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WHAT DRIVES ELECTRONIC MEDICAL RECORD ADOPTION IN PRIVATE HOSPITALS: AN IMPORTANCE-PERFORMANCE MAP ANALYSIS (IPMA)

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A R T I C L E I N F O

Keyword: *EMR Adoption, Patient Safety, IPMA, Management Support, PLS-SEM*

Kata Kunci: Penerapan EMR, Keselamatan Pasien, IPMA, Dukungan Manajemen, PLS-SEM

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Abstract. *This study examined which factors are considered important and have performed well from the perspective of health workers in private hospitals in order to be utilised in EMR adoption for hospital performance. This research method uses PLS-SEM to obtain reliability and validation, followed by IPMA with SmartPLS4™. This study was conducted using purposive sampling with 205 respondents consisting of nurses, general practitioners, specialists, dentists, and others. The PLS-SEM analysis confirmed that all organisational factors, namely Management Support, Patient Safety Climate, Adequate Training, Physician's Involvement, Physician's Autonomy, and Patient Relationship, related to EMR adoption, with Perceived Usefulness and Perceived Ease of Use as mediating variables. The Importance-Performance Map Analysis (IPMA) highlighted key areas for improvement. Patient Safety Climate indicators performed well and should be maintained. However, despite being highly important, Management Support (MANSU3) and Patient Relationship (PATREL4) indicators showed low performance.*

Abstrak. Penelitian ini menguji faktor-faktor apa saja yang dianggap penting dan telah berkinerja baik dari perspektif tenaga kesehatan di rumah sakit swasta agar dapat dimanfaatkan dalam adopsi EMR untuk kinerja rumah sakit. Metode penelitian ini menggunakan PLS-SEM untuk memperoleh reliabilitas dan validasi, diikuti oleh IPMA dengan SmartPLS4TM. Penelitian ini dilakukan dengan menggunakan purposive sampling dengan 205 responden yang terdiri dari perawat, dokter umum, dokter spesialis, dokter gigi, dan lain-lain. Analisis PLS-SEM mengonfirmasi bahwa semua faktor organisasi, yaitu Dukungan Manajemen, Iklim Keselamatan Pasien, Pelatihan yang Memadai, Keterlibatan Dokter, Otonomi Dokter, dan Hubungan Pasien, terkait dengan adopsi EMR, dengan Kegunaan yang Dirasakan dan Kemudahan Penggunaan yang Dirasakan sebagai variabel mediasi. Analisis Peta Pentingnya-Kinerja (IPMA) menyoroti area utama untuk perbaikan. Indikator Iklim Keselamatan Pasien berkinerja baik dan harus dipertahankan. Namun, meskipun sangat penting, indikator Dukungan Manajemen (MANSU3) dan Hubungan Pasien (PATREL4) menunjukkan kinerja yang rendah.

INTRODUCTION

Electronic Medical Record (EMR) implementation in Indonesia is no longer an option but mandatory for all health service facilities, including hospitals and primary care centres, through the Regulation of the Minister of Health (Indonesian Ministry of Health, 2022). This policy was enacted to enhance the quality of care. However, many hospitals view EMR adoption as a mere obligation, failing to realise its potential to significantly improve the quality of care and generate financial benefits for the organisation.

On the other hand, EMR implementation is mostly a top-down approach from management and does not yet involve much of the potential of medical personnel in the hospital. Consequently, EMR has not yet unleashed its potential for organisational development. For example, revenue increased in private hospitals. Current private hospitals have fierce competition, and in order to win the competition between hospitals, they need to develop and implement EMR.

Healthcare services provided by hospitals are based on the expertise of health workers. Therefore, the implementation of EMR implementation must be linked to organisational factors that can be utilised more and must be from the perspective of medical personnel. Demands for health services are highly specialised. Therefore, it is necessary to pay attention to input from various points of view of medical personnel working in different units, including EMR adoption. The successful implementation of EMR as a new technology in Hospitals can be a driving force for significant improvements in Quality of Care in Hospitals (Uslu & Stausberg, 2021; Wurster et al., 2023). Therefore, the study focuses on EMR adoption in private hospitals is still relevant (Lee et al., 2023). However, the study should be able to provide detailed information that can be applied by hospital management.

Previous studies have been done related to EMR adoption (Abdullah Alharbi, 2023; Akwaowo et al., 2022; Eden et al., 2020), including research in Indonesia (Saragih et al., 2020). However, the topic has not been thoroughly explored from a comprehensive perspective by many individuals, such as from a doctor's perspective, including organisational factors as independent variables. Previous study conducted by Abdekhoda et al. has raised the role of organisations in the EMR adoption process (Abdekhoda et al., 2015, 2019). These organisational factors consist of 5 independent variables, namely Management Support, Adequate Training, Physician's Involvement, Physician's Autonomy, and Patient Relationships. These six independent variables can be monitored and evaluated with Perceived Usefulness and Perceived Ease of Use, which have a direct impact on EMR adoption. In this study, Patient Safety Climate was added as an independent variable that can influence Perceived Usefulness, which is then closely related to EMR.

There were research questions concerning the EMR adoption, as explained above, that need to be addressed: "To what extent variable is considered important in the point of view of respondents and can encourage EMR adoption?" and "In the current situation how do they assess these factors, and how important have they become?". To answer these questions, the practical methodology used in this study is IPMA, which uses Partial Least Square – Structural Equation Modeling (PLS-SEM) (Abdekhoda et al., 2019; Ringle & Sarstedt, 2016). IPMA has many uses

in identifying organisational factors that are considered important and that have the highest performance in adopting EMR. Recent research in the health sector states that IPMA is an effective method (Fitriani et al., 2024). The contribution of this study lies in the application of IPMA to organisational factors that influence Perceived Usefulness and Perceived Ease of Use, which are directly related to EMR adoption. This study aims to determine which factors are important and how well they are performed in private hospitals. In addition, the results of this study also contribute to the hospital's improvement of the quality of care for patient services.

RESEARCH METHOD

This study is a survey study with quantitative data analysis conducted in private hospitals in Jakarta. This study is classified as a cross-sectional study conducted in December 2023. There are six independent variables, namely Management Support, Patient Safety Climate, Adequate Training, Physician's Involvement, Physician's Autonomy, and Patient Relationship. 2 mediating variables, namely perceived usefulness and perceived ease of use. The dependent variable is EMR adoption. The eligibility criteria for this study stipulate that participants must be employed in service units utilizing Electronic Medical Records (EMR), including outpatient and inpatient wards. Furthermore, it is essential that these individuals engage with or provide services to patients in their capacity at the hospital.

The design of this study is the measurement of indicators using a Likert scale with 5 points. The scale level used is one '1' strongly disagree, two '2' disagree, three '3' neutral, four '4' agree, and five '5' strongly agree, which is compiled in an online Google-form questionnaire, with items adapted from the validated measurement tool by Abdekhoda (Abdekhoda et al., 2019). For Patient Safety Climate adapted from Altmiller ((Altmiller, 2022). At the same time, Perceived Ease of Use and Perceived Usefulness adapted from Davis (Davis, 1989). For EMR adoption as a dependent variable adapted from Venkatesh 2012 (Venkatesh et al., 2012).

The number of respondents who meet the requirements is 205 respondents. This study uses a non-probability sampling method, with a purposive sampling technique, analysis with PLS-SEM with **SmartPLS4™.**

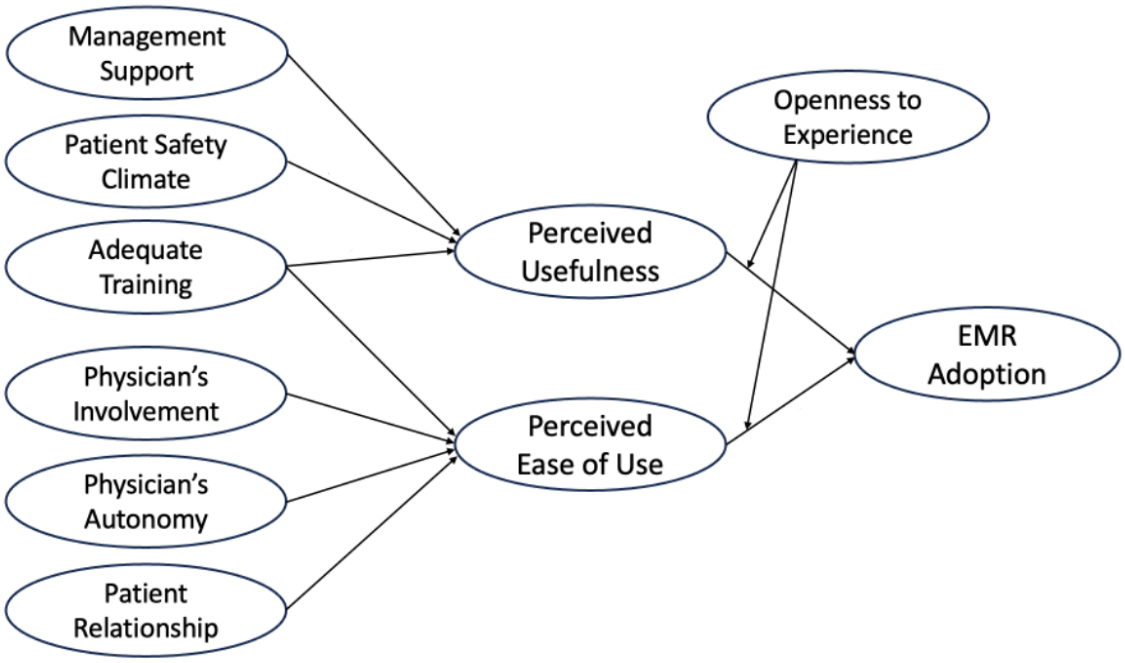

Figure 1. Conceptual Framework

Data were analysed using PLS-SEM, a robust multivariate technique suitable for predictive modelling. The analysis began with reliability and validity tests to assess the measurement model's adequacy, including composite reliability, Cronbach's alpha, and average variance extracted (AVE). Following this, the IPMA method was employed to evaluate service quality dimensions at the indicator level. It provides a visual representation of importance and performance within a four-quadrant matrix, categorising attributes as "high importance–low performance," "low importance–low performance," "high importance–high performance," or "low importance–high performance." This classification helps clinics identify key areas for improvement. The mean scores for importance and performance were used as reference points to position service attributes within the quadrants, guiding strategic priorities to enhance patient satisfaction.

RESULTS AND DISCUSSION

This study was conducted at private hospitals in Jakarta, where EMR is actively used. A total of 205 respondents participated, with their demographic data summarised in Table 1. There were 58% of respondents under 35 years old and only 17% of respondents over 45 years old. This age data can be related to the assumption that the younger generation is more exposed to information and communication technology and is accustomed to using technology such as smartphones (Busch et al., 2021). These younger respondents tend to be more open to accepting EMR compared to the older generation, who need to adjust from the old system to the new service system with EMR. Most respondents were nurses working in outpatient wards, only 8% of respondents were specialist doctors, and 17% were general practitioners. As many as 83% of respondents have worked for more than 3 years in the hospital, so they can be considered to have work experience and understand the organisational culture well.

Table 1. Respondent's Profile

Description	Category	Frequency (n)	Percentage (%)
Current age	18-25 years	40	20
	26-35 years	78	38
	36-45 years	52	25
	> 45 years	35	17
	Total	205	100
Length of work	Less than 3 years	35	17
	3-5 years	55	27
	6-10 years	87	42
	More than 10 years	28	14
	Total	205	100
Healthcare background	Nurse	131	64
	General practitioner	35	17
	Dentist	7	3
	Specialist	17	8
	Other	15	7
	Total	205	100
Working unit / department in hospital	Inpatient	89	43
	Outpatient	32	16
	Emergency Department	23	11
	Intensive Care Unit	21	10
	Operating Theatre	17	8
	Obstetrics	9	4
	Other	14	7
	Total	205	100

The outer loading of the reflective model against its indicators was evaluated as the first step in the PLS-SEM analysis. The measurement tool must demonstrate that all indicators have an outer loading value greater than 0.708. From Figure 2, this research can be said to have reliable indicators.

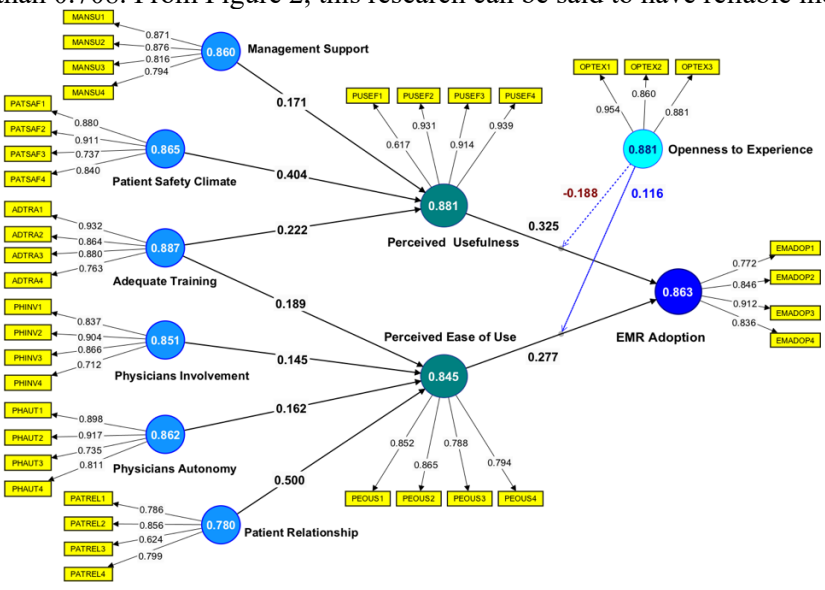

Figure 2. PLS-SEM Model

This study was conducted using PLS-SEM with SmartPLS4™, where the assessment of the measurement (outer) model focuses on evaluating reliability and validity to ensure accurate and consistent measurement of the constructs. This process involves examining indicator reliability, internal consistency reliability, convergent validity, and discriminant validity. As shown in Table 2 below, the results provide a solid foundation for analysing the structural model and performing IPMA analysis in PLS-SEM.

Table 2. Construct Validity and Reliability

Variable	Codes	Indicators	Outer loading
Adequate Training	ADTRA1	I received the training I needed to better understand the use of electronic medical records.	0,932
	ADTRA2	Training on the use of electronic medical records is useful for me to understand how to use it properly.	0,864
	ADTRA3	Training in the use of electronic medical records made me understand new technologies that can improve the quality of patient care.	0,880
	ADTRA4	Electronic medical record training at this hospital provides new knowledge that is useful for my profession.	0,763
		CA=0.887; Rho_a=0.939; Rho_c=0.920; AVE=0.743	
EMR Adoption	EMADOP1	I will continue to routinely use electronic medical records in my daily duties at this hospital.	0,772
	EMADOP2	I am willing to leave the old way and switch to using electronic medical records in this hospital.	0,846
	EMADOP3	I would also recommend the use of electronic medical records for new medical personnel working at this hospital.	0,912
	EMADOP4	I will continue to push for the use of electronic medical records in this hospital even though there are still minor errors found in the system.	0,836
		CA=0.863; Rho_a=0.874; Rho_c=0.907; AVE=0.710	
Management Support	MANSU1	Implementing electronic medical records is important and a priority for top management at this hospital.	0,871
	MANSU2	So far, the process of implementing electronic medical records has been communicated effectively by the top management of this hospital.	0,876
	MANSU3	The top management of this hospital showed good intentions to assist medical personnel during the process of implementing electronic medical records.	0,816
	MANSU4	The top management of this hospital expressed their hope that I would be able to use electronic medical records according to the proposed program.	0,794
		CA=0.860; Rho_a=0.863; Rho_c=0.905; AVE=0.706	
Openness to Experience	OPTEX1	I feel like someone who enjoys learning new things in my job.	0,954
	OPTEX2	I am curious if there is a new program launched by management	0,860
	OPTEX3	I often imagine how things could be done in a different way.	0,881
		CA=0.881; Rho_a=0.898; Rho_c=0.927; AVE=0.808	
Patient Relationship	PATREL1	The use of electronic medical records will not affect the credibility of doctors in the eyes of patients.	0,786

Variable	Codes	Indicators	Outer loading
	PATREL2	With the existence of electronic medical records, patients will have more confidence in the quality of health services they receive at this hospital.	0,856
	PATREL3	Implementasi rekam medik elektronik tidak akan mengurangi kualitas komunikasi antara pasien dengan dokter dan tenaga medis lainnya	0,624
	PATREL4	Patients will have more confidence in their doctors if electronic medical records are implemented well in this hospital.	0,799
		CA=0.780; Rho_a=0.829; Rho_c=0.853; AVE=0.595	
Patient Safety Climate	PATSAF1	I believe that with the presence of electronic medical records in this hospital, the treatment process with a focus on patient safety will increase.	0,880
	PATSAF2	Medical errors that can harm patients can be avoided by implementing electronic medical records in this hospital.	0,911
	PATSAF3	Electronic medical records can be used to track medical errors that occur and encourage improvements in patient safety.	0,737
	PATSAF4	Management encourages the implementation of electronic medical records to reduce the risk of medical errors occurring at this hospital.	0,840
		CA=0.865; Rho_a=0.886; Rho_c=0.908; AVE=0.714	
Perceived Ease of Use	PEOUS1	In general, I feel that the electronic medical records at this hospital are easy to access and use.	0,852
	PEOUS2	I found the navigation menus in the electronic medical record easy to use.	0,865
	PEOUS3	I find it easy to understand the various menus available on the electronic medical record.	0,788
	PEOUS4	I easily got used to how to use electronic medical records at this hospital.	0,794
		CA=0.845; Rho_a=0.865; Rho_c=0.895; AVE=0.681	
Physician's Autonomy	PHAUT1	Using electronic medical records will help hospital management to monitor health care and therapy provided by doctors and nurses.	0,898
	PHAUT2	The implementation of electronic medical records in this hospital will not interfere with the autonomy of doctors in assessing and making therapeutic decisions for patients.	0,917
	PHAUT3	The implementation of medical records is not intended to dictate but will actually protect medical personnel from the possibility of legal claims.	0,735
	PHAUT4	I do not feel that my privacy is being disturbed by the electronic medical records at this hospital.	0,811
		CA=0.862; Rho_a=0.871; Rho_c=0.907; AVE=0.711	
Physician's Involvement	PHINV1	I feel it is important to be actively involved in the process of implementing electronic medical records at this hospital.	0,837
	PHINV2	My active participation in the electronic medical record implementation process will contribute to the success of this program.	0,904

Variable	Codes	Indicators	Outer loading
	PHINV3	I feel passionate about implementing electronic medical records in my daily work.	0,866
	PHINV4	I feel that it is my duty to support the implementation of electronic medical records in this hospital.	0,712
		CA=0.851; Rho_a=0.873; Rho_c=0.900; AVE=0.694	
Perceived Usefulness	PUSEF1	My work as a medical worker can be completed more quickly with the electronic medical records at this hospital.	0,617
	PUSEF2	I feel that by using electronic medical records my performance as a medical professional has improved.	0,931
	PUSEF3	My work is easier to do with the help of electronic medical records at this hospital than before.	0,914
	PUSEF4	I can help improve the quality of health services at this hospital by using electronic medical records properly.	0,939
		CA=0.881; Rho_a=0.944; Rho_c=0.918; AVE=0.741	

CA, Cronbach's Alpha; AVE, Average Variance Extracted; ADTRA, Adequate Training; EMADOP, EMR Adoption; MANSU, Management Support; OPTEX, Openness to Experience; PATREL, Patient Relationship; PATSAF, Patient Safety Climate; PEOUS, Perceived Ease of Use; PHAUT, Physician's Autonomy; PHINV, Physician's Involvement; PUSEF, Perceived Usefulness.

From the table above, it is found that almost all outer loading values have passed the specified threshold of 0.708 except for two indicators, except PUSEF1, with a loading of 0.617 and PATREL 3, with a loading of 0.624. These two values can still be maintained because they are above 0.4 and do not interfere with the Cronbach alpha and AVE values of the relevant variables. This indicator is also considered to have the information needed for content validity. Therefore, all indicators are said to be reliable.

Convergent validity, evaluated using AVE, shows satisfactory results, as all constructs have values exceeding 0.5, indicating that their respective constructs explain more than 50% of the variance in the indicators. The highest AVE value is found in openness to Experience at 0.808, while the lowest AVE value is Patient Relationship at 0.595. Therefore, all variables are said to be valid for further IPMA analysis.

The Heterotrait-Monotrait Ratio (HTMT) analysis showed that all values remain below the 0.90 thresholds, confirming strong discriminant validity among the constructs. All the indicators remain below 0.90, which means the construct does not have a discriminant problem, and the results are satisfactory and, therefore, said to be valid (Sarstedt et al., 2022).

The results of the structural model demonstrate that all organisational factors significantly influence Perceived usefulness and Perceived Ease of Use that affect EMR adoption, as indicated by the p-values below 0.05. The R^2 (R-squared) value for EMR adoption as a dependent variable is 0.666. Therefore, it is classified as having a moderate explanatory power category. In other words, the EMR adoption variable as a dependent variable can be explained by 66.6% of its predictor variables in this model. The R^2 value for the Perceived Usefulness variable was found to be 0.744, while the Perceived Ease of Use was 0.658. Thus, it can be said that Perceived Ease of Use can be explained more by its independent variables compared to Perceived Usefulness.

Table 3. IPMA indicator

Importance-performance map (EMR Adoption)	Performance	Performance
ADTRA1	0,045	61,576
ADTRA2	0,064	64,532
ADTRA3	0,044	44,663
ADTRA4	0,031	68,309
MANSU1	0,070	55,172
MANSU2	0,082	58,374
MANSU3	0,086	55,172
MANSU4	0,059	72,414
PATREL1	0,051	50,246
PATREL2	0,077	44,499
PATREL3	0,042	24,631
PATREL4	0,078	39,245
PATSAF1	0,094	64,778
PATSAF2	0,082	63,547
PATSAF3	0,086	61,576
PATSAF4	0,069	56,814
PHINV1	0,034	60,099
PHINV2	0,020	61,330
PHINV3	0,015	43,514
PHINV4	0,019	61,576
Rerata	0,057	55,603

In this study, the Importance-Performance Map (IPMA) approach was utilised as an effective tool to identify priority areas for improvement by analysing the relationship between indicator importance (its impact on satisfaction) and current performance. The map in Figure 3 divides indicators into four quadrants: high importance-high performance (top-right), high importance-low performance (bottom-right), low importance-high performance (top-left), and low importance-low performance (bottom-left). The primary focus is on the bottom-right quadrant, where indicators are highly important but underperforming, as these areas offer the greatest potential for improvement.

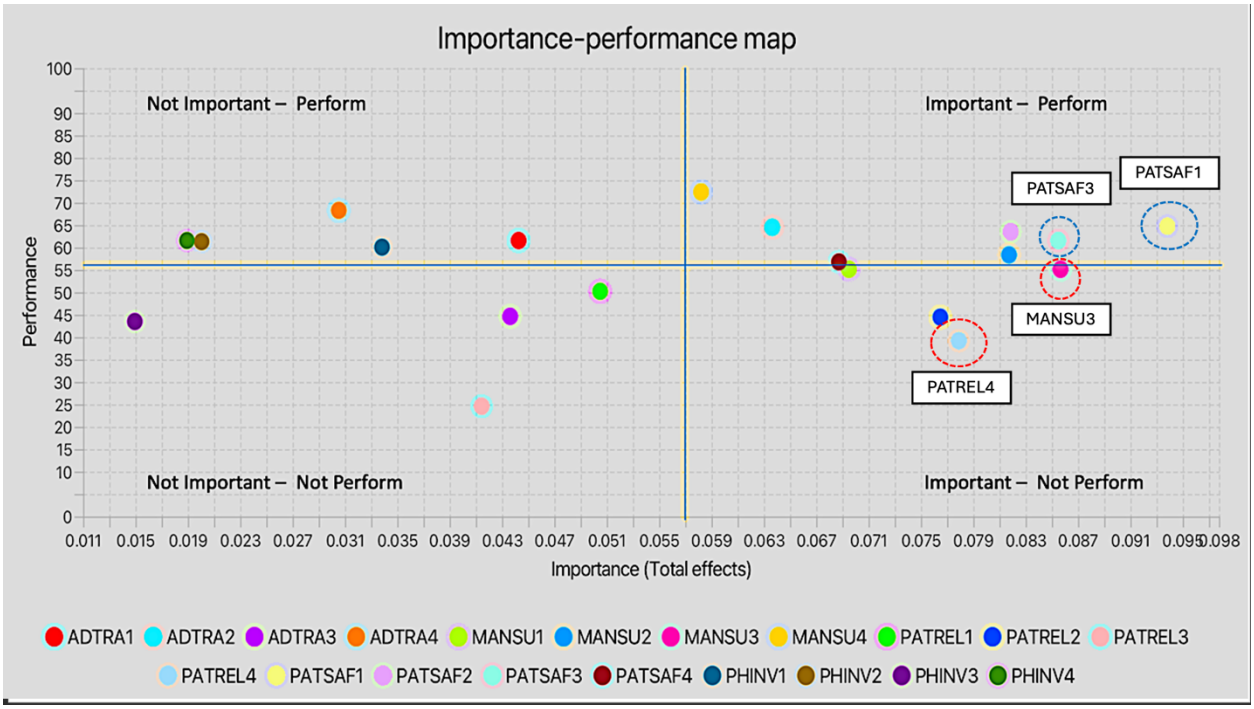

Figure 3. Importance-Performance Map Analysis (IPMA)

In Figure 3, the output results from the IPMA regarding EMR adoption are presented in the upper right quadrant, which features one of the most significant indicators, namely PATSAF1. This indicator reflects the patient safety climate within the organisation. This indicator contains the statement, "I believe that with the presence of electronic medical records in this hospital, the care process with a focus on patient safety will increase". This indicator is regarded as the most important and has demonstrated strong performance from the perspective of medical personnel. Therefore, it is imperative that hospital management ensures its maintenance during the implementation of Electronic Medical Records (EMR). PATSAF3 indicator is found in right upper quadrant, which contains the statement, "Electronic medical records can be used to trace medical errors that occur and encourage improvements in patient safety". This indicator is also considered important and has performed well. Of these two indicators, the patient safety climate is important for medical personnel in assessing the organisation and work environment in the current hospital. This finding is consistent with a previous study conducted by Bisbey (Bisbey et al., 2021); Patient safety is of paramount importance and has been effectively addressed in various healthcare settings. Consequently, it is essential to sustain this focus as an integrated system aligned with established guidelines and key performance indicators. When patient safety practices are executed proficiently, the associated risks may be significantly reduced, thereby preventing unnecessary financial burdens resulting from medical errors. For instance, in cases of patient litigation stemming from medical errors, not only can financial ramifications arise, but the institution's reputation may also suffer considerably.

Furthermore, in the lower right quadrant (high importance – low performance), the MANSU3 indicator was found, reflecting the management support variable. This indicator contains the statement, "The top management of this hospital shows good intentions to help medical personnel during the electronic medical record implementation process". Result of this study indicates that medical personnel express a need for greater support from management; however, they have not perceived the expected level of support from senior hospital management. This finding represents a critical input for hospital management to enhance support measures and motivate medical personnel, thereby facilitating a successful implementation of Electronic Medical Records (EMR) and ultimately improving the quality of care provided. It is essential for hospital management to reallocate resources and efforts appropriately. For instance, management staff should engage more with healthcare providers to foster effective communication. By doing so, medical personnel can become more actively involved in the adoption of EMR, leading to improved patient care outcomes.

Another finding that needs to be followed up is the PATREL4 indicator in the importance quadrant, which has not performed well. This indicator contains the statement, "Patients will trust doctors more if this electronic medical record has been implemented well in this hospital". The results indicate that medical personnel recognize the importance of communicating with patients; however, they have not observed significant evidence that patients understand the benefits of Electronic Medical Records (EMR). It is essential for medical staff to convey directly to patients that EMR is a tool that can enhance the quality of care provided by doctors.

This study has revealed that the indicators of Physician's Involvement were situated within the left lower quadrant (low importance-low performance); however, this should not be overlooked. It is important to note that the respondent profile included a significant proportion of nurses, comprising approximately 64% of the total participants, which indicates a lack of representation from the physician cohort. This limitation warrants consideration, as physicians play a crucial role in the processes of diagnosis and treatment. To address this issue, I recommend conducting further research focused exclusively on the physician group, as well as additional studies that involve nurses while incorporating a broader range of factors pertinent to nursing care.

Conclusion

This study concludes that six independent variables significantly influence the adoption of Electronic Medical Records (EMR) in private hospitals, with patient safety identified as the most important factor in successful EMR implementation. The findings from Importance-Performance Map Analysis (IPMA) underscore that the patient safety climate is a crucial aspect valued by healthcare personnel during the implementation of EMR. It is essential to note that EMR's role in tracing medical errors and enhancing patient safety is recognized as both highly important and well-performing. This indicates that medical personnel view EMR as a valuable instrument in minimizing medical errors and improving patient outcomes.

Furthermore, this study highlights several areas that necessitate improvement. A primary concern is the level of management support (MANSU3), which has been classified as high in

importance but low in performance. Medical personnel express the need for stronger support and motivation from hospital leadership to facilitate effective EMR implementation, particularly in reinforcing patient safety measures. Additionally, the patient relationship factor (PATREL4) suggests that patients may not fully comprehend how EMR contributes to their safety, thereby emphasizing the necessity for enhanced communication and patient education.

To optimize the patient safety advantages offered by EMR, hospitals ought to prioritize strengthening management support, improving staff training, and actively involving patients in the EMR adoption process. By addressing these limitation, hospitals can enhance the quality of care, reduce errors, and foster greater trust between healthcare providers and patients, ultimately ensuring a safer and more efficient healthcare environment.

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