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Understanding User Acceptance of Electronic Medical Records: A Mixed method Study

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ABSTRACT

Introduction: The advancement of information and communication technology has transformed healthcare delivery into digital systems, notably through the use of Electronic Medical Records (EMRs). The implementation of EMR faces challenges, such as limited human resources, technology adaptation, and slow recording processes. This study aims to evaluate users' acceptance of EMRs and to explore the supporting and inhibiting factors affecting their implementation in a private teaching hospital in Yogyakarta.

Methods: A mixed method study with a parallel convergent approach using a cross-sectional (quantitative) and descriptive exploratory (qualitative) design. The quantitative sample was determined by proportionate stratified random sampling. The survey was conducted using a questionnaire based on the Technology Acceptance Model. Qualitative informants were determined purposively and focus group discussions and in-depth interviews were conducted. Quantitative data processing used IBM SPSS version 20 and SmartPLS, while qualitative data processing used thematic analysis, then integrated to obtain a comprehensive understanding.

Results: Perceived usefulness scored very good (85%), perceived ease of use was categorized as good (82%), and behavioral intention to use was also good (84%). Structural modeling showed that perceived usefulness and ease of use significantly influenced behavioral intention ($p = 0.000$; $R^2 = 0.538$). Qualitative findings reinforced these results, highlighting key benefits such as improved data accessibility and work efficiency. However, implementation challenges included system security, ethical concerns, and document legality.

Conclusion: This study offers methodological, contextual, and conceptual novelty by emphasizing a user-driven adoption process of EMRs. Users actively influenced system design and functionality, rather than relying solely on managerial or vendor decisions. Despite challenges, EMRs have reduced administrative burdens, enhanced operational efficiency, and strengthened clinical documentation. Continuous improvement should prioritize usability, legal compliance, and responsive technical support to optimize the benefits of EMR systems.

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INTRODUCTION

The advancement of information and communication technology has profoundly influenced healthcare service delivery, offering both opportunities and challenges. One of the most transformative innovations is the Electronic Medical Record (EMR), which serves not only as a digital repository of patient information but also as a tool to improve care coordination, data accuracy, and clinical efficiency (1). The adoption of EMR systems has increased significantly across countries; in the United States, for instance, EMR usage among physicians grew from 18% in 2001 to 57% in 2011, and by 2013, 72% of physicians were using tablets to access electronic telemedicine platforms (2).

In Indonesia, the Ministry of Health issued Regulation No. 24 of 2022, which mandates all healthcare facilities to implement EMRs as part of the national health digitalization strategy (3). This private teaching hospital began gradually implementing EMRs in 2016, initially using only two computers, in an effort to launch the system well ahead of the government's deadline. An evaluation of the system's implementation will offer insights into the extent of EMR adoption at this site. This regulation aligns with the SATUSEHAT platform—a nationwide health integration system aimed at creating a comprehensive, interoperable health information ecosystem. However, as of 2023, only 1.01% of healthcare facilities nationwide have integrated their EMR systems with SATUSEHAT, highlighting a substantial gap between policy and implementation. In the Special Region of Yogyakarta, for instance, only 16 out of 679 healthcare facilities (2.36%) are connected to SATUSEHAT, and in Sleman Regency, only 3.45% of facilities have integrated systems (4).

There is a significant gap in the interoperability of EHR systems, which hinders seamless information exchange among healthcare providers. This lack of interoperability can lead to fragmented patient care and inaccurate medical records (5). The low level of integration is influenced by several factors, including inadequate infrastructure, limited internet connectivity, resistance to technological change, and low digital literacy among healthcare professionals (6). One of the primary challenges faced by healthcare providers as EMR users lies not only in implementation but also in regulatory compliance, particularly regarding integration with the SATUSEHAT platform. All EMR-based health facilities in Indonesia are required to align and integrate their medical record data into the national platform, the Indonesian Health Services (HIS), to enable more effective and efficient national-level health data exchange (7). Ensuring data privacy while maintaining system performance and interoperability remains a major challenge. The lack of systematic alignment between EHR solutions and existing legal or policy frameworks points to the need for improved certification strategies for EHR systems (8). Access control mechanisms—such as multi-factor authentication and patient consent—are often unavailable, posing risks to data security (9). These obstacles not only delay clinical documentation but also threaten the overall quality and reliability of health information (10) Additionally, common barriers during EMR implementation include system errors, limited staff experience, and uncertainty about handling technical issues as they arise. These challenges often lead to hesitation or delays in system use, particularly among users who lack confidence in troubleshooting or navigating technical problems without immediate support (11).

At this private teaching hospital, in practice, delays still occur in EMR documentation by physicians following clinical procedures. Some doctors rely on nurses for data entry, and senior physicians encounter difficulties using digital systems during face-to-face consultations. Data security remains a major challenge, with some users sharing passwords and usernames. Issues such as the legal validity of digital signatures and patient overload further hinder timely data input. This study applies the Technology Acceptance Model (TAM) to evaluate the implementation and acceptance of EMRs and to identify and analyze user perceptions of usefulness, ease of use, and behavioral intention within a self-developed EMR system at a private teaching hospital. Furthermore, this study explores how user feedback may influence or lead to improvements in the hospital's EMR system. The TAM framework considers three key dimensions: perceived usefulness, perceived ease of use, and behavioral intention, allowing for an objective evaluation of technology acceptance (1). By providing empirical evidence of user perceptions, this study aims to support ongoing efforts to enhance EMR adoption from the user perspective, improve hospital information systems, and contribute to Indonesia's national digital health transformation agenda. By evaluating the hospital's experience, this study seeks to illustrate how a self-developed EMR system can influence service delivery outcomes.

METHOD

This study evaluated the implementation of Electronic Medical Records (EMRs) using the Technology Acceptance Model (TAM) through a mixed-methods approach with a parallel convergent design, offering a methodological contribution to EMR implementation evaluation. The quantitative component employed a cross-sectional survey design, while the qualitative component used a descriptive exploratory approach. This methodological framework integrates quantitative and qualitative data to enable a comprehensive analysis (12). The method allows for a more holistic understanding of user acceptance of EMRs. This model can be replicated in similar healthcare settings in Indonesia to produce evaluations that are not only numerical but also grounded in direct user experience.

Population and Sample/Informants

Quantitative

The population in this study consisted of hospital staff from three professional categories: physicians (118 individuals), nurses (282 individuals), and pharmacists (including 10 pharmacists and 40 pharmacy technicians), totaling 450 individuals. The sample comprised 82 respondents from the three professions—physicians, nurses, and pharmacists—who met the inclusion criterion of having used the EMR system for more than one year. This proportional selection aimed to ensure balanced representation of each profession and was calculated using the Yamane formula. Consequently, the qualitative descriptive overview would be evenly reflected across the three primary user groups of the EMR.

The sampling technique employed was proportionate stratified random sampling (13).

The sample size was determined using the Yamane formula, which is suitable for stratified populations. The sample was distributed proportionally among professional categories to ensure representativeness. The calculated distribution was as follows:

$$n = \frac{N}{1 + Ne^2}$$

Figure 1. Yamane formula
Source: (Sugiyono, 2017)

Notes:
n : sample size
e : error tolerance
N : population

Since the population was stratified, the sample was also stratified accordingly. Therefore, the number of samples for each professional category was determined proportionally based on the total population. Using the proportionate stratified random sampling technique, the sample was calculated as follows:

Medical Doctor = $\frac{118}{450} \times 82 = 22$ respondents

Nurse = $\frac{282}{450} \times 82 = 51$ respondents

Pharmacist = $\frac{50}{450} \times 82 = 9$ respondents

Qualitative

Purposive sampling was conducted using a criterion-based sampling strategy (14). A total of 10 participants were involved in Focus Group Discussions (FGDs) and in-depth interviews. The informants in this study included three key informants—members of the IT development team responsible for system hardware and programming—and seven main informants (nurses/midwives, physicians, and pharmacists) who were directly involved in using the EMR system. Sampling was carried out based on specific considerations and predefined criteria to obtain rich and heterogeneous information for a deeper understanding of the studied phenomenon. Key informants were selected based on their in-depth knowledge of the research topic, while main informants were chosen for their direct involvement in the phenomenon under investigation.

Research Location

This study was conducted at a private teaching hospital (Class B) located in Yogyakarta, Indonesia. The implementation of the Electronic Medical Record (EMR) system in this hospital began in April 2017. The EMR system was internally developed and maintained by the hospital itself, without the involvement of any third-party vendors.

Instrumentation or Tools

For quantitative data collection, a structured questionnaire was used and distributed via Google Forms. The questionnaire employed in this study was adapted from Purwandi (2018), originally based on Davis (1989), and designed to assess information system acceptance through three core constructs: perceived usefulness, consisting of five items; perceived ease of use, consisting of six items; and behavioral intention to use, consisting of five items. In the qualitative method, the researchers served as the primary research instruments (human as instrument) (14). Qualitative data collection was conducted through focus group discussions (FGDs) and in-depth interviews. Several tools were used during this process, including FGD guides, interview guides, voice recorders, writing materials, and laptops. The FGD guide was developed in consultation with a PhD-level research team who also serve as academic faculty and have prior experience conducting EMR-related research.

Data Collection Procedures

For the quantitative method, data were collected using a closed-ended questionnaire which was distributed online by Google form (15). To ensure data integrity and prevent duplication, the researcher activated the single-response restriction per Google account and disabled the editing option after submission. Additionally, the researcher monitored the completion time and response patterns to detect indications of invalid entries. For the qualitative method, data collection was conducted through focus group discussions (FGDs) and in-depth interviews. Both FGDs and interviews were conducted in person by the researchers. The FGDs and in-depth interviews were carried out separately, involving participants with different characteristics; therefore, the informants for the FGDs and the in-depth interviews were not the same individuals.

Data Analysis

In this mixed-methods study, the analysis involved interpreting the results from both approaches. Quantitative and qualitative data were analyzed separately and then integrated using a side-by-side comparison approach, beginning with qualitative findings followed by quantitative results to confirm or contrast the qualitative insights (12). The side-by-side comparison approach was used to support triangulation of findings and strengthen the validity of data interpretation, thereby providing more robust analysis. This approach enabled the researchers to systematically compare and integrate the quantitative and qualitative findings directly, offering deeper insights. Qualitative findings were used exploratively to uncover context, meaning, and participants' subjective perceptions, while the quantitative results served to test consistency or confirm emerging patterns.

Quantitative data from the questionnaire were analyzed using descriptive statistics to summarize and describe the collected data (13). The questionnaire consisted of five response options. Responses were assessed using a scoring rubric for each item, based on percentage criteria. The score ranges were calculated using the following formula:

$$RS = \frac{n\,(m-1)}{m}$$

Figure 2. Score Range Calculation Formula
(Source: Sugiyono, 2017)

Based on the respondents' answers to the questionnaire, evaluation criteria were developed for each statement item. The categorization of response scores was adapted from Riduwan (2015) (16), using percentage-based intervals. The results were classified as follows: very good (85–100%), good (69–84%), fair (53–68%), poor (37–52%), and very poor (20–36%). Descriptive analysis—including frequency, percentage, and mean scores for each variable—was conducted using IBM SPSS Statistics for Windows, version 27.0 (17).

Further analysis was conducted using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS version 4. The model evaluation was carried out in two stages: outer model and inner model. The inner model was evaluated using R-square values to assess predictive power and f-square values to measure the effect size of independent variables on the dependent variable. Model fit was tested using the Standardized Root Mean Square Residual (SRMR) and Norman Fit Index (NFI), indicating acceptable model fit (18,19). Hypothesis testing was performed through bootstrapping with 5,000 resamples, and relationships were considered significant if the T-statistic was >1.96 and the P-value was <0.05. This analysis confirmed that the model was statistically acceptable (20). Qualitative data were analyzed using thematic analysis (14). The analysis followed the steps proposed by Miles and Huberman (1994), which include data reduction, data display, and conclusion drawing.

Validity, Reliability, and Trustworthiness

Validity and reliability testing was conducted using SmartPLS. Convergent validity was assessed through outer loading values (>0.70) and Average Variance Extracted (AVE >0.50), while discriminant validity was tested using the Fornell-Larcker criterion and the Heterotrait-Monotrait Ratio (HTMT <0.90). Instrument reliability was confirmed through Cronbach's Alpha and Composite Reliability values (>0.70), as well as Variance Inflation Factor (VIF <5) to ensure there was no multicollinearity. All indicators met the criteria recommended by Hair et al. (2019) (21).

Trustworthiness in this study was established through data triangulation (FGDs and in-depth interviews) and methodological triangulation (quantitative and qualitative). Transferability was ensured by detailed documentation and contextual descriptions; dependability was demonstrated through the consistency of responses among informants; and confirmability was achieved by involving more than one researcher in code review to minimize interpretive bias (22).

Ethical Approval

This study received ethical clearance from the Ethics Committee of PKU Muhammadiyah Gamping Hospital (Approval Number: 043/KEP-PKU/2024). All participants provided informed consent prior to data collection. The confidentiality and anonymity of all participants were strictly maintained throughout the research process.

RESULTS

This section presents the findings from both the quantitative and qualitative components of the study. Each method is reported separately to highlight the strengths and address the limitations inherent to each approach, thus providing a more comprehensive analysis.

Quantitative Findings

Table 1 presents the characteristics of the respondents in the quantitative phase. The respondents varied in age, education, professional position, and years of service in the hospital.

Table 1. Respondent Characteristics

Respondent characteristics	**N (%)**
Gender	
Male	28 (19,9)
Female	113 (80,1)
Age (years)	
17-25	5 (3,5)
26-34	87 (61,7)
35-43	32 (22,7)
44-52	10 (7,1)
>52	7 (5)
Education	
Diploma (D3)	72 (51,1)
Bachelor's/Professional	64 (45,4)
Master's/Subspecialist	5 (3,5)
Profession	
Medical Doctor	9 (6,4)
Nurse/Midwife	105 (74,5)
Pharmacist	27 (19,1)
Years of Service	
1-3	17 (12,1)
4-5	21 (14,9)
>5	103 (73)

A total of 141 respondents participated in the study. Most respondents were female (80.1%), aged between 26 and 34 years (61.7%), and held a diploma degree (51.1%). The majority were nurses or midwives (74.5%) and had more than five years of service (73%). The profile of EMR users was dominated by female health workers in their productive years (26–34), with a diploma-level educational background, and most were nurses or midwives. The fact that the majority had over five years of clinical experience suggests that EMR acceptance was driven by individuals with a mature level of professional practice. This indicates that technology adoption was influenced not only by administrative mandates but also by a functional need directly perceived by the users themselves.

Table 2 presents the frequency distribution of responses related to the evaluation of EMR implementation in the hospital. The results show that the average percentage for perceived usefulness was 85% (very good), perceived ease of use was 82% (good), and behavioral intention to use was 84% (good), with one item in the behavioral intention construct rated as very good.

Table 2. Questionnaire Results

No.	Variable	Questionnaire item	Actual score	Ideal score	%	Category
1	Perceived Usefulness	1	626	705	89	Very Good
		2	616	705	87	Very Good
		3	607	705	86	Very Good
		4	558	705	79	Good
		5	603	705	86	Very Good
		Total	2010	3525	85	Very Good
2	Perceived Ease of Use	1	565	705	80	Good
		2	587	705	83	Good

No.	Variable	Questionnaire item	Actual score	Ideal score	%	Category
		3	579	705	82	Good
		4	573	705	81	Good
		5	563	705	80	Good
		6	588	705	83	Good
		Total	3455	4230	82	Good
3	Behavioral Intention to Use	1	594	705	84	Good
		2	573	705	81	Baik
		3	590	705	84	Good
		4	583	705	83	Good
		5	612	705	87	Very Good
		Total	2952	3626	84	Good

These findings indicate that the EMR system was perceived as highly useful (85%) and reasonably easy to use (82%). Interestingly, the dimension of ease of use scored slightly lower than perceived usefulness. This suggests that while the system is beneficial, there is still room for improvement in terms of user interface or user training. Technology adoption is not solely about advanced features but also about how well the system supports users in their daily tasks. This offers a valuable lesson for EMR developers and hospital management.

Based on the analysis conducted using SmartPLS, the model demonstrated acceptable validity and reliability. The outer loading values for all indicators exceeded 0.70, the Average Variance Extracted (AVE) values were greater than 0.50, and both Cronbach's Alpha and Composite Reliability values were above 0.70 (see Table 3), indicating that the measurement instrument used in this study was both valid and reliable.

Evaluation of the inner model showed an R-square value of 0.538 for behavioral intention, indicating a moderate level of predictive power for the model. The f-square values revealed that the variable perceived ease of use had a stronger effect ($f^2 = 0.308$) on behavioral intention compared to perceived usefulness ($f^2 = 0.155$), as presented in Table 4.

Model fit was assessed using the Standardized Root Mean Square Residual (SRMR) and the Normed Fit Index (NFI). The SRMR value was 0.081 and the NFI value was 0.820, both of which indicated an acceptable fit for the structural model.

Hypothesis testing was performed through bootstrapping with 5,000 resamples. The results showed statistically significant relationships between perceived usefulness and behavioural intention (T-statistic = 4.018; P-value = 0.000), and between perceived ease of use and behavioural intention (T-statistic = 5.542; P-value = 0.000). These findings support the research hypotheses, confirming that both perceived usefulness and perceived ease of use significantly influence users' behavioral intention to adopt the Electronic Medical Record system.

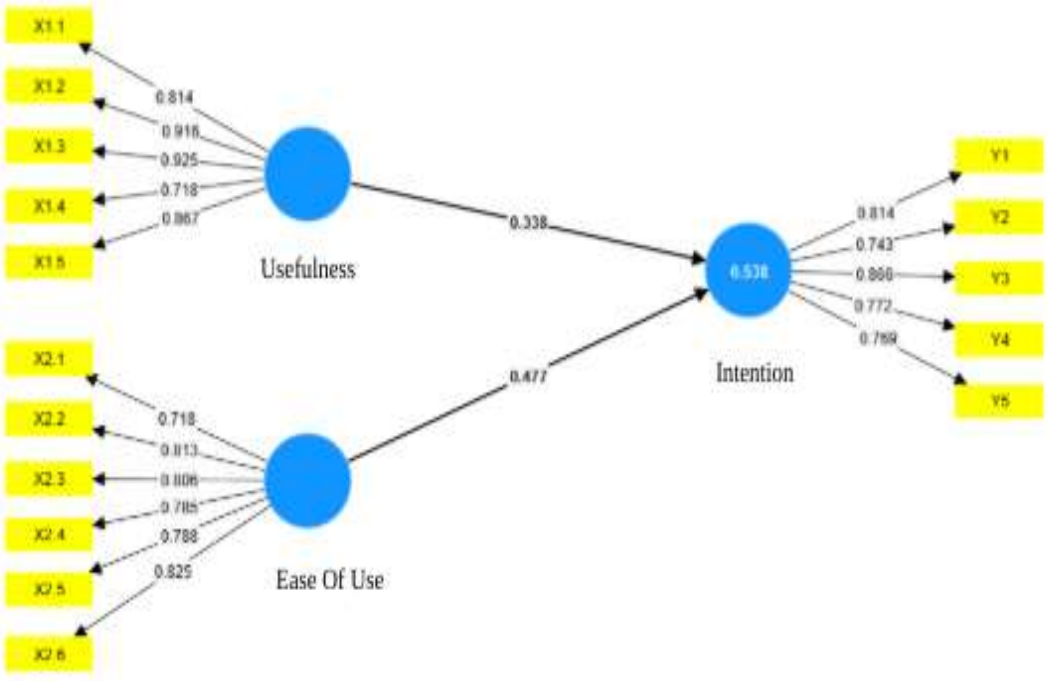

Figure 3. Outer Model and Inner Model the Influence of Usefulness and Convenience on Behavioral Intention

The structural model results revealed an interesting finding: ease of use had a stronger influence on the intention to use EMRs than perceived usefulness. Users were more motivated to adopt the system not merely because of its functional benefits, but because of the comfort and simplicity in using it. This figure illustrates that both perceived usefulness and perceived ease of use directly contribute to users' behavioral intention to adopt the EMR system.

Table 3. Validity and Reliability

Variable	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Perceived Usefulness	0,904	0,922	0,929	0,725
Perceived Ease of Use	0,880	0,893	0,908	0,624
Behavioral Intention	0,853	0,866	0,895	0,631

As shown in Table 3, all outer loadings for the observed variables were above the recommended threshold of 0.70, indicating that each item reliably represents its corresponding latent construct. This suggests that the indicators have strong correlations with their respective variables, thus confirming item reliability. The measurement instrument used in this study is not only statistically valid but also reflective of actual user experiences. With all reliability and validity values exceeding the required thresholds ($P > 0.05$), the measured constructs genuinely represent users' perceptions. This provides strong legitimacy to the study's findings and positions it as a credible reference for understanding health technology adoption.

In addition, the Average Variance Extracted (AVE) values for each construct exceeded 0.50, fulfilling the criteria for convergent validity. An AVE value greater than 0.50 indicates that more than half of the variance in the observed variables is captured by the latent construct rather than by measurement error. These results support the internal consistency and validity of the measurement model used in this study.

Table 4. f-square and Hypothesis Testing

Hypothesis	f-square	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values	Result
Perceived Usefulness → Behavioral Intention	0.155	0,338	0,335	0,084	4,018	0,000	Accepted
Perceived Ease of Use → Behavioral Intention	0.308	0,477	0,491	0,086	5,542	0,000	Accepted

The hypothesis testing using bootstrapping (5,000 resamples) revealed that both perceived usefulness and perceived ease of use significantly influence behavioral intention to use the EMR system. The path from perceived usefulness to behavioral intention yielded a T-statistic of 4.018 with a P-value of 0.000, indicating a significant positive effect. Similarly, the path from perceived ease of use to behavioral intention resulted in a higher T-statistic of 5.542 and the same level of significance (P = 0.000). Regarding effect size, the f-square value for perceived usefulness was 0.155, suggesting a small-to-moderate effect, while perceived ease of use had a larger effect size of 0.308, indicating a moderate influence. This table highlights that ease of use ($f^2 = 0.308$) has a stronger impact on the intention to use EMRs compared to perceived usefulness ($f^2 = 0.155$). Both relationships are statistically significant; however, the findings emphasize that users are more motivated by comfort and simplicity in system usage than by perceived functional benefits alone. A system that is intuitive and easy to navigate more effectively encourages EMR adoption. These results support the conclusion that ease of use plays a more substantial role than perceived usefulness in shaping users' intention to adopt the EMR system.

Table 5. R-Square

	R-square	R-square adjusted	Keterangan
Behavioral Intention	0.538	0.532	Moderate

The results showed that the R-square value for behavioral intention was 0.538, indicating that 53.8% of the variance in behavioral intention could be explained by the independent constructs in the model. According to Chin (1998), this value reflects a moderate level of explanatory power (23). All outer loadings in the measurement model exceeded the 0.70 threshold, thus meeting the criteria for convergent validity. With an R^2 value of 0.538, the model explains more than half of the variation in behavioral intention. This suggests that the two core variables in TAM are sufficiently reliable in predicting technology adoption and serve as a strategic foundation for training interventions, system redesign, and digital adoption policies in healthcare facilities.

Qualitative Findings

In the qualitative phase of the study, a total of ten informants participated—seven in the Focus Group Discussions (FGDs) and three in in-depth interviews. The participants represented diverse professional backgrounds including physicians, nurses, pharmacists, and IT development team members, with varying years of experience and length of EMR system use.

Table 6. Characteristics of FGD and Interview Informants

No.	Characteristic	*f*	%	*Mean*
1	Gender			
	Male	2	20	
	Female	8	80	
	Total	10	100	
2	Age			
	17-25 years	0	0	35,9 years
	26-34 years	7	70	
	35-43 years	1	10	
	44-52 years	0	0	
	>52 years	2	20	
	Total	10	100	
3	Profession			
	Medical Doctor	1	10	
	Nurse/Midwife	4	40	
	Pharmacist	2	20	
	IT Development Team	3	30	
	Total	10	100	
4	Years of Service			
	1-3 years	0	0	9,5 Years
	4-5 years	2	20	
	>5 years	8	80	
	Total	10	100	
5	Duration of EMR Use			
	<1 years	0	0	6 Years
	1-3 years	0	0	
	3-5 years	2	20	
	>5 years	5	50	
	Total EMR user	7	70	
6	Total EMR developers	3	30	

Based on the characteristics of the FGD participants, the majority were aged between 26 and 34 years (n = 6), while the remaining participants were between 35 and 43 years old, with an average age of 32 years. Most of the FGD participants were female. The seven participants represented six different hospital units. Two participants were from the pharmacy department (one from the inpatient and one from the outpatient unit), and the remaining five were from the Emergency Department (IGD), Ar-Royan, Wardah, Na'im, and Az-Zahra units. In terms of professional roles, four participants were nurses, and one was a physician. Most participants had been working in the hospital for more than five years (n = 5), while the others had between three and five years of experience. The average length of work experience was eight years, and the average duration of EMR use was six years.

For the in-depth interview, three informants were involved. One was between the ages of 26 and 34, while the other two were over 52 years old. The average age among these informants was 45 years. Two were male, and one was female. All three interview participants were members of the hospital's Health Information System development team (SIMRS), each with more than five years of professional experience. The average length of service among them was 13 years.

The strength of the qualitative data lies in the diversity of perspectives. In this study, the combination of clinical healthcare professionals and IT developers provided a comprehensive view that bridged user expectations with developer logic. Findings from this group not only addressed what occurred but also explored why and how EMR technology could be accepted or rejected. This represents an important step in building a user-centered and inclusive digital hospital ecosystem.

Thematic analysis of focus group discussions and in-depth interviews revealed five major themes: (1) Implementation process and organizational support; (2) System ease of use, efficiency, and perceived benefits; (3) System security and ethical use; (4) Patient safety risks; and (5) Professionalism and future expectations. These themes are elaborated as follows:

Implementation Process and Organizational Support

The transition to EMRs was initiated due to frequent issues with the paper-based system, including incomplete discharge summaries, delays, and lost medical records. As one member of the development team explained, the EMR was introduced in response to these problems:

"...there were many complaints from doctors and patients about delays or missing medical records. That's when we decided to shift to outpatient EMRs..." (W03)

This illustrates that the hospital's initial step toward digital transformation was reactive. In the FGD, this was reinforced by clinical staff complaints regarding frequently lost documents, indicating complementarity in identifying the initial root problems.

The development team began designing the EMR system internally as a solution to these problems.

"...we had issues with incomplete summaries, so we initiated the use of electronic medical records..." (W03)

This quote further supports that documentation problems were a trigger for system innovation, aligning with FGD feedback on patient data inconsistencies.

Although there was no dedicated budget at the beginning of the 2017 implementation, the development team proceeded using a phased approach. A key informant from the in-depth interviews (W02), who was directly involved in the early phase, highlighted the very limited infrastructure readiness.

"...at the time, we were not ready—neither hardware nor software. Our servers, networks, and devices were all unprepared..." (W02)

This statement reflects that the facilitating conditions were not initially met, but rather served as a trigger for innovation and adaptation. The lack of readiness did not hinder their progress; instead, it became a starting point for gradually building system preparedness. The same informant further described a shift from a reactive to a proactive approach:

"*...so we started planning and preparing, including hardware, software, and human resources..." (W02)*

This demonstrates how users' firsthand experiences became the foundation for strategic planning, leading to a bottom-up innovation process. It reinforces the importance of user feedback in shaping system development.

Training and socialization were conducted gradually. These were key elements during the early phase of system implementation. An FGD participant (F01) confirmed that initial communication about how to use the system was clear:

"...Initially, there was clear socialization on how to use the system..." (F01)

This reflects a positive perception of early developer communication efforts. However, the training approach was not always conventional—it often involved a room-to-room strategy. An in-depth interviewee (W03), who was involved in the technical implementation, described a more flexible and contextual method:

"...the training wasn't conducted in classrooms—we went room to room. Later, we held formal training sessions organized by HR..." (W03)

Resource limitations did not prevent the training from taking place. Instead, the team opted for field-based engagement before transitioning to formal sessions. This illustrates an adaptive strategy that responded to on-site realities and staff needs.

From an organizational support perspective, informant interviews (W01) revealed that hospital management played an active role in establishing both material and non-material facilitating conditions. This support was reflected in the approval of hardware procurement and external learning opportunities:

"...for hardware improvements, our proposals were nearly always approved..." (W01)

"...we requested a server worth 1.2 billion rupiah, and it was approved..." (W01)

"...we were allowed to visit other hospitals for benchmarking and inspiration..." (W01)

These points underscore the critical role of management in strengthening infrastructure and expanding the implementation team's insights through learning visits. Conceptually, this reinforces the dimension of organizational facilitating conditions in the TAM model, which influences the perceived ease of use and perceived usefulness of the system from the users' perspective.

Ease of Use, Efficiency, and System Benefits

Users reported clear benefits of EMR implementation over manual systems. System users consistently reported numerous tangible benefits from implementing Electronic Medical Records (EMR) over manual systems. From a user perspective, one informant described significant changes in file management:

"...Previously, files were piled up. Now, it's much slimmer..." (W02)

This reflects improved physical efficiency in managing medical record data. The positive effects were also evident in human resource allocation:

"...We went from nine filing staff to just one..." (W02)

This change indicates a direct impact on operational efficiency, aligning with enhanced perceived usefulness from a managerial standpoint. It also led to cost savings:

"...Paper costs dropped from nearly 100 million to 25–35 million per month..." (W02)

EMRs also improved workflow speed and made information retrieval easier. From the perspective of clinical service users, informants (F07 and F03) emphasized the improved speed and ease of access to patient information—an aspect closely related to perceived ease of use:

"...more efficient... drug history is easy to track..." (F07)

"...Just a few clicks and all the data are there..." (F03)

Time saved from documentation could be redirected to patient care. These findings reinforce that EMRs not only deliver administrative efficiency but also improve work pace and clinical service accuracy. Time previously spent on documentation can now be redirected toward patient-focused care, as illustrated by informant W03:

"...Previously, I finished by sunset. Now, I'm done by late afternoon..." (W03)

Though initial adjustment was challenging, format simplification improved usability. However, adapting to the system was not instantaneous. In-depth interviews revealed that simplifying input formats was key to improving user acceptance:

"...we simplified the forms—just the essential fields to meet the standards..." (W03)

"...doctors quickly adapted as the forms were straightforward..." (W02)

These statements indicate that successful system adoption is strongly influenced by interface design and alignment with users' workflows. Format simplification not only improved efficiency but also played a critical role in accelerating adoption among clinical users—particularly physicians.

System Security and Ethical Use

Security concerns remain a challenge, and unsafe behaviors were reported. Although the EMR system has brought many benefits, various security and legal challenges continue to hinder comprehensive implementation. Several FGD participants revealed risky user behaviors that threaten data security, such as the use of external devices and unauthorized website access from hospital computers:

"...using flash drives or accessing YouTube from hospital PCs... can introduce viruses..." (F01)

These behaviours expose the system to cybersecurity breaches caused by users themselves, reflecting weak organizational enforcement of digital security policies.

Credential-sharing among users also compromises system integrity: The issue of credential violations, such as password sharing, was raised by FGD participants (F01 and F03), potentially obscuring digital trails and posing risks to the integrity of medical data. This indicates poor access control and a lack of user accountability, which may reduce system trust and violate patient data security principles:

"...some users still share their passwords with others, including students..." (F01)

"...a medical student filled out the entire chart while the doctor used their phone..." (F03)

Legal validation of electronic signatures remains incomplete. While doctors can use digital signatures, patient signatures remain manual. This highlights legal limitations in implementing electronic signatures. Although the hospital has introduced innovations in digital signature usage, the system is not yet fully recognized by legal authorities.

"...digital barcodes on death certificates were rejected by civil registry..." (F01)

"...we're preparing to integrate hospital data with external certified e-signature platforms..." (W02)

Patient Safety Risks

Despite the increased efficiency and convenience brought by EMR implementation, clinical risks remain a significant concern. FGD participants emphasized that errors in diagnosis entry or medication documentation could have direct consequences for patient safety. A nurse shared that they often needed to reconfirm diagnoses with doctors due to incomplete system entries:

"...sometimes we have to contact the doctor via phone to confirm diagnoses not entered into the system..." (F02)

In other cases, participants described how patients themselves were used as a secondary source of verification to detect potential prescription errors:

"...if a prescription seems odd, we ask the patient—like when the dosage doesn't match..." (F01)

These statements illustrate situations in which the responsibility for clinical verification is shifted to patients, who are neither ethically nor technically accountable for clinical accuracy. This indicates a high perceived risk regarding the system's reliability.

Furthermore, several participants expressed concern that errors—although recognized during patient handovers—may persist in the EMR system for extended periods if not corrected promptly. This underscores the need for rapid and systematic data correction procedures within EMRs and highlights the importance of aligning EMR functionalities with existing clinical workflows:

"...errors in the EMR can persist for months if not updated, even when caught during patient handovers..." (F06)

Professionalism and Future Expectations

Users expressed a strong willingness to continue using EMRs, with enthusiasm spreading informally through peer recommendations. A key informant from the in-depth interviews (W03) illustrated how a domino effect occurred within hours of initial use:

"...even that same night, one doctor shared the system in the medical committee group, and by morning, several others asked to use it..." (W03)

This reflects a high behavioral intention to use, driven by positive user experience and professional social dynamics. The adoption process appears influenced not only by individual perceptions of system usefulness but also by peer influence within the medical community.

Participants in the FGD also acknowledged that EMRs support overall professional standards in clinical practice. However, certain legal documents—such as informed consent—are still maintained in paper format due to unresolved legal considerations:

"...informed consent is still on paper because of legal concerns..." (F01)

"...we're preparing metadata and certified electronic signatures..." (F02)

These statements reflect user expectations for the alignment of EMR systems with national legal frameworks and indicate a shared commitment among users to support the continued digitalization of healthcare in a lawful and systematic manner.

Nevertheless, this optimism is tempered by structural challenges in system development. One FGD participant pointed out that limited technical resources—particularly the reliance on a single in-house programmer—hinder the pace of system improvement relative to user expectations.

"...development progress is limited since we rely on one in-house programmer..." (F06)

Challenges and Mitigation Strategies in EMR Implementation

Despite the overall success of EMR implementation at this Hospital, several challenges remain, both technical and organizational. One of the primary issues is the variability in user preferences and expectations across different professional groups, which often leads to conflicting requests in system development. As noted by an EMR developer:

"Sometimes user A wants it one way, but user B wants the opposite. Their requests contradict each other." (W03)

This highlights the difficulty in maintaining a consistent level of perceived usefulness when faced with divergent user expectations. If unmanaged, such misalignments can hinder the system development process and reduce user satisfaction.

To address these inconsistencies, the hospital established a communication forum to mediate discussions and consolidate feedback before passing requests to the IT development team:

"We addressed this through the communication forum. All input goes through us first, and then we evaluate it before it reaches the programmers." (W03)

This strategy functions as an effective facilitating condition, serving to prevent fragmented development requests and promote collective, consensus-based decision-making. It underscores the importance of governance mechanisms in ensuring that EMR development remains user-centered while balancing cross-professional demands.

Professional collaboration across departments has also been strengthened to ensure that system enhancements consider the needs of different clinical roles:

"We've started interprofessional discussions—doctors, specialists, and others—so everyone's voice is heard before changes are made." (F01)

Another significant issue is system downtime, which disrupts clinical workflows and access to patient information. To mitigate this, the hospital has developed standard operating procedures (SOPs) and conducted specific trainings to guide staff during outages:

"We train the staff on how to handle system downtimes—what steps to take if the system is down for more than five or ten minutes." (W02)

"Each unit has its own SOP. If the system fails, we return to manual mode." (W01)

"During downtimes, nurses can't access the drug database, so they end up calling pharmacy for information." (F05)

In addition to internal issues, external factors such as interoperability with national health insurance systems (BPJS) and shifting government policies also impact system performance.

"Our EMR is integrated with BPJS, so if BPJS is undergoing maintenance, our system slows down too. But users just say, 'The EMR is slow,' not realizing the cause." (W01)

"We must adapt to government policies, especially those from the Ministry of Health and National Insurance (BPJS), which require our data to be integrated with their systems." (W02)

These challenges illustrate the complex nature of EMR implementation in a dynamic healthcare environment. Nonetheless, proactive problem-solving approaches, clear communication mechanisms, and adaptability to policy changes have allowed the hospital to maintain operational continuity and continue developing the EMR system sustainably.

TAM Evaluation and User Feedback on System Innovation

This study employed the Technology Acceptance Model (TAM) not merely to assess user acceptance of the Electronic Medical Record (EMR) system, but to explore the underlying reasons and processes behind such acceptance. Quantitative results revealed high user ratings for perceived usefulness (85%) and perceived ease of use (82%). Interestingly, ease of use was found to have a stronger influence on users' behavioural intention to continue using the system than perceived usefulness. This indicates that systems that are simple, intuitive, and easy to navigate are more likely to encourage adoption than those that merely offer advanced features.

Qualitative findings further reinforced that technological innovation in the hospital setting did not follow a top-down directive but emerged from user experiences and feedback. Physicians, nurses, pharmacists, and IT personnel actively contributed not only evaluations but also practical insights—ranging from initial adaptation difficulties, expectations for continuous training, to the demand for a more responsive system. Challenges such as interprofessional preference discrepancies, system downtimes, and integration with the national health insurance (BPJS) scheme were addressed through an internal communication forum, where feedback was consolidated prior to development decisions. This highlights users not as passive implementers but as active partners in shaping the system's evolution.

By integrating both quantitative and qualitative data, this study demonstrates that the success of EMR implementation is not solely determined by the technology itself, but by how it is shaped and refined through continuous dialogue with its users. TAM served not only as a measurement tool but also as a framework for guiding user-centered Innovation, system downtime, and integration with BPJS are handled through an internal communication forum where feedback is consolidated before further development. This demonstrates that users are not simply implementers, but active partners in shaping the direction of the system's evolution.

By combining quantitative and qualitative data, this study demonstrates that EMR success is not solely about the technology implemented, but about how the system is shaped and refined through dialogue with its users. TAM serves as a tool that not only measures acceptance but also creates space for change that begins with listening to the voice of users.

DISCUSSION

The evaluation of the Electronic Medical Record (EMR) system represents a critical effort to assess the actual conditions and effectiveness of its implementation within the hospital setting. As noted by previous studies, information system evaluation is a structured approach to understanding how well a system functions in practice and to what extent it meets user and organizational needs (24). The TAM-based evaluation in this study not only measured the degree of EMR acceptance among users but also explored how perceptions of ease of use and usefulness actively shaped behavioral intentions. The findings emphasize that technology adoption is not a one-way process from system to user; rather, it evolves through tangible user feedback, which acts as a catalyst for innovation.

User-centered development of EMRs offers significant benefits. When EMR content is tailored to specific clinical contexts—such as medical specializations or disease types—it can streamline workflows and improve patient outcomes (25). Involving users in EMR development enhances system usability and user acceptance, as demonstrated in Warid's (2019) study on EMR development for thalassemia patients (26). A development approach that focuses on user needs not only improves the efficiency and quality of care but also fosters effective system adoption. Ensuring user involvement and interface flexibility has been identified as a key determinant of successful EMR implementation (26, 27).

EMRs must be customized to the clinical environment in which they are implemented to ensure relevance and effectiveness (25). At this private teaching hospital, the EMR development process has undergone several iterations to accommodate user needs based on practical experiences. Positive user experiences—such as a clear interface and intuitive functionality—can foster a sense of ownership, which in turn promotes sustained adoption. Users who perceive the system as both easy to use and beneficial are more likely to maintain strong behavioral intentions to use EMRs (28,29). This finding aligns with the results of the present study, which revealed that perceived ease of use exerted a stronger influence on users' intention to adopt the system than perceived usefulness. A system that is easy to navigate contributes significantly to user acceptance and ultimately encourages wider EMR utilization

(30). The following section presents a detailed account of the study's findings, focusing on users' perceptions of usefulness, ease of use, and behavioral intention to adopt the EMR system.

Perceived Usefulness

The results of this study demonstrate that the perceived usefulness of the Electronic Medical Record (EMR) system is a key factor in shaping users' acceptance and adoption. In the quantitative analysis, the construct of perceived usefulness received the highest overall score, with a mean percentage of 85%, categorized as very good. These results align with Davis's Technology Acceptance Model (TAM), which posits that when users perceive a technology as useful in enhancing their job performance, they are more likely to adopt and continue using it (31).

Overall, the evaluation of the influence of perceived usefulness and perceived ease of use on behavioral intention—using the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach—demonstrated a well-fitting structural measurement model. The R-square value for behavioral intention ($R^2 = 0.538$) indicates that both constructs—usefulness and ease of use—moderately explain the variance in behavioral intention, consistent with the classification proposed by Hair et al. (2019).

The F-square values for both predictors suggest that perceived ease of use and perceived usefulness exert a substantial impact on behavioral intention, with ease of use exerting a relatively stronger effect. Hypothesis testing confirmed that both pathways—from usefulness to behavioral intention and from ease of use to behavioral intention—were statistically significant. These findings support the study's hypotheses and affirm that both constructs are critical determinants of behavioral intention in the context of EMR utilization.

In line with these quantitative findings, qualitative insights further identified key drivers such as system accessibility, key drivers such as system accessibility, intuitive features, and user-friendliness were found to directly influence users' willingness to engage with the EMR system. This aligns with previous studies suggesting that users' perceptions of technological ease significantly contribute to their acceptance and continued use of such systems. (32).

Electronic medical records were recognized as tools that enhance the quality and productivity of hospital services (33). In this study, qualitative findings also revealed dissatisfaction with manual processes such as the preparation of discharge summaries, which were often considered incomplete, delayed, or prone to being lost. Delays in returning medical records were attributed to non-adherence to procedures and incomplete documentation (34). These issues have also been identified in previous studies, where delays were linked to late documentation, lack of designated staff to retrieve records, and the physical distance between service units and the medical records department (35).

The transition initiated in 2017, was a strategic response to longstanding inefficiencies in manual record-keeping. EMRs were designed to manage the entire medical record lifecycle—from documentation during patient care, to record storage and retrieval. Given the complexity of managing paper-based records, this shift was necessary to ensure accurate, timely, and accessible medical documentation (36).

The implementation of EMRs has resulted in more streamlined access to medical history and real-time patient data, thus improving staff productivity, reducing workload, and increasing the overall efficiency and effectiveness of service delivery. Users noted that EMRs facilitated real-time data entry, improved data accuracy, and simplified clinical processes. These findings are in line with prior literature, which states that EMRs enhance task completion, accuracy, and system responsiveness (37). Similarly, Janet and Yeracaris (2020) also reported that EMRs improve efficiency, reliability, and service quality, particularly in primary care settings (38). The hospital management echoed these sentiments, highlighting the organizational advantages of EMR implementation. From a managerial standpoint, EMRs reduced the volume of paper records, minimized staffing in the medical records department, and lowered the budget allocated for paper usage—contributing to more cost-efficient operations. These findings support the notion that effective healthcare facility management depends on digital systems that ensure high-quality, efficient, and integrated services (39).

The findings of Rosalinda et al. (2021), who found that EMRs facilitate data retrieval, improve service quality, and enhance staff productivity. EMRs are continuously updated with the latest patient information, ensuring data consistency and accessibility for future visits. In contrast, manual records require physical searches and transfers, which are time-consuming, demand significant storage space, and increase the risk of document loss. EMRs thus offer a more secure, clear, and accessible source of patient data (33).

Despite these benefits, the effectiveness of EMR systems must also be evaluated from the standpoint of data protection and legal compliance. One significant concern involves the sharing of user credentials, where senior physicians sometimes delegate EMR input tasks to medical students or interns. Such practices violate basic information security principles—particularly the access control component, which emphasizes restricting access to sensitive data only to authorized personnel (40). These violations not only compromise patient confidentiality but also pose legal and reputational risks for the institution.

The study also identified ongoing challenges related to the legal validity of EMRs. For example, barcode-based signatures—although functional—have not yet been fully accepted for legally binding documents such as consent forms. While Indonesian Law No. 19 of 2016 formally recognizes the use of electronic signatures, certified digital signatures within EMRs are not yet comprehensively implemented, especially on the patient side (41). In terms of technical protection, Ardianto et al. (2024) identified five critical dimensions of EMR data security (42) EMR data security remains uneven, with weak confidentiality practices, partial implementation of authentication protocols, and non-standardized accountability systems.

These findings underscore that the perceived usefulness of EMRs is not solely determined by functional benefits such as faster access to patient data or streamlined workflows. Rather, it also depends on the trustworthiness, legality, and secure handling of information. Enhancing user awareness, strengthening access controls, and aligning with legal frameworks are essential to realizing the full potential of EMR systems.

Perceived Ease of Use

The findings of this study indicate that the perceived ease of use of the Electronic Medical Record (EMR) system was rated as good based on the questionnaire analysis, a result that is consistent with the qualitative findings from focus group discussions (FGDs). Although the initial implementation of the EMR system faced challenges—particularly related to format complexity—the subsequent revision of the system's structure greatly improved user experience. Users reported that the EMR system became easier to navigate and utilize, especially after prolonged exposure and increasing familiarity with the platform.

These findings are consistent with Bauman et al. (2018), who noted that although the initial adoption of EMRs tends to increase documentation time, user efficiency improves significantly as familiarity with the system grows (43). The role of system design in facilitating ease of use was also emphasized by Romney (2004) and Habib & Prasetyawan (2016) who stated that information formats must be intuitive, easy to understand, and logically structured to optimize user engagement (44). In line with this, Rohmah et al.,(2020) found that a simple and clear interface is critical in avoiding user confusion and promoting ease of navigation (41). Participants in the current study similarly expressed that the simplified format after system modifications allowed them to complete tasks more efficiently without feeling overwhelmed. Moreover, user orientation and socialization were identified as crucial components in supporting the ease of EMR adoption. Early-stage system socialization efforts—including direct user training, regular update meetings, and dissemination of information about the benefits of EMRs—played a vital role in helping staff transition from manual to electronic systems. As noted in the literature, effective socialization is a significant determinant of successful EMR implementation (45).

Differences in priorities between nurses and physicians reflect the diverse needs of users during the implementation of health information innovations (27). The simplification of EMR input formats has significantly improved ease of use, making the system more accessible and user-friendly across professional groups. EMRs have demonstrated multiple benefits at the departmental level, including substantial workload reduction, streamlined workflows, and enhanced capacity for patient data storage (46). Furthermore, EMRs can serve as a platform to improve interprofessional communication. Integrated digital communication tools within EMR systems have been shown to enhance collaboration and increase provider satisfaction during clinical decision-making processes (47). The digitization process is not solely aimed at increasing operational efficiency but also at strengthening clinical and administrative decision support systems and ensuring quality assurance across care processes. (48). While EMRs offer a means to facilitate cross-specialty and interdisciplinary collaboration, they may also pose limitations due to system constraints and a potential decline in face-to-face communication among providers (49).

Nevertheless, individual factors were found to influence perceptions of ease of use. Although many users acknowledged the system’s relative simplicity, some professionals, particularly physicians, did not necessarily

associate ease of use with their attitudes toward EMR adoption. Instead, they valued EMRs primarily for their potential to improve the quality of patient care through better care coordination and the reduction of clinical errors (50). Thus, while perceived ease of use facilitates adoption for many users, professional values and motivations can modulate its overall influence on user acceptance.

Behavioral Intention

The findings of this study indicate that users' behavioral intention toward the adoption and continued use of the Electronic Medical Record (EMR) system was shaped from the early stages of system implementation. Informants reported that their initial interest and motivation were driven by the preparation efforts made prior to EMR rollout. Positive behavioral intention not only reflects users' acceptance but also signals optimism for future system use and development. Participants expressed hope that the EMR system would continue to evolve with enhanced features to better support healthcare delivery (41).

To sustain and strengthen EMR utilization, respondents emphasized the importance of incorporating user feedback into system development. Several suggestions were proposed to improve medical record completeness and quality, including the enhancement of infrastructure and staffing levels, periodic training sessions, increased awareness campaigns about the importance of complete documentation, and improvements to the electronic system to make it more user-friendly. In line with previous findings by Yaniawati and Sukajie (2024), this study highlights the importance of engaging users not only as system operators but also as active contributors to the ongoing development of Electronic Medical Records (EMRs). Respondents in this study suggested a number of strategies to sustain and enhance behavioral intention to use EMRs. These included providing incentives for staff who consistently complete patient records, strengthening inter-unit coordination to improve workflow, ensuring the availability of technical personnel to promptly resolve system issues, and developing automated reminder systems for incomplete data entries.

User feedback plays a pivotal role in enhancing the quality of electronic medical records (EMRs). It serves not only to identify data quality issues but also to inform the development of data quality feedback tools, which can elevate documentation standards across diverse clinical practices and software platforms (51). Integrating user insights can contribute to reducing medical errors and improving clinical decision-making. For instance, electronic feedback systems (e-feedback) have been shown to increase physician satisfaction and their commitment to modifying clinical practices (52). Involving users in system refinement processes enhances their overall satisfaction with EMRs. Studies suggest that users who feel heard and actively engaged in system improvement are more likely to adopt and effectively utilize EMR systems (53,54). Furthermore, EMRs developed through multidisciplinary feedback foster greater interprofessional collaboration and improve documentation efficiency (55). These findings underscore the importance of continuous, structured user engagement as an integral component of EMR development and implementation strategies.

Such recommendations reflect the users' forward-looking mindset and signal a readiness to support systemic improvements. Behavioral intention, in this context, is not only influenced by system-related factors such as perceived usefulness or ease of use, but also by the organizational environment and responsiveness to user feedback. These insights reinforce the idea that sustained EMR utilization depends on a combination of technical functionality, organizational support, and user empowerment. In developing the EMR system, the hospital's SIMRS (Health Information System) team adhered to national regulations. Specifically, the obligation for health facilities to maintain medical records is mandated under the Indonesian Ministry of Health Regulation (PMK) No. 269 of 2008. Furthermore, the shift toward computerized, electronic-based health information systems is required by PMK No. 24 of 2022, which mandates that all health service facilities implement electronic medical records integrated into computerized decision-support systems (39). The ongoing evolution of EMR systems is also shaped by broader global trends. The healthcare sector is currently experiencing the impacts of the Fourth Industrial Revolution (Industry 4.0), where technological innovation acts as a major driver of transformation. The influence of this revolution is particularly evident in hospitals and clinics, where digital health technologies, including EMRs, have become critical tools for improving service delivery, data management, and patient care outcomes (56).

These findings underscore that behavioral intention toward EMR adoption is not solely influenced by perceived system performance, but is also shaped by a broader interplay of organizational support, regulatory

mandates, and ongoing technological transformation. Organizational responsiveness—reflected in managerial support, staff training, and infrastructure investments—can significantly enhance user perceptions of the EMR system and foster a sense of ownership and accountability (57). When users feel supported and see tangible improvements aligned with their needs, their willingness to engage with the system tends to increase.

Moreover, national regulatory frameworks act as strong external drivers. The Indonesian Ministry of Health Regulation No. 24 of 2022 mandates all healthcare facilities to implement electronic medical records, thus creating a compliance-based impetus for hospitals to accelerate digital transformation. Such regulations do not merely compel system adoption, but also raise expectations for interoperability, legal recognition, and data governance—further influencing user motivation and behavioral alignment.

Sustaining user engagement in this evolving context requires a dual strategy: continuous system refinement informed by user feedback and institutional agility in responding to regulatory and technological shifts. When supported by both internal and external enablers, behavioral intention can evolve from initial compliance into long-term, value-driven adoption, ultimately maximizing the transformative potential of EMRs in healthcare delivery.

Limitations and Cautions

One of the key strengths of this study is the use of a mixed-methods design, combining both quantitative and qualitative approaches. The integration of these two methods allowed for a more comprehensive understanding of EMR implementation, as the qualitative findings complemented and enriched the quantitative results. Furthermore, the evaluation was conducted directly with end-users who interact with the EMR system during routine hospital services, thereby enhancing the relevance and applicability of the findings to clinical practice.

However, this study also has several limitations. In the quantitative component, data collection relied on self-assessment questionnaires, which may introduce response bias, as participants' evaluations reflect their perceptions at the time of data collection. This method may limit the ability to capture longitudinal changes in user acceptance over time. Future research employing a longitudinal design and involving samples from multiple hospitals is recommended to evaluate the sustainability of EMR acceptance and provide broader generalizability.

As with most qualitative research, the study is contextualized, meaning that the insights gained are influenced by the specific setting and timing of the research. To enhance the transferability and dependability of the findings, the researchers provided thick descriptions within the research protocol, ensuring that readers can assess the applicability of the results to other contexts. Nonetheless, further research is needed to explore perspectives across a more diverse range of hospital settings, and to include broader stakeholder groups, such as hospital management and executive leadership, to obtain a more comprehensive understanding of EMR acceptance and implementation dynamics.

Recommendations for Future Research

This study serves as an important preliminary step in evaluating the implementation of Electronic Medical Records (EMRs) within a hospital setting. However, the findings are limited to a single Muhammadiyah-'Aisyiyah-affiliated hospital and thus provide only a contextual snapshot of EMR usage within this specific institution. Future research is recommended to expand the scope by involving multiple Muhammadiyah-'Aisyiyah hospitals across different regions. Broader, multi-site studies would allow for a more comprehensive understanding of EMR implementation challenges and successes, and would facilitate the continuous improvement of EMR services throughout the Muhammadiyah-'Aisyiyah hospital network. Such research would also support the development of more standardized strategies for optimizing EMR utilization in faith-based healthcare institutions.

CONCLUSION

This study demonstrates that the EMR implementation in this private teaching hospital exemplifies a successful transformation from manual to digital medical record systems, driven by user-centered innovation. Unlike conventional EMR development approaches—typically dominated by hospital management and vendors—this initiative was shaped significantly by frontline users. Users were not passive recipients but active agents influencing the system's design and functionality, a participatory model rarely documented in EMR literature from low- and

middle-income countries. This positions the case as a potential model for user-driven health information system development.

Ease of use emerged as the strongest determinant of behavioral intention to adopt EMRs, emphasizing that simplicity and alignment with clinical workflows outweigh the allure of complex features. The implementation reduced paper dependency, streamlined administrative tasks, and optimized clinical workflows, marking EMR as a strategic investment in health system efficiency and sustainability.

Despite notable challenges—such as ethical use violations, incomplete legal validation of electronic documentation, data security gaps, and ongoing regulatory shifts—the organization demonstrated strong commitment to continuous improvement. Moving forward, strengthening EMR systems should focus on simplifying user interfaces, ensuring regulatory compliance (e.g., standardized metadata), reinforcing data security and access control, integrating certified electronic signatures, establishing interprofessional feedback forums, improving response to system downtimes, and providing ongoing digital training and mentorship for healthcare workers.

In summary, the hospital's experience offers a practical and scalable blueprint for EMR development in similar settings, highlighting the importance of shared ownership between management, developers, and end users in driving digital health transformation.

AUTHOR'S CONTRIBUTION STATEMENT

EL and DDP made substantial contributions to the conceptualization, study design, supervision of data collection, data analysis, data interpretation, and manuscript writing. YP was responsible for conducting data analysis and interpretation, drafting the manuscript, and ensuring alignment with the journal's formatting requirements. MA contributed to the data analysis and interpretation, and provided valuable input and revisions to improve the manuscript. MAS and NUK served as the guarantors of the work.

CONFLICTS OF INTEREST

All authors declare that there are no potential conflicts of interest that could have influenced the neutrality of this research. The authors explicitly state that they have no financial or personal relationships with any entities that could have inappropriately affected the objectivity of this study.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

The author declares that tools powered by Artificial Intelligence (AI), including Grammarly, Quillbot, and ChatGPT, were used solely to enhance the readability and correct the grammar of the manuscript. The content, ideas, analysis, and conclusions presented in this paper are entirely the author's own work. All outputs generated by AI have been thoroughly reviewed, edited, and approved by the author, who takes full responsibility for the final version of the manuscript. All statistical analyses were conducted using the SPSS software application.

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