....

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Cont.....

Code Indicator	Description	Result					
		Less Prepared		Just Ready		Well Prepared	
		f	%	f	%	f	%
	Information Management						
TKP-M1	The hospital has currently carried out several service activities using a computer	0	0	11	14.3	66	85.7
TKP-M2	The hospital has used an integrated computerized system in all existing service units	0	0	10	12.9	67	87.0
Mean Leadership Governance Readiness Variables				32.9			
	Human Resource Readiness Variables	Less Prepared		Just Ready		Well Prepared	
		f	%	f	%	f	%
	Staff Availability						
SDM-KS1	The hospital has conducted an analysis of the human resources needs needed to support the implementation of electronic medical records	3	3.9	42	54.6	32	41.6
SDM-KS2	Hospitals already have a good number of human resources to implement RME	1	1.3	27	35	49	63.6
SDM-KS3	I have a good ability to operate technology (computer)	1	1.3	21	27.3	55	71.4
	Training						
SDM-P1	The hospital has planned training for its human resources as a step to accelerate the implementation of RME	6	7.8	29	37.6	42	54.5
SDM-P2	Hospitals have provided training in using technology (computers) as an effort to accelerate the application of RME	6	7.8	36	46.7	35	45.4
SDM-P3	Hospitals have sent or included human resources to attend training on RME	5	6.5	46	59.7	26	33.7
Mean Human Resource Readiness Variables				21.19			
	Infrastructure Readiness Variables	Less Prepared		Just Ready		Well Prepared	
		f	%	f	%	f	%
	IT availability						
I-IT1	In this hospital, facilities (rooms, computers, information systems, networks, capacity) to accelerate the implementation of RME are readily available	3	3.9	35	45.4	39	50.6
	IT Management						
I-MIT1	Hospital IT management has an understanding of computer operations as one of the foundations in accelerating the implementation of RME	0	0	18	23.4	59	76.6
I-MIT2	IT staff are already involved in infrastructure planning for RME deployment	2	2.6	19	24.7	56	72.7
	Budget						
I-A1	Hospitals already have a budget for the implementation of RME	2	2.6	42	54.6	33	42.9
Mean Infrastructure Readiness Variables				15.4			

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Table 4. Readiness Assessment RME

Readiness Application RME	Frequency	%	Mean	Information
Organizational Culture Readiness				
Less Prepared	6	2.60	43.42	Well Prepared
Just Ready	78	15.58		
Well Prepared	144	81.82		
Leadership Governance Readiness				
Less Prepared	6	1.3	32.09	Well Prepared
Just Ready	87	18.18		
Well Prepared	135	80.52		
Human Resource Readiness				
Less Prepared	12	2.6	21.19	Well Prepared
Just Ready	57	31.17		
Well Prepared	159	66,23		
Infrastructure Readiness				
Less Prepared	6	2.60	15.44	Well Prepared
Just Ready	63	22.08		
Well Prepared	159	75.32		
Total Mean			112.14	Well Prepared

The readiness of the application of electronic medical records must also be seen from the value of each component or the assessment. The readiness to implement RME in each aspect, namely organizational culture obtained an average score of 43.42 at an interval of 36.7-55, namely being very prepared, leadership governance obtained an average score of 32.09 at intervals of 26.7-40, namely being very prepared, human resources obtained an average score of 21.19 being in the interval 21-30 which is very ready. and the infrastructure gained an average score of 15.44 at intervals of 13.35-20.1 i.e., very well prepared. The readiness of the application of RME in hospitals in terms of all aspects can be determined by summing the average scores of the four aspects. The overall result of the total score obtained, namely 112.14, was at an interval of 106.35-145.01, so the readiness assessment can be categorized as that the hospital is very ready to implement the RME.

Based on the results of research, the hospital is very well prepared in terms of organizational culture related to the readiness to implement electronic medical records, namely 81.82%. Judging from the readiness component of leadership governance, it has been very prepared with a readiness of 80.52%, in terms of readiness, human resources are also very ready, namely with a readiness of 66.23%. In addition, in terms of infrastructure, it is very ready with readiness, namely 75.32%.

DISCUSSION

In this section, organizational culture is more directed at changing the system in hospitals, which was originally the use of medical records that were still traditional in nature, namely manually, has now changed to RME (Maha Wirajaya & Made Umi Kartika Dewi, 2020);(Kusriyanti et al., 2021). Based on the results of the RME readiness analysis on the aspects of organizational culture, information was obtained that the readiness of organizational culture got an average score of 43.42, namely very prepared with 144 respondents (81.82 %) having stated that the hospital was very ready in the application of RME which was dominated by the statement that all respondents already knew very well that this RME planning required the involvement of all hospital

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parties. In his research(Silow-Carroll et al., 2012) mentioned that one of the successes in the implementation of RME is the participation of clinical and administrative staff in the design process and implementation planning. Organizational culture is an important aspect of supporting RME readiness (Lambooij et al., 2017). In the aspect of organizational culture, there were also 6 respondents, 2.60% said they were not ready, which was dominated by the statement that the hospital had not discussed the framework for implementing the RME. The hospital has not conducted an analysis of the RME work process flow, and the hospital has not conducted discussions to prepare human resources that will carry out the RME. This research is in line with research (Pratama & Darnoto, 2017) namely readiness in terms of organizational culture is quite ready and also has shortcomings, namely the workflow of electronic medical records that have not been planned (Pratama & Darnoto, 2017). Organizations need to implement change management in the implementation of systems in low- and middle-income environments should focus on the attributes and targets of change, including clarity of vision, suitability of change, effectiveness, organizational flexibility, and self-ability. In particular, the issue of training, the computer skills of staff, computer infrastructure, and strategic implementation (Kabukye et al., 2017).

Leadership governance describes the role and support of leadership and governance that affects the implementation of RME because leaders are decision makers. This shows that the leader has a role as a determinant of the policies to be taken including strategies to develop an innovation, seize an opportunity, negotiate, and execute a decision consistently (Maha Wirajaya & Made Umi Kartika Dewi, 2020); (Kabukye et al., 2017); (Kusriyanti et al., 2021). Based on the results of the analysis that has been obtained, it can be seen that the readiness of leadership governance got an average score of 32.09, which is very ready with 135 respondents (80.52%) stating that hospitals are very ready in the application of RME in the aspect of leadership governance readiness which is dominated by the statement that hospitals have used integrated computerized systems in all service units that to be one of the supporters of smooth implementation of RME. In the aspect of leadership governance There were 6 respondents (1.3 %) who stated that they were not ready, which was dominated by the statement that the hospital had not made a working team in the implementation of the RME. This research is in line with research(Pratama & Darnoto, 2017) namely that the special team is currently not in the hospital so that for the future development process, it is necessary to form an executive team in planning the hospital information system (Pratama & Darnoto, 2017). It requires support from the leadership through the commitment of each unit in the implementation of the system, the leadership encourages the staff the importance of change and encourages in the acceptance and use of the existing system, convincing emr to be successfully implemented (Kabukye et al., 2017); (Kusriyanti et al., 2021). Evaluation is needed on the process of using RME as a form of Clinical Risk Management tool, which aims to improve the quality of sustainable hospital services (Guzzo et al., 2017).

Human Resources (HR) as users of the RME system users and part of the policy compiler will greatly determine the success of RME development (Praptana et al., 2021). Based on the results of the analysis, it can be seen that the hospital showed that the readiness of HR received an average score of 21.19 with 159 respondents (66.23%) stating that the hospital was very prepared in the application of RME which was dominated by the statement that officers related to medical records had a good ability to operate computers. The ability to operate a computer can be improved by training and mentoring. The habituation factor also has an effect because habituation will make people skilled in doing things (Sudirahayu & Harjoko, 2016). In the human resources aspect, 12 respondents (2.6%) stated that they were not ready, which was dominated by the statement that hospitals had not provided training in using computers related to RME and had not

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sent or included HR to attend training on RME. At Darma Kerti Tabanan Hospital, it shows that it is quite ready to develop RME, namely it already has 1 medical record and information technology expert each and also has sufficient knowledge about RME, but in terms of training there is no training related to the application of RME (Maha Wirajaya & Made Umi Kartika Dewi, 2020). Integrated EMR should be implemented by 2023 with the necessary support from administration, medical and nursing staff, and administration. The role of Human Resources is very important in the use of EMR implementation by maintaining staff education and training and emphasizing the importance of the role of technological advances in improving the quality of health (Stadelmann, 2012); (Alkureishi et al., 2016), the skills of health professionals on the RME system are indispensable before the implementation of the system (Biruk Senafekesh et al., 2014). Providing health education using audiovisual methods can affect the user's level of knowledge (Eka Noviyanti et al., 2023). Experience in using EMR should be applied consistently, core competencies should be strictly designed as a form of professionalism (Hung et al., 2021).

Infrastructure readiness is related to IT infrastructure, IT management, and budgets. The overall adoption of EHR requires a lot of costs and requires a long process (Silow-Carroll et al., 2012). Based on the results of the analysis, it can be seen that several secondary hospitals in Surabaya on infrastructure readiness achieved an average score of 15.44, namely very prepared with 159 respondents (75.32%) stating that hospitals are very ready in the application of RME which is dominated by the statement that hospital IT management has a good understanding and ability in computer operations. In the infrastructure aspect, there were 6 respondents (2.60%) stating that the hospital was not ready, which was dominated by the statement that the hospital did not have facilities (computer rooms, information systems, and so on) to accelerate the implementation of RME. This research is in line with research from (Hidayat & Sari, 2017) namely that it does not yet have an adequate IT infrastructure. The unpreparedness of the infrastructure aspect is that the availability of servers and computers is inadequate in running electronic medical records by 48% and the available electronic medical record application menu is not able to meet the needs of officers running RME by 26% (Faida & Ali, 2021). A good RME is when a computerized health information system can record detailed information such as patient demographics, meeting summaries, medical history, allergies, intolerances, and laboratory test histories. Multiple EMR support scheduling, billing, reporting, order entry, results management, and decision support (Ludwick & Doucette, 2009). The ease of use of RME, system speed and high quality documents can have an effect on user satisfaction (Fairley et al., 2013). Hospitals are important in paying attention to the aspects of the available budget, because the more prepared and enthusiastic human resources in implementing technology certainly cannot be separated from the incentives that will be given (Simon et al., 2007). The health service provider can choose technology by considering the results of the analysis that has been carried out by considering the type of technologies, working procedures, advantages, and disadvantages of the technology so the health service provider can choose the appropriate technology in the hospital (Putra Adhitama et al., 2023)

The overall result of the total score obtained, which is 112.14, is in the very ready category. The score category in range I (98-145) shows that human resources, organizational culture, leadership governance, and hospital infrastructure are well prepared to use RME and can overcome various challenges for successful implementation of RME. The organization, procedures, programs, infrastructure and support of appropriate leaders play an important role in the implementation of the system (Garavand et al., 2016).

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CONCLUSION

Modification of the DOQ-IT instrument in the form of a questionnaire can be used in research to measure the level of readiness of health facilities in the implementation of RME as evidenced by valid and reliable instrument measurement results. Based on the results of research that has been carried out, it can be concluded that in the aspects of organizational culture, leadership governance, human resources, and infrastructure as a whole have a very ready category. The overall result readiness assessment can be categorized as that the hospital is very ready to implement RME. Further research can be used in health facilities that will implement RME so that it can be measured in which category it is readiness.

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