



Determinants of Hospital Information System use Among Inpatient Nurses: The Mediating Role of Training

Niken Dewi Permatasari Sunjaya*, Hosizah Markam, Johanes

Universitas Esa Unggul, Indonesia

Email: nikendewipermatasari@student.esaunggul.ac.id *

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ABSTRACT

Rapid advances in digital healthcare have increased the need for effective Hospital Information Systems (HIS) to support nursing services, clinical documentation, and hospital management. However, HIS utilization among nurses remains influenced by system performance, information quality, technical support, and user competency. This study aimed to examine the effects of system quality, information quality, and service quality on HIS use among inpatient nurses, with training as a mediating variable. A quantitative explanatory study with a cross-sectional design was conducted among 54 inpatient nurses at RSBHT Hospital using total sampling. Data were collected using a validated and reliable questionnaire and analyzed through descriptive analysis using the Three Box Method and Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS. The findings showed that system quality and information quality significantly influenced HIS use, whereas service quality did not have a direct significant effect. Furthermore, system quality, information quality, and service quality significantly influenced training, and training demonstrated the strongest effect on HIS use while strengthening the indirect relationships between quality dimensions and system utilization. The study suggests that hospitals should improve HIS usability, information completeness, technical responsiveness, and continuous practice-based training programs to optimize nurses' adoption and utilization of HIS. These findings highlight the strategic role of training in bridging technological quality and effective HIS implementation in healthcare settings.

INTRODUCTION

The rapid advancement of information and communication technology in the Industry 4.0 era has fundamentally transformed healthcare organizations in managing clinical and administrative information (Ahmed et al., 2022; Al-Assaf et al., 2024; Choudhry et al., 2024; Pakaya, 2026; Santa et al., 2025; Sripathi & Leelavati, 2024). Hospitals, as labor-intensive, capital-intensive, and technology-intensive institutions, generate extensive volumes of data from various service activities, including patient registration, diagnosis, treatment, medication management, financial transactions, and clinical documentation. The ability to integrate, process, and utilize these data effectively has become a critical factor in improving healthcare efficiency, decision-making accuracy, and service quality. Therefore, Hospital Information Systems (HIS) have emerged as strategic infrastructure that enables hospitals to manage healthcare information systematically, support clinical workflows, and strengthen

organizational performance. In Indonesia, HIS implementation has become a regulatory requirement through the Regulation of the Minister of Health Number 82 of 2013 concerning Hospital Management Information Systems, which has been further strengthened by Law Number 17 of 2023 concerning Health. In addition, the transition toward electronic medical records based on the Regulation of the Minister of Health Number 24 of 2022 has accelerated digital transformation in healthcare documentation, including nursing services.

An effective HIS is expected not only to store and process healthcare data but also to provide accurate, complete, timely, and accessible information for healthcare professionals. Reliable information enables nurses and other healthcare providers to make appropriate clinical decisions, coordinate patient care, and improve operational efficiency. Conversely, inadequate system performance, incomplete information output, and insufficient technical support may reduce user acceptance and increase workloads among healthcare workers. Since nurses represent one of the largest groups of HIS users and interact with digital systems continuously throughout patient care processes, their ability and willingness to utilize HIS are essential indicators of successful health information system implementation. Therefore, understanding the factors that influence HIS usage behavior among nurses is important to ensure that technological investments contribute to meaningful improvements in healthcare delivery.

At RSBHT Hospital, HIS has been implemented since April 8, 2019, and consists of fourteen integrated modules, including registration, outpatient services, inpatient care, laboratory services, emergency department, operating theatre, medical records, pharmacy, drug warehouse, national health insurance claims, billing, reporting, physician fees, and finance. However, despite the availability of an integrated system, several operational challenges remain, particularly in the inpatient unit. Hospital management reported that inpatient documentation was frequently incomplete. A preliminary survey involving ten inpatient nurses indicated that 70% of respondents had insufficient understanding of HIS operation due to inadequate training. Furthermore, 80% reported difficulties following the latest system update because of operational errors, duplicate data entries, and network problems. Regarding information quality, 60% stated that displayed information remained incomplete because several required inpatient assessment forms were unavailable. In terms of service quality, 60% perceived that responses from the information technology team and system vendor were too slow, while the absence of a user manual further complicated system utilization. These conditions indicate that HIS adoption is influenced not only by technological availability but also by system quality, information quality, technical support, and users' competency in operating the system.

To explain the success factors of healthcare information systems, the Human, Organization, and Technology-fit (HOT-Fit) model provides a comprehensive framework that integrates technological, human, and organizational perspectives. According to Yusof et al. (2008), HIS success is determined by the alignment between human factors, organizational conditions, and technological characteristics. Within the technology dimension, system quality reflects the performance of hardware, software, and procedures, including ease of use, reliability, flexibility, accessibility, availability, and response time. Information quality refers to the extent to which system outputs are accurate, complete, relevant, consistent, and timely, whereas service quality represents support provided by system providers through technical assistance, responsiveness, and problem-solving capability. Meanwhile, system use represents

user behavior in adopting and utilizing HIS, commonly measured through usage frequency and duration (Davis, 1989; Venkatesh et al., 2003). Although the HOT-Fit model has been widely applied in evaluating healthcare information systems, the role of user capability development through training requires further investigation.

Previous studies have demonstrated that system quality and information quality are important determinants of HIS utilization. Abda'u et al. (2018), using the HOT-Fit model in a regional hospital in Kebumen, found that system quality and information quality influenced HIS use. Similarly, Kuo et al. (2018) reported that improvements in HIS quality dimensions contributed to better user satisfaction and system effectiveness. However, findings regarding service quality have been inconsistent. Khotimah (2020) identified different patterns of relationships among HOT-Fit dimensions when evaluating a hospital management information system in Yogyakarta, suggesting that technological and service factors may operate differently depending on organizational contexts. These differences indicate that the influence of HIS quality dimensions on actual system use cannot be generalized without considering additional mechanisms that shape user behavior.

Training represents an important mechanism that may explain how technological quality is translated into effective HIS utilization. Previous evidence suggests that access to HIS alone does not guarantee successful implementation. Bogale (2021) reported that although many healthcare workers had received HIS training, implementation challenges remained due to limitations in knowledge transfer and practical application. Similarly, Bygholm (2018) emphasized that one-time training sessions are insufficient because healthcare workers require continuous, task-oriented learning processes aligned with daily work activities. Nevertheless, previous studies have generally examined system quality, information quality, service quality, and training separately or focused primarily on user satisfaction rather than actual system usage behavior. Limited empirical evidence has examined whether training functions as an intervening mechanism that strengthens the relationship between HIS quality dimensions and nurses' actual system use, particularly in inpatient settings where HIS utilization occurs intensively during each work shift.

Therefore, the research gap addressed in this study lies in the limited understanding of the mechanism through which training mediates the relationship between technological quality factors and HIS usage behavior among inpatient nurses. Unlike previous studies that primarily assessed direct relationships between HIS quality dimensions and user outcomes, this study integrates system quality, information quality, service quality, and training within a single structural model based on the HOT-Fit perspective. The novelty of this research lies in examining training as a bridging mechanism that converts technological advantages into practical HIS utilization behavior among nurses. This approach provides a more comprehensive understanding of HIS implementation because successful digital transformation depends not only on improving system characteristics but also on strengthening users' capability to apply the system effectively.

Based on this research gap, this study aimed to examine the influence of system quality, information quality, and service quality on HIS use among inpatient nurses at RSBHT Hospital, with training positioned as an intervening variable. Specifically, this study investigated (1) the direct effects of system quality, information quality, and service quality on HIS use; (2) the influence of these three quality dimensions on training; and (3) the role of training in mediating

the relationship between HIS quality dimensions and system utilization. The findings are expected to contribute theoretically by expanding the application of the HOT-Fit model through the inclusion of training as a behavioral transformation mechanism. Practically, this study provides evidence-based recommendations for hospital managers to improve HIS implementation strategies through system refinement, information quality improvement, responsive technical support, and continuous competency-based training programs for nurses.

METHOD

This study employed an explanatory quantitative design with a cross-sectional approach to examine the relationships among the research variables based on the formulated hypotheses. The study was conducted at RSBHT Hospital, a type C general hospital located in Kunciran, Tangerang, Banten, from December 2023 to January 2024. The population consisted of all inpatient nurses, totaling 54 individuals. A total sampling technique was applied; therefore, all 54 inpatient nurses who had participated in system training were included as respondents.

The research model consisted of three independent variables: system quality, information quality, and service quality; one intervening variable, training; and one dependent variable, hospital information system (HIS) use. Data were collected using a structured questionnaire measured on a four-point Likert scale. System quality was assessed through indicators of ease of use, ease of learning, response time, availability, reliability, flexibility, and accessibility. Information quality was measured through completeness, accuracy, readability, timeliness, availability, relevance, and consistency indicators. Service quality was assessed through response speed and technical support indicators. Training was measured through reaction, learning process, behavior, and outcome indicators. HIS use was assessed through indicators of usage frequency and duration.

Before the main data collection, the questionnaire was tested on 30 respondents to evaluate validity and reliability. Validity was assessed using Pearson product-moment correlation by comparing the calculated *r*-value of each item with the *r*-table value of 0.361 at a significance level of 0.05. All questionnaire items were considered valid. Reliability was assessed using Cronbach's alpha, with values above 0.60 indicating acceptable reliability. All variables met the reliability criteria, with alpha values of 0.794 for system quality, 0.787 for information quality, 0.834 for service quality, 0.812 for training, and 0.832 for HIS use.

Data from the 54 respondents were analyzed using descriptive and inferential statistical methods. Descriptive analysis was conducted using the Three Box Method to interpret respondents' perceptions of each indicator based on Likert-scale responses. Inferential analysis was performed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS. The analysis consisted of measurement model and structural model assessments. The measurement model was evaluated through convergent validity, assessed using indicator loading factors and Average Variance Extracted (AVE), and reliability testing using composite reliability. The structural model was assessed using the coefficient of determination (R^2), variance inflation factor (VIF) for multicollinearity assessment, effect size (f^2), and model fit indices, including Standardized Root Mean Square Residual (SRMR) and Normed Fit Index (NFI). The hypotheses were tested using bootstrapping, with statistical significance determined by a *t*-statistic value greater than 1.96 or a *p*-value below 0.05.

RESULT AND DISCUSSION

RSBHT Hospital is a private type C general hospital with one hundred beds, built on a site of 3,592 square metres, and it has run its hospital information system since 8 April 2019 through fourteen integrated modules covering registration to finance, including the inpatient module that is meant to record every service a patient receives from admission to discharge. Fifty-four inpatient nurses took part as respondents. All of them were women; by age, twenty were between twenty and thirty years old (37 percent), twenty-one were between thirty-one and forty years old (39 percent), ten were between forty-one and fifty years old (19 percent), and three were older than fifty (5 percent). By education, twenty-nine held a diploma (54 percent) and twenty-five held a bachelor's degree (46 percent). By length of service, eight nurses had worked for zero to two years (15 percent), twenty-two for three to five years (40 percent), seventeen for six to ten years (31 percent), and seven for more than ten years (13 percent), as summarised in Table 1.

Table 1. Distribution of Respondents by Characteristics

Characteristic	Category	n	%
Gender	Female	54	100
Age	20–30 years	20	37
	31–40 years	21	39
	41–50 years	10	19
	> 50 years	3	5
Education	Diploma (D3)	29	54
	Bachelor (S1)	25	46
Length of service	0–2 years	8	15
	3–5 years	22	40
	6–10 years	17	31
	> 10 years	7	13

Source: Primary data processed by researchers (2024).

Before the main analysis, the questionnaire's validity and reliability were re-confirmed within the measurement model of the Partial Least Squares Structural Equation Modelling. Convergent validity held for every indicator, with loading factors ranging from 0.751 to 0.862 for system quality, 0.736 to 0.855 for information quality, 0.822 to 0.908 for service quality, and comparable ranges for training and system use, all of them above the 0.50 cut-off used for this study. Discriminant validity was likewise satisfied, and reliability was strong across the board, as shown in Table 2, with composite reliability running from 0.921 to 0.953 and Average Variance Extracted running from 0.625 to 0.771.

Table 2. Composite Reliability and Average Variance Extracted

Variable	Cronbach's Alpha	Composite Reliability	AVE
System Quality	0.909	0.928	0.647
Information Quality	0.914	0.930	0.625
Service Quality	0.892	0.925	0.757
Training	0.940	0.953	0.771
System Use	0.884	0.921	0.744

Source: Primary data processed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS.

Turning to how nurses actually rated each variable, the Three Box Method placed all five variables in the medium category, as set out in Table 3. System quality obtained a mean index of 37.42, with the ease-of-use dimension scoring lowest at 36.00, closely followed by response

time at 36.75, meaning nurses still found the system's features not fully easy to use and its response to requests not yet fast. Information quality obtained a mean index of 35.93, with completeness scoring lowest at 35.50 and consistency close behind at 35.25, meaning the information the system produced was not yet felt to be fully complete or fully free of error. Service quality obtained a mean index of 36.37, with response speed scoring lowest at 34.25, pointing to a system provider that nurses still considered slow to answer their requests. Training obtained a mean index of 36.45, with the outcome or knowledge dimension scoring lowest at 34.75, suggesting that training had not yet left nurses feeling fully skilled at using the system. Finally, the use of the hospital information system obtained the lowest mean index among all variables, at 32.37, with the frequency dimension scoring lowest at 30.50, indicating that nurses tended to open the system only after a service had already been given rather than while providing care.

Table 3. Three Box Method Index Summary

Variable	Mean Index	Category	Lowest-scoring dimension (index)
System Quality	37.42	Medium	Ease of use (36.00)
Information Quality	35.93	Medium	Completeness (35.50)
Service Quality	36.37	Medium	Response speed (34.25)
Training	36.45	Medium	Outcome/knowledge (34.75)
System Use	32.37	Medium	Frequency (30.50)

Source: Primary data processed by researchers using the Three Box Method.

The structural model showed that system quality, information quality, and service quality together explained 94.3 percent of the variance in training, leaving only 5.7 percent to factors outside the model, while system quality, information quality, service quality, and training together explained 96.3 percent of the variance in the use of the hospital information system, leaving only 3.7 percent to other factors. Both figures fall well above the 0.67 threshold that is usually read as a strong model. No multicollinearity problem was found, since the variance inflation factor for every predictor stayed below 10, ranging from 1.028 to 1.072. The effect size of each path further showed where the real leverage in the model lay: system quality had a small effect on system use (f-square 0.073) and information quality likewise a small effect (f-square 0.139), while service quality had a negligible effect on system use (f-square 0.001); by contrast, system quality, information quality, and service quality each had a medium effect on training (f-square 0.189, 0.178, and 0.178, respectively), and training had a strong effect on system use (f-square 0.610). The model fit indices supported the overall model, with a Standardized Root Mean Square Residual of 0.070, below the 0.10 cut-off, and a Normed Fit Index of 0.656, within an acceptable range.

The path analysis produced two structural equations. For training, $\text{Training} = 0.256(\text{System Quality}) + 0.474(\text{Information Quality}) + 0.272(\text{Service Quality})$, showing that information quality carried by far the largest weight in shaping how nurses experienced training. For system use, $\text{System Use} = 0.139(\text{System Quality}) + 0.245(\text{Information Quality}) - 0.016(\text{Service Quality}) + 0.629(\text{Training})$, showing that training carried the largest weight of all, well above any of the three quality dimensions taken on its own. Looking at the indirect paths that run through training, system quality contributed an additional 0.161 to system use, information quality an additional 0.298, and service quality an additional 0.171, so that the total effect of each dimension on system use, once training is taken into account, rose to 0.248 for system quality, 0.449 for information quality, and 0.123 for service quality. In every case

the total effect exceeded the direct effect, which shows that training does not merely sit alongside system quality, information quality, and service quality but actively carries their benefit through to how often and how long nurses actually use the system.

The eight hypotheses were tested by comparing each path's t-statistic against the 1.96 threshold, and the results are summarised in Table 4. System quality, information quality, and service quality together, through training, significantly shaped the use of the hospital information system, so H1 was accepted. System quality significantly influenced system use directly ($t = 2.113$), so H2 was accepted, and information quality did likewise ($t = 2.120$), so H3 was accepted. Service quality, however, showed no significant direct influence on system use ($t = 0.209$), so H4 was rejected. System quality, information quality, and service quality each significantly influenced training ($t = 2.882, 4.523$, and 2.736 , respectively), so H5, H6, and H7 were all accepted. Finally, training significantly influenced system use ($t = 5.934$), so H8 was accepted.

Table 4. Summary of Hypothesis Testing

Hypothesis	Path	Coefficient	t-statistic	Decision
H1	System, Information, Service Quality → Training → System Use	$R^2 = 0.963$	-	Accepted
H2	System Quality → System Use	0.139	2.113	Accepted
H3	Information Quality → System Use	0.245	2.120	Accepted
H4	Service Quality → System Use	-0.016	0.209	Rejected
H5	System Quality → Training	0.256	2.882	Accepted
H6	Information Quality → Training	0.474	4.523	Accepted
H7	Service Quality → Training	0.272	2.736	Accepted
H8	Training → System Use	0.629	5.934	Accepted

Source: Primary data processed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS.

That system quality raises system use directly is consistent with the Human, Organization, and Technology-fit model, which treats how well a system's hardware, software, policies, and procedures perform as a condition for whether a system is put to use (Yusof et al., 2008), and with the view that a system's performance shapes how much benefit its users obtain from it (DeLone & McLean, 1992). Because the SIRS at RSBHT Hospital was rated adequate on ease of use, reliability, availability, flexibility, and ease of access, nurses were able to keep using it consistently, echoing earlier findings that a hospital information system judged reliable tends to be used more (Abda'u et al., 2018). Even so, the same result exposed the model's softest spot: ease of use and response time were the two lowest-scoring dimensions of system quality, which means the fastest, cheapest way to raise system quality further is to simplify the interface and speed up the system's response, not to add new features.

Information quality behaved in much the same direction. Complete, accurate, and timely information helps a user reach a better decision (Laudon & Laudon, 2004; Wang & Strong, 1996), and once nurses felt that the system gave them information quickly enough and kept it up to date, they were more inclined to keep it open while working, in line with the argument that quality output increases the perceived usefulness of a system (Venkatesh et al., 2003) and with (Abda'u et al., 2018; Jad & Zainol, 2022) conclusion that information quality is one output attribute that pushes use of a hospital information system upward. This lines up with a similar finding that the quality of information produced as system output has a substantial bearing on how a system's overall quality is judged (Nurlani & Permana, 2017). Yet completeness and

consistency, the two weakest dimensions found here, point to a concrete cause behind that weakness: as the preliminary interviews already suggested, many assessment forms needed in the inpatient unit were still missing from the system, which is precisely the kind of gap that keeps the completeness score down and, over time, erodes trust in the data the system produces.

Service quality told a different story. Its direct path to system use was not significant, which on the surface seems to run against the general claim that a reliable service provider builds up confidence in a system (Yusof et al., 2008). Read together with the rest of the model, however, the result makes sense: service quality did shape training strongly, and training in turn was what moved system use, so the benefit of a responsive information technology team reaches nurses' daily practice mainly by making training more effective rather than by touching system use on its own. This pattern is consistent with earlier work using the same model that also found service quality exerting its influence indirectly rather than as a stand-alone driver of use (Kuo et al., 2018). This is also consistent with findings that once users are confident a system's provider offers higher-quality service, they tend to feel more satisfied with the system itself, even when that confidence does not always translate into heavier day-to-day use (Lubis, 2017; Soraya et al., 2019). The lowest-scoring dimension of service quality, response speed, matches almost exactly what the ten nurses raised in the preliminary interviews about a slow information technology team and vendor and the absence of a user manual, which suggests that closing that particular gap is a realistic, low-cost place for management to start.

The influence that system quality, information quality, and service quality each held over training, together with training's own strong pull on system use, is the central finding of this study. A system that performs well and produces good information gives training something solid to work with, so it is not surprising that information quality carried the heaviest weight of the three predictors of training: once the material taught in training reflects a system that already behaves the way nurses expect, the training sticks better. This mirrors the point that transferring knowledge and skill in a single session is not enough on its own and that training needs to be tied to real practice and repeated over time (Bygholm, 2018), and it also lines up with the finding that a large share of trained staff can still show poor implementation (Bogale, 2021), since the outcome or knowledge dimension of training was the weakest one recorded in the present study as well. In other words, the sheer fact that training has been given is not enough by itself; what training is built on and how it is reinforced afterwards is what decides whether it eventually shows up as more frequent, longer use of the hospital information system. This also fits argument that the relevance of a system has a large bearing on how useful it is judged to be, since a system whose features feel relevant to daily nursing tasks is easier to reinforce through training (Seddon & Kiew, 1996). Training's especially strong direct effect on system use, together with the fact that frequency was the weakest dimension of use itself, further suggests that many nurses still treat the system as a place to record what has already been done rather than a tool to consult while giving care, a habit that focused, task-based training is well placed to change.

CONCLUSION

The findings of this study concluded that the utilization of the Hospital Information System (HIS) among inpatient nurses at RSBHT Hospital was significantly influenced by system quality, information quality, and training, whereas service quality did not have a direct

effect on HIS use. System quality and information quality contributed to improving nurses' willingness to use HIS, while service quality strengthened HIS utilization indirectly through its contribution to training. Training emerged as the strongest determinant of HIS use and functioned as an important mediating mechanism that transformed technological advantages into practical user behavior. The study also identified that all research variables remained within the medium category, indicating that HIS implementation required continuous improvement, particularly in system usability, response time, information completeness, technical support responsiveness, and nurses' practical competence in operating the system. Therefore, hospital management should prioritize continuous practice-based training, improve system interfaces and performance, complete required clinical documentation features, strengthen technical support mechanisms, and provide adequate user guidance to encourage more consistent HIS utilization in daily nursing activities.

Future research should expand investigations of HIS adoption by involving larger sample sizes, multiple hospitals, and diverse healthcare settings to improve the generalizability of findings. Further studies may incorporate additional variables related to individual, organizational, and environmental factors, such as user satisfaction, organizational readiness, digital competency, leadership support, and change management, to provide a more comprehensive understanding of HIS implementation. Longitudinal research designs are also recommended to examine changes in nurses' HIS utilization behavior before and after structured training interventions, considering that training plays a central role in strengthening the relationship between HIS quality dimensions and actual system use. Such research could provide deeper evidence regarding strategies for achieving sustainable digital transformation in healthcare organizations.

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