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The effect of hospital management information system (HMIS) quality on the effectiveness of patient safety goal implementation at Marina permata hospital, South Kalimantan

Pengaruh kualitas sistem informasi manajemen rumah sakit terhadap efektivitas penerapan sasaran keselamatan pasien di Rumah Sakit Marina Permata, Kalimantan Selatan

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Abstract

Background: Hospital Management Information Systems (HMIS) may contribute to patient safety, but the relative contributions of different quality dimensions remain uncertain. Objective: To examine associations between HMIS system, information, and service quality and the perceived effectiveness of patient safety goal implementation at Marina Permata Hospital, South Kalimantan. Methods: An explanatory quantitative study included 62 healthcare workers and staff using HMIS. Questionnaire responses were evaluated using multiple linear regression. Results: System quality was not independently associated with perceived patient safety goal implementation ($B = -0.190$; $\beta = -0.163$; $p = 0.175$). In contrast, information quality ($B = 0.677$; $\beta = 0.590$; $p < 0.001$) and service quality ($B = 0.587$; $\beta = 0.506$; $p < 0.001$) were positively associated. The combined model was significant ($F = 96.832$; $p < 0.001$; $R^2 = 0.834$). The nonsignificant partial coefficient for system quality should not be interpreted as evidence that it is unimportant; system reliability may be an enabling condition, while shared variance between predictors warrants further examination. Conclusion: Improvements in information completeness and user support deserve priority based on the inferential findings, whereas system reliability should remain an operational monitoring priority based on the descriptive results. Cross-sectional, self-reported data preclude causal inference.

Keywords: *Hospital Management Information System; system quality; information quality; service quality; patient safety goals*

Abstrak

Latar belakang: Sistem Informasi Manajemen Rumah Sakit (SIMRS) berpotensi mendukung keselamatan pasien, tetapi kontribusi setiap dimensi kualitas belum sepenuhnya diketahui. Tujuan: Menganalisis hubungan kualitas sistem, informasi, dan layanan SIMRS dengan persepsi efektivitas penerapan sasaran keselamatan pasien di Rumah Sakit Marina Permata, Kalimantan Selatan. Metode: Penelitian kuantitatif eksplanatori melibatkan 62 tenaga kesehatan dan staf pengguna SIMRS. Data kuesioner dianalisis menggunakan regresi linear berganda. Hasil: Kualitas sistem tidak menunjukkan hubungan parsial yang bermakna ($B = -0{,}190$; $\beta = -0{,}163$; $p = 0{,}175$). Kualitas informasi ($B = 0{,}677$; $\beta = 0{,}590$; $p < 0{,}001$) dan kualitas layanan ($B = 0{,}587$; $\beta = 0{,}506$; $p < 0{,}001$) menunjukkan hubungan positif bermakna. Model simultan signifikan ($F = 96{,}832$; $p < 0{,}001$; $R^2 = 0{,}834$). Ketidaksignifikanan koefisien parsial kualitas sistem tidak menunjukkan bahwa aspek tersebut tidak penting; keandalan sistem dapat berperan sebagai prasyarat operasional, sedangkan kemungkinan tumpang tindih antarprediktor memerlukan kajian lebih lanjut. Kesimpulan: Kelengkapan informasi dan dukungan pengguna merupakan prioritas berdasarkan temuan inferensial, sedangkan keandalan sistem tetap perlu dipantau berdasarkan temuan deskriptif. Desain potong lintang dengan data persepsi tidak memungkinkan kesimpulan kausal.

Kata Kunci: *Sistem Informasi Manajemen Rumah Sakit; kualitas sistem; kualitas informasi; kualitas layanan; sasaran keselamatan pasien*

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Introduction

Patient safety is integral to healthcare quality, requiring reliable patient identification, effective communication, medication safety, procedural verification, infection prevention, and fall-risk reduction. Digital information systems can support these processes by improving information availability and coordination, but technology-related failures may also introduce new hazards. Systematic reviews have shown both potential benefits of health information technology and patient safety risks associated with inaccessible data, interface problems, and software disruptions [1,2,3]. The relevant question is therefore not merely whether an HMIS has been deployed, but whether its information, technical performance, and user support are fit for clinical practice [4,5].

Hospital Management Information Systems (HMIS) support the collection, storage, exchange, and retrieval of data used for clinical and administrative decision-making. Information must be timely, complete, accessible, and sufficiently accurate to inform care processes [4]. Nonetheless, software performance, information fragmentation, or delayed resolution of technical incidents may disrupt delivery of care. Health IT safety literature emphasizes that technical capabilities and sociotechnical work processes must be evaluated together rather than assuming a direct benefit from software availability alone [2,6,7,8]. Separate evaluations of digital health and Indonesian hospital information systems have examined implementation arrangements and staff performance [9,10,11].

The updated DeLone and McLean Information Systems Success Model distinguishes system quality, information quality, and service quality as antecedents of use, user satisfaction, and net benefits [12,13]. System quality concerns availability, usability, efficiency, reliability, and technical performance; information quality addresses the accuracy, completeness, relevance, clarity, and timeliness of system outputs; and service quality reflects the competence and responsiveness of assistance to users. Empirical applications in healthcare support evaluating these dimensions jointly, although effect sizes and downstream outcomes differ across settings [14,15]. In hospital workflows, high-quality information is a prerequisite for accurate patient identification, communication across clinical teams, medication verification, and timely interventions. A systematic review of digital health information quality identified accessibility, completeness, security, timeliness, accuracy, interpretability, and relevance among clinically meaningful characteristics [4]. Technical quality remains important because downtime and interface limitations impede access to that information, while responsive support may determine whether incidents are resolved before they affect clinical work [2,16].

The six patient safety goals examined here comprise accurate patient identification, effective communication, safe management of high-alert medications, verification of the correct patient, site, and procedure for surgery, reduction of healthcare-associated infection risks, and fall prevention. These goals depend on reliable clinical information and coordinated workflows. Prior scholarship has called for explicit alignment of electronic health systems with patient safety goals, while recent reviews argue that patient safety should be considered alongside technological, informational, human, and organizational evaluation domains [5,7]. Studies focusing on patient identification and hospital data confidentiality illustrate the importance of examining specific safety processes alongside broader information-system outcomes [17,18].

Evidence from different contexts suggests that hospital information system quality is related to user experience and operational outcomes, but the strength and significance of the three quality dimensions are not uniform [14,15,19,20]. Indonesian HMIS studies employing PRISM, PIECES, and HOT-FIT approaches have highlighted the importance of considering user, organizational, and technological factors together, rather than attributing system success to one technical characteristic [19,21,22,23,24,25,26]. The Bahteramas study

evaluated perceived net benefits; its outcome is therefore distinct from perceived implementation of the six patient safety goals examined here [25].

Marina Permata Hospital is a private type C hospital in Tanah Bumbu, South Kalimantan, where HMIS is used in routine clinical and administrative work. Difficulties related to information completeness, service responsiveness, and reliability provide a practical basis for evaluating the system. The present investigation focuses on the association between three HMIS quality dimensions and the perceived effectiveness of implementing six patient safety goals. The analysis is specific to this organizational setting and should not be interpreted as a causal or nationally representative assessment.

Previous studies have frequently evaluated hospital information systems through information system success, user satisfaction, usability, or HOT-FIT frameworks [13,14,15,24,25]. For example, Kuo et al. studied quality dimensions and physician satisfaction, while the Indonesian evaluations at Dharma Kerti and Bahteramas emphasized broader HIS or net-benefit outcomes [15,24,25]. The contribution of the present study is a context-specific assessment of the three DeLone–McLean quality dimensions against the perceived implementation of all six patient safety goals in one private type C hospital. This is a focused empirical extension, not a claim that the conceptual model or variables are novel worldwide [5,12]. Accordingly, this study examined the associations of system quality, information quality, and service quality with the perceived effectiveness of implementing patient safety goals at Marina Permata Hospital, individually and jointly. Four hypotheses were specified: H1, system quality is significantly associated with the outcome; H2, information quality is significantly associated with the outcome; H3, service quality is significantly associated with the outcome; and H4, all three quality dimensions jointly explain a significant proportion of variation in the outcome. The conceptual framework is grounded in the DeLone–McLean model [12,13].

The proposed study framework specifies direct associations between system quality (H1), information quality (H2), and service quality (H3) and the perceived implementation of patient safety goals. H4 tests the joint model. These conceptual links do not establish temporal or causal pathways.

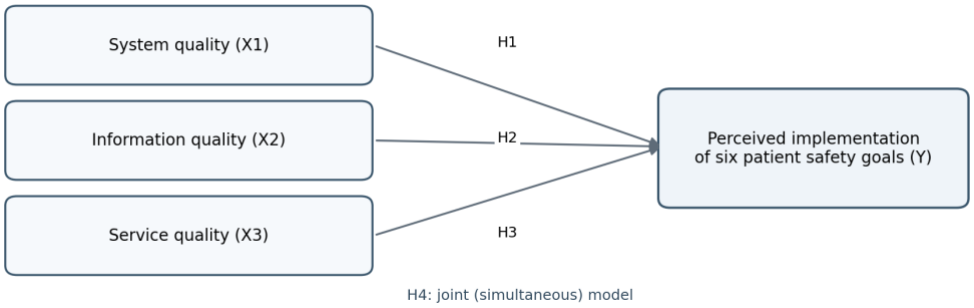


Figure 1. Conceptual model of HMIS quality dimensions and perceived implementation of six patient safety goals.

Materials and Methods

Study Design and Setting

This study employed a quantitative explanatory design using questionnaire data collected during one period of observation. It assessed associations between HMIS quality and perceived implementation of patient safety goals in the inpatient unit of Marina Permata Hospital, a private type C hospital in Tanah Bumbu, South Kalimantan, Indonesia. As the study did not involve random assignment or temporal sequencing, the regression results should be interpreted as associations rather than causal effects.

Participants and Sampling

The target population comprised healthcare workers and staff using HMIS at Marina Permata Hospital. A sample of 62 participants was reportedly selected by simple random sampling, with a 5% margin of error stated for the Slovin calculation. However, the eligible population size (N), sampling-frame composition, and numbers of questionnaires distributed and returned were not reported; therefore, the sample-size calculation and response rate cannot be independently verified. Unit-level representation (e.g., inpatient services, pharmacy, laboratory, and radiology) was also unavailable for verification. These omissions limit assessment of selection bias and representativeness.

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Research Instrument

A structured questionnaire assessed three HMIS quality constructs and the perceived implementation of six patient safety goals. The independent constructs followed the system quality, information quality, and service quality dimensions of the DeLone–McLean model [12,13]. Items were summarized using a five-point Likert-type scale. For the regression analysis, composite scores were treated as approximately continuous; this approach is common in applied research but entails assumptions about measurement and residual distributions and should be evaluated in sensitivity analyses [27]. The available documentation did not specify item-level identifiers, so those cannot be reconstructed reliably. Prior instrument-development work has also examined the measurement properties of hospital information system quality scales [28].

System quality was assessed using indicators covering ease of use, response time, reliability, system integrity/data security, and ease of learning. Information quality was assessed based on accuracy, completeness, timeliness, relevance, and clarity, whereas service quality was assessed using five dimensions: tangibles, reliability, responsiveness, assurance, and empathy. The effectiveness of patient safety goal implementation was assessed across six patient safety goals: accurate patient identification, effective communication, high-alert medication safety, correct patient/site/procedure verification for surgery, infection-risk reduction, and fall prevention. Operational definitions and indicators. Item numbers were not available and require confirmation from the final questionnaire.

Variable	Mean	SD	Range	Interpretation
System quality	4.01	NR	NR	Good
Information quality	4.02	NR	NR	Good
Service quality	3.99	NR	NR	Good
Patient safety goal implementation	4.00	NR	NR	Good

Data Collection

Primary data were obtained directly from respondents through the questionnaire, while secondary data were obtained from relevant hospital administrative and operational documents. The questionnaire was administered to healthcare workers and staff who used the HMIS in their routine activities.

Data Analysis

Responses were checked, coded, and analyzed using descriptive statistics and multiple linear regression. The dependent variable (Y) was the perceived effectiveness of patient safety goal implementation; predictors were system quality (X1), information quality (X2), and service quality (X3). The fitted model was $Y = \beta0 + \beta1X1 + \beta2X2 + \beta3X3 + \varepsilon$. Two-sided tests were interpreted at the 0.05 significance level. Normality, multicollinearity, and heteroscedasticity checks were reportedly considered; however, the relevant test methods and full results were not available for independent assessment. A variance inflation factor of 4.933 was reported for system quality, warranting caution about overlapping variance and coefficient stability.
The regression model was specified as follows:

Equation

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon \quad \textbf{(1)}$$

where Y represents the effectiveness of patient safety goal implementation; X_1 represents system quality; X_2 represents information quality; X_3 represents service quality; β_0 is the intercept; β_1–β_3 are the regression coefficients; and ε is the error term.

Item validity was reportedly evaluated using corrected item–total correlations, with a critical correlation of approximately 0.250 for 62 respondents at the 5% level. However, item-wise coefficients, construct-specific valid-item counts, Cronbach's alpha estimates, and excluded items were not reported. Instrument reliability and validity therefore cannot be established from the information available and should be documented using the underlying analytical output before publication.

Ethical Considerations

Hospital permission was obtained before data collection. A research ethics committee approval number was not documented in the available materials; neither the consent procedure nor the method for ensuring respondent anonymity could be independently verified. The authors must confirm these details, including

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whether independent ethical approval was obtained or formally waived, before publication. Absence of documentation should not be interpreted as evidence of ethics approval.

Results and Discussion

This study assessed the associations between HMIS quality and the perceived effectiveness of implementing patient safety goals among hospital staff. The results are organized into descriptive findings and multivariable associations, followed by discussion of their theoretical and operational implications. All indicators represent respondent ratings rather than direct counts of safety incidents or audited compliance with the patient safety goals.

Respondent Characteristics and Descriptive Findings

The analysis included 62 HMIS users. The reported age groups were 32–40 years (46.77%), 27–32 years (38.71%), and 22–27 years (14.52%); the shared age boundaries should be checked against the original coding scheme. Education was predominantly bachelor/professional (69.35%), followed by diploma (29.03%) and master/doctoral education (1.61%). Age and education were not incorporated as adjustment variables, so residual confounding by respondent characteristics remains possible.

All four constructs were categorized as good based on their mean questionnaire scores: system quality, 4.01; information quality, 4.02; service quality, 3.99; and perceived patient safety goal implementation, 4.00. Standard deviations, observed minima and maxima, and indicator-level frequency distributions were not reported; consequently, response homogeneity and possible ceiling effects cannot be assessed conclusively from mean scores alone.

Table 1. Descriptive statistics of the study variables

Variable	Mean score	Interpretation
System quality	4.01	Good
Information quality	4.02	Good
Service quality	3.99	Good
Patient safety goal implementation	4.00	Good

The overall ratings were similar, although specific weaknesses emerged: system reliability (3.66), information completeness (3.87), service responsiveness (3.90), and infection-risk reduction (3.79) had the lowest means in their respective domains. These descriptive ratings identify possible improvement targets but do not establish statistical predictors of the outcome. Among patient safety goals, effective communication (4.15) and patient identification (4.13) received the highest mean ratings, whereas infection-risk reduction (3.79) was lowest. These are self-reported ratings and should not be equated with objectively measured compliance rates or patient harm outcomes.

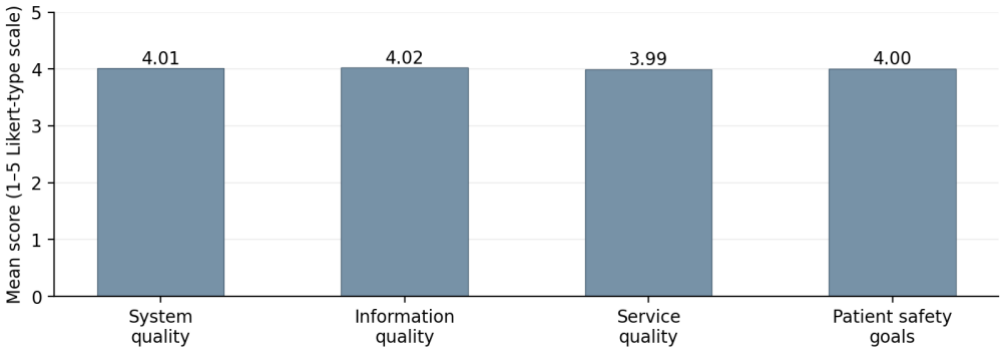


Figure 2. Mean respondent ratings of HMIS quality and patient safety goal constructs (n = 62). Bars show descriptive means only.

Effect of System Quality on Patient Safety Goal Implementation

After adjustment for information quality and service quality, system quality was not significantly associated with perceived implementation of patient safety goals (B = −0.190, β = −0.163, t = −1.373, p = 0.175).

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Thus, H1 was not supported. The negative partial estimate does not demonstrate that reliability improvements would be harmful; the meaning of the coefficient is conditional on the other predictors in the model.

This finding differs from simple expectations derived from the DeLone–McLean model but is not necessarily inconsistent with that framework, which emphasizes interrelated quality dimensions [12,13]. System quality had a mean score of 4.01 and its reliability indicator was comparatively low (3.66). The reported VIF of 4.933 indicates substantial overlap with other predictors, but without complete VIFs, correlation matrices, dispersion estimates, or sensitivity models, neither suppression nor a ceiling effect can be asserted as the mechanism of nonsignificance.

The nonsignificant partial association should therefore be distinguished from the operational importance of stable and accessible systems. Reliability remains an enabling condition for information availability, and system disruptions can pose patient safety risks irrespective of the partial coefficient in this sample [2,7,16]. The descriptive findings support this interpretation. Although system quality was generally rated good, system reliability was the weakest indicator (3.66). This suggests that maintaining system stability and minimizing disruptions remain important managerial priorities even though system quality did not show a significant independent effect in the regression model [2,29].

Effect of Information Quality on Patient Safety Goal Implementation

Information quality showed a positive, statistically significant association with perceived implementation of patient safety goals (B = 0.677, β = 0.590, t = 4.836, $p < 0.001$), supporting H2. The standardized coefficient was the largest among the three predictors. The information quality mean was 4.02, with information clarity/format rated highest (4.15) and completeness lowest (3.87).

Information quality was the strongest predictor conditional on the other quality constructs (standardized β = 0.590). Its relative prominence is plausible because clinical workflows depend on accurate, complete, interpretable, and timely information. This is compatible with multidimensional digital information quality frameworks and with the emphasis on information in recent HIS evaluation reviews [4,5]. This finding is theoretically consistent with the DeLone and McLean model, which conceptualizes information quality as a central dimension of information-system success [12,13]. In a hospital environment, information generated by HMIS must be sufficiently accurate, complete, timely, relevant, and understandable to support clinical and administrative decisions [14].

The relatively strong effect of information quality also has a practical explanation. Several patient safety goals require reliable information throughout the care process. Accurate patient identification, effective communication, medication safety, and surgical verification all depend on information being available and understandable to healthcare professionals [29]. Therefore, improvements in the completeness and integration of HMIS information may have a direct contribution to more effective patient safety practices.

The relatively low score for information completeness (3.87) indicates a specific area for improvement. The study therefore suggests strengthening the integration of information across supporting units, particularly laboratory, radiology, and pharmacy services, so that relevant clinical information can be accessed through a more integrated HMIS.

Effect of Service Quality on Patient Safety Goal Implementation

Service quality was positively associated with perceived implementation of patient safety goals (B = 0.587, β = 0.506, t = 4.438, $p < 0.001$), supporting H3. Its standardized coefficient was lower than that of information quality but higher than the nonsignificant estimate for system quality. The overall service-quality mean was 3.99. Among its dimensions, tangibles had the highest mean (4.09), followed by assurance (4.02), empathy (3.95), reliability (3.98), while responsiveness had the lowest mean (3.90).

The significant effect of service quality indicates that the benefits of HMIS depend not only on the technical capabilities of the system and the information it produces, but also on the support available to users. Technical assistance, problem resolution, user guidance, and responsiveness to system-related difficulties can influence how effectively healthcare workers use HMIS in routine care. This finding is consistent with the Updated DeLone and McLean framework, which added service quality as a distinct dimension of information-system success [12,13]. In the hospital context, responsive technical support can help minimize interruptions in information access and facilitate continued use of the system during clinical activities.

The relatively low responsiveness score (3.90) suggests that the hospital could strengthen technical support through clearer service procedures, defined response times for user complaints, a responsive

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helpdesk, and periodic training. These measures could improve the ability of healthcare workers to use HMIS consistently in support of patient safety practices [19].

Simultaneous Effect of HMIS Quality on Patient Safety Goal Implementation

The three predictors were jointly associated with perceived patient safety goal implementation ($F = 96.832$, $p < 0.001$), supporting H4. The model R^2 was 0.834, meaning that 83.4% of the observed variance in the outcome score was accounted for statistically by the three simultaneous predictors within this sample. This is not evidence that the HMIS caused 83.4% of patient safety outcomes.

Table 2. Multiple linear regression results

Predictor	B	SE	β	t	p	VIF
Constant	−2.099	NR	—	−1.001	0.321	—
System quality	−0.190	NR	−0.163	−1.373	0.175	4.933
Information quality	0.677	NR	0.590	4.836	< 0.001	NR
Service quality	0.587	NR	0.506	4.438	< 0.001	NR

NR = not reported in the available analyses; SE and remaining VIF values require verification from the original statistical output.

The regression equation was:

$$Y = -2.099 - 0.190X_1 + 0.677X_2 + 0.587X_3$$

where Y represents the effectiveness of patient safety goal implementation, X_1 system quality, X_2 information quality, and X_3 service quality.

The significant overall model and nonsignificant partial system-quality coefficient can coexist: the F test evaluates the set of regression coefficients jointly, whereas each t test evaluates one coefficient conditional on the others. Hence, the omnibus finding does not imply that all three individual predictors are significant. Interpretation should also consider the relatively high VIF for system quality and the single-source nature of the questionnaire data.

The finding is also consistent with the conceptual framework of information-system success, in which system quality, information quality, and service quality operate as interconnected dimensions. In practical terms, a stable system provides the infrastructure for producing usable information, while responsive support helps healthcare workers use that information effectively [1]. The combined contribution of these dimensions is therefore more meaningful for patient safety than evaluating system quality alone.

The large R^2 warrants a cautious interpretation. The predictor and outcome measures were derived from the same respondent-rated questionnaire, introducing possible common method bias and shared response tendencies [30]. No independent safety outcome, single-factor diagnostic, or alternative multi-source model was reported. The cross-sectional design, single-center sampling, and unmeasured organizational characteristics further limit inference and external validity. Overall, the results identify information quality and service quality as significant independent correlates of perceived patient safety goal implementation. Priorities based on statistical associations should therefore emphasize information completeness and responsiveness of technical assistance. System reliability, despite the nonsignificant partial coefficient, remains an operational priority on the basis of its comparatively low descriptive rating and the broader safety literature [2,5,16].

Managerial implications

Table 3. Practical actions and proposed monitoring measures (targets require local baseline assessment).

Finding	Recommended action	Suggested monitoring indicator	Priority
Information completeness: mean 3.87	Audit record completeness and interface exchange with pharmacy, laboratory, and radiology	Completeness rate; time to availability of critical results	High: inferential
Service responsiveness: mean 3.90	Incident triage, user support escalation, refresher training	Ticket response/resolution time; follow-up satisfaction	High: inferential
System reliability: mean 3.66; p = 0.175	Monitor uptime, downtime incidents, and recovery tests	Uptime; mean recovery time; number of failures	Operational: descriptive
Infection-risk reduction: mean 3.79	Link digital safety workflows to infection prevention audits	Observed adherence to infection prevention protocols	Operational: descriptive

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Limitations

The cross-sectional, single-center design prevents causal inference and limits external generalizability. All constructs were based on respondents' perceptions, creating a risk of common method bias; an R^2 of 0.834 does not demonstrate objectively verified safety improvement. The source information was insufficient to verify sampling-frame size, response rate, group representation, item-level validity, Cronbach's alpha, complete regression diagnostics, full dispersion statistics, and informed-consent or ethics approval documentation. These details should be supplied from the original records rather than estimated. Further work should recruit multiple hospitals, use longitudinal or mixed-method designs, adjust for staff characteristics, and include objective patient safety indicators [5,30,31].

Conclusions

Among 62 HMIS users at Marina Permata Hospital, information quality and service quality were positively associated with perceived implementation of patient safety goals, whereas system quality was not independently significant. The three dimensions jointly explained 83.4% of the variation in the self-reported outcome ($R^2 = 0.834$). Information completeness and service responsiveness emerge as priorities supported by the multivariable findings; system reliability requires attention on descriptive and safety-management grounds rather than as a demonstrated independent predictor. These associations should not be interpreted causally because of the cross-sectional design, limited sampling information, and potential common method bias. Multicenter studies combining staff perceptions with audited patient safety indicators are recommended.

Conflict of Interest

The authors declare that there is **no conflict of interest** related to the research, authorship, or publication of this article.

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Supplementary Materials

No supplementary materials are provided for this study.

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