



Implementation of Electronic Medical Records at Primary Care in Semarang City Region: An Analysis of Individual and Organisational Determinants

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Abstract: Implementing electronic medical records (EMR) in Puskesmas faces various challenges and barriers that hinder system users. This study aims to identify the effects of individual and organizational factors on the implementation of EMR in Puskesmas located in Semarang City. The study was designed as a cross-sectional study and was conducted between August and September 2023. Participants were selected from five health centres representing five regions of Semarang city, and included 46 health professionals, including physicians, nurses, midwives, medical record keepers and IT staff. The survey was taken from a standardized questionnaire based on the Technology Acceptance Theory and Institutional Theory. The results showed that 34% of the respondents were between 20 and 30 years old, where 76.1% were female and 52.2% had a bachelor's degree, and were dominated by nurses, where the majority had 1-5 years of experience. The constant (a) of 1.770 indicates the value of the independent variables in increasing EMR usage. The regression coefficient of the individual factor variable of 0.207 has a positive effect on EMR implementation. Organisational factors negatively affect the implementation of EMR use. The test results found that individual factors partially and significantly ($0.005 < 0.05$) affect the implementation of EMR utilised.

Keywords: EMR; Individual factor; Organisational factor; Puskesmas

Introduction

The Indonesian healthcare system has recently been transformed, with the use of Electronic Medical Records (EMR) has been a key factor. EMR facilitates the electronic storage, management and sharing of patient medical information and is critical to reducing healthcare costs, improving patient care and enabling more complex clinical analysis (Sherer et al., 2016). Electronic Medical Records (EMR) are utilized not only in secondary healthcare facilities, but also in primary healthcare facilities such as Puskesmas. The implementation of EMR at Puskesmas is a commendable move towards providing more efficient and higher quality healthcare services. However, the implementation of EMR at Puskesmas still faces several

challenges and obstacles. These challenges and obstacles cause several difficulties for EMR users.

Since 2019, all community health centres in the vicinity of Semarang City have been implemented with electronic medical records by the Semarang City Health Office. In the implementation of electronic medical records, a migration from paper-based records to electronic ones has occurred. This involves a series of steps, where an introduction to electronic medical records and its advantages are presented, followed by training sessions for users to ensure their ability to provide services to patients using the electronic medical record system.

During the implementation of electronic medical records in Puskesmas of Semarang City, certain problems have arisen, as per the preliminary study. Four main concerns regarding electronic medical records

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exist, involving security and privacy, lack of interoperability, digital divide, and service continuity. Security is the principal obstacle, as it is easily accessible and discloses complete information regarding a patient's health condition. The lack of interoperability poses a challenge for organisations seeking medical record information due to system incompatibility (Janssen et al., 2021). The digital divide represents the divide between those who have access to technology and those who do not. The issue of service continuity is the final challenge associated with implementing electronic medical records. If there are data problems such as connection disruptions, device failures, or other issues, the progress of a service process can be disrupted.

Previous research has also investigated the challenges of implementing electronic medical records in healthcare facilities, including hospitals and primary care services. While individual factors are seen as significant barriers to RME implementation, the impact of organisational (institutional) aspects remains unclear. Cucciniello et al. (2015) used a socio-technical approach to outline the ways in which individual determinants and organisational factors interact to impede the adoption of electronic health records, but they did not examine the issue from a comprehensive institutional approach.

The researcher considers it crucial to investigate the implementation of electronic medical records at Puskesmas in Semarang City. Several problems arise in the use of EMR that necessitate a study that would provide a comprehensive account of these problems. Such a study would enable Puskesmas leaders, health professionals (including doctors and nurses) and the Semarang City Health Department to find workable solutions for the implementation of sustainable electronic medical records. This research was important to help guide healthcare providers in improving the application and use of technology at an individual and organisational level by identifying the factors that influence the success or failure of electronic health record implementation (Saghafian et al., 2021). Furthermore, based on Szarfman et al. (2022), the importance of this study was to ensure that the implementation of electronic medical records in primary health care facilities in Semarang city complies with the Ministry of Health's standards in terms of system interoperability and information exchange between health care facilities.

The study's theoretical framework was developed using two previously established theories: the Technology Acceptance Model (TAM) from the Information Systems science field, which has been applied in health services, and Institutional Theory from the organisational management science field, to evaluate

how organisational factors impact the conduct of health practitioners (Fahemneamah et al., 2018). The aim of this research was to assess the impact of individual and organisational factors on the adoption of electronic medical records in the Puskesmas of Semarang City.

Method

This study used a cross-sectional study design conducted in Semarang City during August to September 2023. The population of this study consisted of health workers who have direct contact with the electronic medical record system at Puskesmas in Semarang City. The sample was selected using purposive sampling technique from 5 Puskesmas representing 5 regions in Semarang City. The sampling of these health centers was expected to provide a representative picture of the implementation of electronic medical records in primary health care providers in Semarang City. The total sample was 46 health workers consisting of doctors, nurses, midwives, medical recorders, and IT staff.

The dependent variable was implementation of electronic medical records, while the independent variables were individual factors and organizational factors. The operational definition of the application of electronic medical records is the use of medical records in the process of collecting, storing, managing, and accessing patient medical information which is carried out electronically through a computer system or special software. Individual factors are defined as determinants of health workers that influence the use of electronic medical records, including usefulness, ease of use, behavioural interest, and actual use. While organisational factors are determinants of the organisation and management of health centres including top management support, information system management, organisational structure and organisational culture (Abdekhoda et al., 2015).

The research instrument used was a questionnaire adopted from a standardised questionnaire based on Technology Acceptance Theory (TAM) and Institutional Theory. This questionnaire was designed to collect data regarding perceptions, attitudes, and factors affecting EMR implementation. Data collection was done through distributing questionnaires to the selected sample. Trained enumerators were responsible for data collection. The collected data will be analysed using SPSS statistical software version 29. The statistical analysis starts with descriptive analysis to analyse the distribution of the data. Next, regression analysis will be used to test the hypothesis whether there is an influence of individual factors and organisational factors on EMR implementation. This study complies with the

applicable research ethics in accordance with the standards of Semarang City Health Office.

Result and Discussion

From table 1, the study sampled five healthcare centres, with 34% of respondents aged between 20 and 30 years, and 31% aged 31 to 40. The majority (76.1%) of respondents were female and 52.2% held D4/S1 education. Nurses (26.1%) were the most frequently reported position, with the majority having 1-5 years of experience.

Table 1. Characteristic Sample

Characteristic	n	Respondent
		%
Primary Care		
Sron dol	8	17.4
N gesrep	10	21.7
P andaranan	8	17.4
H almahera	10	21.7
G ayamsari	10	21.7
Age		
20-30 years	17	34
31-40 years	14	31
41-50 years	7	17
51-60 years	8	12
Gender		
Man	11	23.9
Woman	35	76.1
Level of Education		
Senior High School	2	4.3
Diploma 3	18	39.1
Diploma 4/Bachelor	24	52.2
Magister	2	4.3
Job Title		
Doctor	11	23.9
Dentist	2	4.3
Nurse	12	26.1
Medical Record	11	23.9
Public Health	5	10.9
Administration Lead	5	10.9
Working Period		
< 1 years	6	13.0
1-5 years	25	54.3
6-10 years	2	4.3
>10 years	13	28.3

In addition, the researchers use descriptive statistics to provide an overview of the data through standard deviation, mean, minimum and maximum values. Table 2 shows the results of the descriptive statistical analysis.

Based on table 2, it can be concluded that the data are less variable for both individual variables (X1), organisational variables (X2) and RME implementation variables (Y1). This is because the standard deviation is greater than the mean. In order to determine the

relationship between the independent and dependent variables, multiple linear regression tests were carried out to determine the functional relationship. The test results are presented in table 3.

Table 2. Descriptive Analysis Results

Variable	N	Min	Max	Mean	Std. Deviation
Individual_X1	46	39	15	46.91	4.44
Organisational_X2	46	39	60	45.80	4.50
EMR Implementation_Y	46	6	57	8.67	1.85

Table 3. Multiple Linear Regression Results Coefficients^a

Model	Unstandardized Coefficients	
	B	Std. error
(Constant)	1.77	2.98
Individual_X1	.20	.07
Organizational_X2	-.06	.06

Based on table 3, it can be explained that the constant (a) = 1.77 shows the constant value; if the value of the independent variables (individual factors and organisational factors), then the use of EMR will increase by 1.77. The regression coefficient of the individual factor variable of 0.20 has a positive effect on the application of EMR usage. This shows that the use of EMR will increase by 0.018 and if the variable EMR use increases by 1%, then the use of EMR will increase by 20.7% assuming the value of other variables remains constant. The results of this analysis provide evidence of the extent to which individual and organizational factors explain variability in RME implementation.

However, the organisational factor variable has a negative effect on the application or use of EMR. Furthermore, a partial test was conducted to determine whether the independent variable (X) had a significant effect on the dependent variable (Y). Testing is done with a significance level of 0.05. The test results can be seen as follows.

Table 4. T test Results

Model	t	Sig.
(Constant)	.53	.55
Individu_X1	2.93	.00
Organisasional_X2	-.88	.38

According to the partial test results, the individual factor has a significant value indicated by 0.005 < 0.05. Therefore, individual factors have a partial and significant effect on EMR implementation. Therefore, hypothesis (Ha) is accepted. Nevertheless, the organisational factors have no significant or partial effect on EMR implementation, leading to the rejection of Hypothesis (Ha).

The F test is used to show whether the independent variables included in the model have a simultaneous effect on the dependent variable. The results of the regression test are shown in table 5.

Table 5. F Test (Simultaneous) ANOVA^a

Model		ANOVA ^a			F	Sig.
		Sum of Squares	df	Mean Square		
1	Regression	28.19	2	14.09	4.81	.01 ^b
	Residual	125.91	43	2.92		
	Total	154.10	45			

According to table 5 above, the high F-ratio value (4.81) shows a significant difference between the variation explained by the regression model and the unexplained variation. The significance value (Sig.) of 0.01b is lower than the general significance level (0.05), indicating that the regression model as a whole is statistically significant. At least one of the predictor variables (Constant, X2_Organisation, and X1_Individual) significantly influences the dependent variable Y_Implementation_RME. This study's results indicate that due to the significant F-ratio and significance values, we can conclude that at least one of the tested factors (Constant, X2_Organisation, and X1_Individual) plays a significant role in explaining the variance in implementing Electronic Medical Records (RME).

Moreover, a coefficient of determination analysis was performed to assess the extent of the effect of individual and organisational factors on EMR implementation, and the results are presented in table 6.

Table 6. Coefficient of Determination Model Summary^b

Model	R	R. Square	Adjusted R Square	Std. Error of the Estimate
1	.0428 ^a	.18	.14	1.71

Table 6 shows that R-squared is 0.18 or 18%. This value indicates that the independent variables, including individual and organisational factors, account for 18.3% of the variation, while the remainder is due to variables not included in this research model. The relatively low R-squared value indicates the presence of other unaccounted for factors that influence variations in EMR implementation beyond the Individual factors and Organizational factors within the scope of this study. Further interpretation requires additional contextual knowledge and a thorough understanding of the regression model variables.

Discussion

The findings from the research suggest that personal determinants are the primary factors affecting

the adoption and usage of electronic health records in primary healthcare centres (Puskesmas), whereas institutional influences are not decisive in the implementation of EMR. Nonetheless, aspects including the backing from top-level management at Puskesmas and the administration of the Puskesmas Information System warrant consideration by the Semarang City Health Office. Several respondents noted in a questionnaire that an assessment of the current puskesmas information system is required as the use of EMR often results in errors. However, the puskesmas faces difficulties in rectifying the issue as the information system integrated with EMR is regulated by the Health Office. Coordination is necessary between the health office and each health centre in Semarang city to receive support from top management.

Many healthcare facilities around the world have implemented EMR systems to improve information retrieval, but only a few have succeeded, according to the findings of Gesulga et al. (2017). In terms of adoption and achieving the expected benefits of implementation, the percentage of failures is higher. The same thing was also found by researchers in the implementation of EMR in Puskesmas, Semarang City, that EMR users in Puskesmas often feel that there are several aspects that need to be fulfilled in order to achieve the benefits of using EMR at this time. The successful implementation of an electronic medical record (EMR) system depends on the acceptance of the system by practice users. Understanding the attitudes of healthcare professionals towards the use of EMR is key to the successful implementation of the system (Mijin et al., 2019).

The complexity of EMR technology presents a significant barrier to implementing it in healthcare organisations. Users may experience difficulties adapting to a complex interface and understanding specific system functions (Dutta & Hwang, 2020). Data security concerns also pose significant challenges due to the sensitivity of information stored in EMR (Keshta & Odeh, 2021). Uncertainty surrounding the backing of top-level management and insufficient participation from healthcare professionals throughout the industry remains a significant issue. Inadequate training for healthcare staff in the use of information systems according to Qarragita et al. (2023) may be an obstacle to successful technology adoption, as it requires an in-depth understanding of software features and functions. To maximise the use of RME, healthcare providers must recognise and overcome these obstacles. They should also give sufficient assistance and instruction to all staff responsible for EMR operation (Legesse & Berhanie, 2022).

More than 50% of EMR systems fail or cannot be used properly. Resistance and opposition to change

from a paper-based system to an electronic system can cause several problems (Awol et al., 2020). Other issues contributing to the implementation of electronic medical records (EMR) include lack of pre-implementation activities, lack of organisational readiness, unavailability of technology, funding, and lack of technical skills and computer usage skills by staff (Oo et al., 2021). This condition will affect the quality of service felt by patients as consumers. Quality health services have been defined as health services that can satisfy every user of health services in accordance with minimum service standards and their implementation in accordance with established professional standards and codes of ethics (Dewi et al., 2023). Therefore, Puskesmas should also note that the quality of services provided by health workers is influenced by the health technology used in the health service facility (Alotaibi & Federico, 2017).

Based on research from Kabukye et al. (2020) showed that it was important to conduct an assessment at the beginning to see the readiness of health care facilities in implementing EMR. Readiness assessments can help healthcare organisations identify barriers to successful EMR implementation, assess organisational readiness and available resources, and identify areas for improvement (Senafekesh et al., 2014). In fact, readiness assessment was the most important step prior to implementation and is an essential requirement for the success of EMR in terms of adoption or acceptance (Walle et al., 2023). Readiness assessment, as a comprehensive assessment to provide an accurate picture of existing conditions and organisational readiness for change, is also a way to identify potential causes of innovation failure such as organisational resistance (Rajamani et al., 2022).

The limited capacity of health workers in terms of computer literacy was also an obstacle that was still found in Puskesmas. Several systematic reviews consistently found that lack of computer literacy was the most common barrier to EMR adoption (Woldemariam & Jimma, 2023). Three studies conducted in Saudi Arabia reported that computer literacy was strongly associated with health workers' acceptance of EMR, health workers' use of EMR, and health workers' satisfaction with EMR (Khalifa, 2013). In addition, studies conducted in developing countries found that low levels of computer literacy among health professionals were associated with poor EMR adoption (Yehualashet et al., 2021).

Individual factors are a significant barrier to the adoption of electronic medical records. Some health professionals may not have sufficient digital skills to implement complex EMR technologies (Jedwab, Redley, et al., 2021). In addition, personal attitudes and motivation to move from manual to electronic medical

records can exacerbate initial discomfort or reluctance to adopt new technology (Baniulyte et al., 2023). The belief that implementing EMR may result in a heavier workload could impede its adoption, particularly for senior nurses who face challenges using technology and require more time for training (Jedwab, Hutchinson, et al., 2021). Several senior nurses in the field have expressed their belief that electronic medical records can often cause disruptions to services when errors occur.

The implementation of EMR is hampered by organisational factors (Nurcholis & Budi, 2020). Developing the necessary infrastructure and resources to facilitate EMR can be hindered by unsupportive leadership or lack of commitment from the organisation's management. Another major barrier is the lack of training and education of health workers in the use of EMR (Devkota et al., 2011). In addition, data security and privacy are major concerns and organisations must adhere to strict regulations, which can further complicate the implementation of EMR (Basil et al., 2022). Organisational culture can be a significant barrier to EMR implementation. If the culture resists change or fails to adopt new technology, it will be hard to implement EMR (Reynolds et al., 2006). Integrating EMR into established healthcare workflows presents inherent challenges, particularly in evaluating and improving systems (Helena et al., 2022). Therefore, when developing a successful implementation strategy for EMR systems in healthcare, organisations need to assess both individual and organisational factors (Fennelly et al., 2020).

Conclusion

The implementation of electronic medical records (EMRs) in primary healthcare at Puskesmas in Semarang City was impacted by individual and organisational factors. The individual factors encompassed usability, ease of use, behavioural interest, and actual usage. On the other hand, the organisational factors consisted of support from top-level management, information system management, organisational structure, and organisational culture. The study concludes that it is important to focus on individual and organisational aspects to overcome challenges and enhance the positive impact of EMR adoption in primary care.

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Author Contributions

Conceptualization, Z.A.G.; methodology, Z.A.G. and A.F.; validation, A.A.I. and T.S.; formal analysis, Z.A.G.; investigation, T.S. and A.A.I.; resources, Z.A.G. and A.F.; data curation, T.S.; writing—original draft preparation, Z.A.G.; writing—review and editing, Z.A.G.; visualization, Z.A.G. and T.S. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

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