



## Determinants of Electronic Medical Record Closing Delays: A HOT-Fit Approach

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### ABSTRACT

**Background:** Timely completion of Electronic Medical Records (EMR) is essential for ensuring continuity of care, administrative efficiency, and hospital accreditation compliance. However, delays in EMR closing remain a common problem in hospital services..

**Methods:** A quantitative cross-sectional study was conducted among 150 healthcare professionals involved in EMR documentation processes. Data were collected using structured questionnaires based on HOT-Fit dimensions, including human, organizational, and technological factors. Data were analyzed using descriptive statistics, correlation tests, and multiple linear regression analysis.

**Results:** Human factors ( $\beta = -0.241$ ;  $p = 0.002$ ), organizational factors ( $\beta = -0.398$ ;  $p < 0.001$ ), and technological factors ( $\beta = -0.219$ ;  $p = 0.004$ ) significantly influenced EMR closing delays. Organizational factors were identified as the strongest predictor. The regression model explained 56.4% of the variance in EMR closing delays (Adjusted  $R^2 = 0.564$ ). Better alignment between human, organizational, and technological components was associated with improved EMR closing timeliness.

**Conclusion:** EMR closing delays are influenced by multidimensional factors involving human, organizational, and technological components. Strengthening organizational support, improving user competency, and optimizing EMR system performance are important strategies to reduce delays and improve hospital service quality.

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## INTRODUCTION

Electronic Medical Records (EMR) have become an essential component of hospital information systems in improving healthcare quality, patient safety, and administrative efficiency. The implementation of EMR enables healthcare providers to access patient information more quickly, improve communication among healthcare professionals, reduce documentation errors, and support evidence-based clinical decision-making (Of et al., 2025). In addition, EMR systems play an important role in hospital accreditation, health reporting, insurance claims processing, and continuity of patient care (Hot-fit et al., 2024). Along with the rapid digital transformation in healthcare services, the effectiveness of EMR implementation has increasingly become an important indicator of hospital performance and service quality (Uktuvia et al., 2024).

One important aspect of EMR management is the timely completion and closing of medical records. EMR closing refers to the process of ensuring that all patient documentation, including physician notes, nursing records, diagnostic results, discharge summaries, coding processes, and administrative verification, has been completed within the required timeframe after patient discharge or completion of treatment (Rosita et al., 2024). Timely medical record completion is necessary to maintain continuity of care, improve communication among healthcare providers, and support efficient hospital administration. However, delays in EMR closing remain a common problem in many healthcare institutions and continue to affect the quality and efficiency of healthcare services (Parikesit, 2025).

Delayed EMR closing may create various administrative, clinical, and organizational consequences. Incomplete medical records can interfere with follow-up treatment processes, delay insurance claim submissions, reduce the accuracy of hospital reporting systems, and increase the workload of healthcare personnel who must repeatedly follow up unfinished documentation (Metode et al., 2025). In addition, delayed documentation may negatively affect hospital accreditation performance and create legal risks related to incomplete patient records (Amrullah, 2025). Therefore, improving EMR closing timeliness has become an important managerial concern in hospital information management systems.

Previous studies have shown that EMR documentation performance is influenced by multidimensional factors involving human, organizational, and technological components. Human-related factors such as knowledge, digital literacy, workload, discipline, motivation, and attitudes toward EMR systems may affect the completeness and timeliness of documentation (Qarimah et al., 2025). Healthcare workers who have adequate understanding of EMR procedures and perceive the system positively are generally more compliant in completing documentation according to hospital standards. Conversely, excessive workload, limited competency, and resistance to digital systems may contribute to delays in medical record completion (Kruse et al., 2016).

Organizational factors also play an important role in determining the effectiveness of EMR implementation. Leadership support, supervision, communication, training programs, standard operating procedures, and organizational culture may influence staff compliance and accountability in documentation activities. Hospitals with clear policies and regular monitoring systems tend to demonstrate better performance in maintaining timely medical record completion. In contrast, weak supervision, lack of coordination, and inadequate training may increase the occurrence of delayed EMR closing (Miandoab et al., 2025).

From the technological perspective, the quality of the EMR system itself significantly affects user performance and operational efficiency. Reliable systems with user-friendly interfaces, adequate integration, fast response times, and stable technical performance can facilitate documentation processes and reduce work interruptions (Parikesit, 2025). On the other hand, system downtime, complicated navigation, poor usability, and inadequate technical support may

discourage users and delay documentation activities. Information quality and data security are also important considerations in maintaining effective EMR utilization (Ikawati & Haris, 2024).

The Human–Organization–Technology Fit (HOT-Fit) model is widely recognized as a comprehensive framework for evaluating health information systems because it emphasizes the alignment between human factors, organizational environments, and technological systems (Id et al., 2020). The HOT-Fit model has been widely used to assess system utilization, implementation effectiveness, and user satisfaction in healthcare settings (Hot-fit et al., 2024). Nevertheless, most previous studies primarily focused on general EMR adoption and implementation outcomes, while studies specifically examining EMR closing delays as an operational performance indicator remain limited (Sirait & Silaban, 2025). In addition, evidence regarding delayed EMR closure using the HOT-Fit framework in hospital settings, particularly in developing countries, is still relatively scarce (Nadia et al., 2025).

Considering the importance of timely documentation and the multidimensional nature of EMR closing delays, a comprehensive evaluation is needed to identify the factors contributing to this problem. Understanding the interaction between human, organizational, and technological dimensions is important for developing effective strategies to improve documentation compliance and optimize hospital information systems (Harsiwi et al., 2024). Therefore, this study aimed to analyze the determinants of Electronic Medical Record closing delays using the HOT-Fit model. The findings of this study are expected to provide evidence-based recommendations for strengthening EMR management, improving documentation timeliness, and enhancing the overall quality of hospital services.

## **METHOD**

### **Research Design**

This study employed a quantitative analytic design with a cross-sectional approach to analyze the determinants of Electronic Medical Record (EMR) closing delays based on the Human–Organization–Technology Fit (HOT-Fit) model. Ethical approval for this study was obtained from the Ethics Committee of Awal Bros University (No. 0131/UAB1.20/SR/KEPK/04.26).

### **Participants and Sampling**

The participants consisted of healthcare professionals and administrative personnel directly involved in EMR documentation and verification processes, including physicians, nurses, medical record officers, health information management staff, and unit administrators. Eligible respondents were hospital personnel who had used the EMR system for at least six months and agreed to participate in the study. Temporary staff, personnel on leave during the study period, and respondents who submitted incomplete questionnaires were excluded from the study. The study population included hospital personnel involved in EMR closing workflows across inpatient, outpatient, emergency, nursing, physician, and medical record departments in the selected hospital. A proportionate stratified random sampling technique was applied to ensure adequate representation from each professional group. The minimum sample size was determined based on assumptions for multiple regression analysis with a significance level of 5%, statistical power of 80%, and medium effect size. A total of 150 respondents participated in this study.

### **Research Instrument**

Data were collected using a structured self-administered questionnaire developed based on the HOT-Fit framework and previous studies related to health information systems. The questionnaire consisted of demographic characteristics, human factors, organizational factors, technological factors, and EMR closing timeliness. Human factors included knowledge, skills, compliance, workload, and attitudes toward EMR use. Organizational factors assessed leadership support, supervision, communication, policy implementation, teamwork, and training availability.

Technological factors evaluated system quality, ease of use, reliability, response time, information quality, and technical support. EMR closing delay was assessed based on respondents' perceptions and supported by hospital documentation records. All questionnaire items were measured using a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5).

**Table 1. Sample Questionnaire Items**

No	Question
1	I understand the procedures for completing EMR documentation on time
2	Hospital management regularly monitors EMR completion performance
3	The EMR system is easy to navigate and use
4	Technical problems in the EMR system often delay record completion
5	Medical records in my unit are usually closed within the required timeframe

**Table 2. Likert Scale Scoring**

Value	Scale
1	Strongly Disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly Agree

Higher scores indicated better conditions in each HOT-Fit dimension. Reverse scoring was applied to negative statements where necessary, and composite scores were calculated for each variable.

### Validity and Reliability

Content validity was evaluated by experts in health information management, hospital administration, and medical informatics. Construct validity was assessed using Pearson product-moment correlation, with item correlation coefficients greater than 0.30 considered valid. Reliability testing was conducted using Cronbach's alpha, with coefficients  $\geq 0.70$  considered acceptable. Prior to the main study, a pilot test involving 30 respondents outside the study population was conducted to evaluate instrument clarity and consistency.

### Data Collection Procedure

Data collection was carried out over a period of three months. Prior to distributing the questionnaires, respondents were given an explanation regarding the purpose of the study, the confidentiality of their responses, and the voluntary nature of their participation. Written informed consent was obtained from all participants before the data collection process began.

In addition to primary questionnaire data, secondary data were obtained from hospital EMR audit reports, including information related to delayed record closure, incomplete documentation rates, and average completion time. These data were used to support interpretation of the study findings.

### Data Analysis

The data were analyzed using statistical software. Descriptive statistical methods, such as frequencies, percentages, means, and standard deviations, were applied to summarize the characteristics of respondents and the study variables. In addition, data normality was evaluated using the Kolmogorov-Smirnov or Shapiro-Wilk test.

Bivariate analysis using Pearson or Spearman correlation tests was performed to examine relationships between HOT-Fit dimensions and EMR closing delays. Comparative analysis using independent t-tests or one-way ANOVA was conducted to compare variable scores across

respondent characteristics. Multiple linear regression analysis was used to identify the dominant predictors of EMR closing delays while controlling for potential confounding variables. Statistical significance was determined at  $p < 0.05$  with a 95% confidence interval.

## RESULTS AND DISCUSSION

### Results

Results: A total of 150 respondents participated in this study, consisting of physicians (26.7%), nurses (46.0%), medical record officers (18.0%), and administrative staff (9.3%). Most respondents had used the EMR system for more than one year (72.0%), indicating adequate experience in the documentation process.

**Table 3. Characteristics of Respondents**

Variable	Frequency (n)	Percentage (%)
Physician	40	26.7
Nurse	69	46.0
Medical Record Officer	27	18.0
Administrative Staff	14	9.3
EMR Use > 1 Year	108	72.0
EMR Use $\leq$ 1 Year	42	28.0

The average score for each HOT-Fit dimension showed that organizational factors had the highest mean score, followed by technological and human factors. However, delayed EMR closing was still reported in several units.

**Table 4. Mean Scores of HOT-Fit Variables**

Variable	Mean $\pm$ SD
Human Factors	3.72 $\pm$ 0.58
Organizational Factors	3.89 $\pm$ 0.61
Technological Factors	3.76 $\pm$ 0.64
EMR Closing Timeliness	3.41 $\pm$ 0.70

**Table 5. Correlation Between HOT-Fit Variables and EMR Closing Delays**

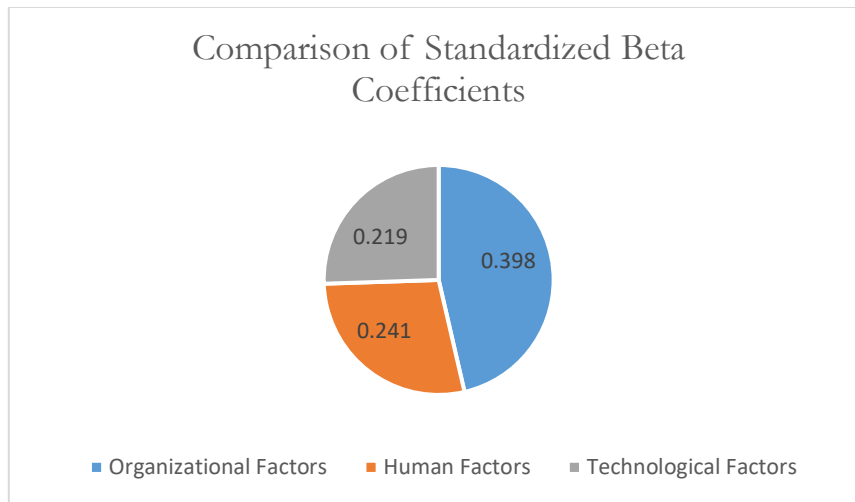
Variable	r-value	p-value
Human Factors	-0.462	<0.001
Organizational Factors	-0.581	<0.001
Technological Factors	-0.437	<0.001

All three dimensions were significantly associated with EMR closing delays. Negative correlation values indicate that better HOT-Fit conditions were associated with lower delays.

**Table 6. Multiple Regression Analysis of Determinant Factors**

Variable	$\beta$ Coefficient	t-value	p-value
Human Factors	-0.241	-3.18	0.002
Organizational Factors	-0.398	-5.44	<0.001
Technological Factors	-0.219	-2.97	0.004

The regression model explained 56.4% of variance in EMR closing delays (Adjusted  $R^2 = 0.564$ ). Organizational factors were the most dominant predictor.



**Figure 1. Comparison of Standardized Beta Coefficients**

### Discussion:

The findings of this study demonstrate that human, organizational, and technological factors significantly influenced EMR closing delays. These results support the Human Organization Technology Fit (HOT-Fit) model, which emphasizes that the effectiveness of health information systems depends on the alignment between users, organizational support, and technological performance (Id et al., 2020). The findings indicate that delays in EMR completion are multidimensional and cannot be explained solely by technological issues.

Among the examined variables, organizational factors emerged as the strongest determinant of EMR closing delays. This finding suggests that leadership commitment, supervision, policy implementation, and monitoring systems play a critical role in maintaining documentation timeliness. Strong organizational governance may encourage healthcare workers to comply with documentation standards despite workload pressures and operational challenges. This result is consistent with previous studies reporting that management support and effective supervision significantly improve EMR compliance and documentation performance (Amrullah, 2025; Miandoab et al., 2025).

Human factors were also found to significantly influence EMR closing delays. Staff knowledge, discipline, workload management, and awareness regarding the importance of documentation contributed to timely EMR completion. Healthcare personnel with better understanding of hospital procedures and EMR workflows were more likely to complete documentation within the required timeframe. These findings are in line with previous studies highlighting that user competency, digital literacy, and positive attitudes toward EMR systems are important determinants of documentation quality and system utilization (Qarimah et al., 2025; Kruse et al., 2016).

Technological factors also demonstrated a significant contribution to EMR closing delays. System downtime, slow response time, limited usability, and complex interfaces may interrupt documentation workflows and reduce operational efficiency. This finding indicates that improving system reliability and user-friendliness may help healthcare personnel complete documentation more effectively. Similar findings have been reported in previous studies showing that system quality, information quality, and technical performance strongly influence user satisfaction and EMR utilization (Hot-fit et al., 2024; Ikawati & Haris, 2024).

The findings of this study have important implications for hospital management and healthcare policymakers. Hospitals should strengthen supervision systems, establish clear policies regarding EMR completion deadlines, and provide regular training programs to improve staff

competency and compliance. In addition, information technology departments should continuously optimize system performance and minimize technical disruptions that may interfere with documentation activities. Integrating EMR completion indicators into hospital quality assurance programs may also support better monitoring and accountability (Harsiwi et al., 2024).

This study contributes to the existing literature by applying the HOT-Fit model specifically to EMR closing delays rather than general EMR implementation outcomes or user satisfaction. The findings demonstrate that documentation timeliness is influenced by interactions between human, organizational, and technological dimensions. Organizational factors were identified as the most dominant predictor, indicating that managerial and policy-related interventions remain essential in improving EMR performance (Sirait & Silaban, 2025).

This study has several limitations that should be considered. First, the cross-sectional design prevents the researchers from determining causal relationships between variables. Second, part of the data was collected through self-reported questionnaires, which may lead to response bias. Furthermore, since the study was carried out in only one hospital, the findings may not fully represent other healthcare institutions with different organizational systems or technological environments.

Future studies are recommended to use longitudinal or multi-center designs to provide broader evidence regarding determinants of EMR closing delays. Qualitative approaches may also be useful to explore healthcare workers' experiences and barriers related to EMR documentation processes. Furthermore, future research may evaluate the effectiveness of integrated interventions involving management support, user training, and technological optimization in improving EMR closing timeliness (Nadia et al., 2025).

## **CONCLUSION**

This study demonstrated that human, organizational, and technological factors significantly influenced Electronic Medical Record (EMR) closing delays based on the Human–Organization–Technology Fit (HOT-Fit) model. Among these dimensions, organizational factors emerged as the most dominant determinant, indicating that leadership support, supervision, policy implementation, and monitoring systems play a critical role in improving documentation timeliness. The findings suggest that reducing EMR closing delays requires not only technological improvements but also strong organizational commitment and user competency development. Effective integration between human resources, organizational management, and EMR system performance is essential to optimize documentation processes and improve hospital service quality. Hospitals are encouraged to strengthen supervision mechanisms, provide continuous training programs, and improve EMR system usability to support timely medical record completion. Future studies are recommended to explore broader healthcare settings and evaluate intervention-based strategies for improving EMR documentation performance.

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## AUTHOR CONTRIBUTION STATEMENT

MT, MB, and AZ conceived and designed the study framework, research objectives, and methodology. MT, BH, WS, and MF conducted data collection, participant coordination, and field supervision. MB, AZ, and AM performed data management, statistical analysis, and interpretation of results. MT, MB, and AZ drafted the manuscript and prepared the tables and figures. BH, WS, AM, and MF critically reviewed the manuscript for important intellectual content and provided revisions. All authors read, approved the final version of the manuscript, and agreed to be accountable for all aspects of the work

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