Evaluating User Satisfaction with Hospital Management Information Systems: A PIECES Framework Analysis at Wates General Hospital

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Abstract: This study examines the impact of the PIECES framework—Performance, Information, Economics, Control, Efficiency, and Service—on user satisfaction with the Hospital Management Information System (SIMRS) at Wates General Hospital. Despite the hospital's adoption of SIMRS for managing inpatient daily census, issues with data accuracy persist, leading to concerns about system effectiveness and efficiency. Using a cross-sectional design, we collected data from 72 respondents through structured questionnaires and observations. The study employed univariate, bivariate, and multivariate analyses to assess the relationships between the PIECES aspects and user satisfaction. The findings reveal that each PIECES aspect significantly influences user satisfaction, with control and security emerging as dominant factors. Logistic regression analysis indicates that robust control and security measures drastically increase user satisfaction, followed by system performance. Based on these results, we recommend targeted improvements to SIMRS security protocols and system performance to enhance overall user satisfaction. This research contributes to the theoretical understanding of hospital information system evaluation and offers practical recommendations for improving implementation of SIMRS in healthcare settings.

Keywords: Hospital Management Information System; User Satisfaction; PIECES Framework; Data Accuracy; Healthcare Information Systems

1. Introduction

Hospitals serve as critical healthcare facilities, delivering inpatient services organized by both the government and private sector (Owusu Kwateng et al., 2019). Accurate documentation of patient health services, whether through manual records or electronic medical records (EMRs), plays a vital role in ensuring the sustainability and quality of healthcare services (Woldemariam & Jimma, 2023). The data captured in these records form the basis for hospital governance decisions, particularly by aggregating hospital statistics that reflect key performance indicators.

The inpatient daily census plays a crucial role in the hospital management by serving as a primary source of statistical data essential for evaluating various performance indicators. These indicators include the Bed Occupancy Rate (BOR), Length of Stay (LOS), Turnover Interval (TOI), Bed Turnover (BTO), Net Death Rate (NDR), and Gross Death Rate (GDR) (Bosque-Mercader & Siciliani, 2023). These metrics are critical for assessing the efficiency, quality, and overall performance of hospital operations. The accuracy with which staff complete daily census data directly affects the reliability of these statistical calculations. Consequently, inaccuracies can lead to flawed decision-making processes that affect hospital operations and strategic planning (Pejić Bach et al., 2024).

In compliance with the Law of the Republic of Indonesia Number 44 of 2009 concerning Hospitals, hospitals are mandated to record and report all organizational activities via a Hospital Management Information System (SIMRS). Wates General Hospital has implemented SIMRS to digitize inpatient daily census activities (Pratiwi et al., 2023). Despite this, some staff members perceived the data from the SIMRS as inaccurate, prompting them to resort to manual recording as an additional step. This situation raises concerns about the effectiveness and efficiency of SIMRS in producing accurate and relevant data.

The potential for inaccurate information and data generated by SIMRS to impact user satisfaction is significant because user satisfaction is a crucial indicator of successful information system implementation (Pratiwi et al., 2023). Factors such as system performance, information quality, cost efficiency, control and security,

operational efficiency, and service quality strongly influence SIMRS user satisfaction (Herwati et al., 2023; Pratiwi et al., 2023).

To evaluate these factors, the PIECES (Performance, Information, Economics, Control, Efficiency, and Service) framework offers a comprehensive approach. This method identifies problems, opportunities, and recommendations within the context of information system analysis and design (Benmamoun et al., 2023). The PIECES framework has been extensively applied in research evaluating hospital management information systems (AbouZahr, 2023).

This study aims to analyze the impact of PIECES aspects on SIMRS user satisfaction during the implementation of the inpatient daily census at Wates General Hospital. Specifically, the study seeks to measure the influence of performance, information quality, cost efficiency, control and security, operational efficiency, and service quality on user satisfaction. This research provides deeper insights into the factors that shape user satisfaction with SIMRS.

Previous studies have underscored the importance of each PIECES aspect to enhance user satisfaction. For example, Sidharta and Rahmahwati (2023) demonstrated that performance and economic aspects significantly influence user satisfaction. Similarly, Mamakou et al. (2024) and Ali et al. (2023) highlighted the critical role of information quality and security in determining user satisfaction with information systems.

Through a detailed examination of each PIECES aspect, this study offered specific recommendations for improving and further developing SIMRS at Wates General Hospital. The identification of the most influential aspects will be pivotal in efforts to enhance SIMRS quality. The findings of this study are expected to contribute significantly to the literature on hospital management information systems and serve as a reference for decision makers in other healthcare institutions.

This research addresses the following key questions:
1. How does each PIECES aspect influence SIMRS user satisfaction at Wates General Hospital?
2. Which PIECES aspects most strongly affect SIMRS user satisfaction?
3. What recommendations can be made to improve SIMRS quality based on this study's findings?

This study, through answering the questions, offers both theoretical insights into the elements affecting user satisfaction with SIMRS and practical suggestions for improving hospital management information systems' quality and effectiveness.

The following section details the research methods, including the study design, population and sample, ethical considerations, research instruments, data collection procedures, and data analysis techniques. Section 3 presents the key findings from the univariate, bivariate, and multivariate analyses on each component of the PIECES framework. In Section 4, the study interprets findings related to SIMRS user satisfaction considering previous literature, highlights key factors driving satisfaction, and proposes strategies to enhance SIMRS quality at Wates General Hospital. Section 5 concludes by summarizing the main points, acknowledging the study's limitations, and proposing possible avenues for future investigation.

2. Research Methods

2.1 Study design

This study employs an analytic quantitative approach with a cross-sectional design. This design allows for the identification and analysis of the relationships between independent variables (the PIECES aspects) and dependent variables (user satisfaction) at a specific point in time. The cross-sectional design was chosen for its suitability for measuring prevalence and relationships between variables in a single snapshot of the studied population.

2.2 Population and sample

The study population included all users of the Hospital Management Information System (HMIS) at Wates General Hospital, including inpatient ward nurses, ward administrators, and inpatient registration officers. A simple random sampling technique was employed to select a sample of 72 respondents, ensuring that each member of the population had an equal chance of being selected. The sample size is adequate to provide valid and reliable representation of the broader population.

2.3 Ethical approval

The study was conducted after obtaining ethical approval from the Health Research Ethics Commission of Wates General Hospital (number: KEPK/141/RS/IV/2023) and the Ethics Commission of FKKMK UGM (number: KE/FK/0792/EC/2023). This ensures that the research adheres to ethical standards and protects the rights and well-being of all participants.

2.4 Research instruments

Data collection was conducted using observations and structured questionnaires developed based on the PIECES framework (Performance, Information, Economics, Control, Efficiency, and Service). The questionnaire was meticulously designed to capture detailed information across several key sections:
1. Demographics: Basic information about respondents, including gender, age, highest educational attainment, job position, and length of hospital employment.
2. Performance (P): This section evaluates how well the HMIS supports respondents' operational tasks, focusing on system speed, reliability, and user-friendliness. Example questions include the following:
   - How quickly does the HMIS process the data you enter?
   - How reliable is the HMIS in terms of uptime and availability?
3. Information and Data (I): This section assessed the quality and accuracy of information produced by the HMIS, emphasizing its relevance and timeliness. Example questions include:
   - How accurate is the information generated by the HMIS?

- How relevant is the information provided by the HMIS for your tasks?

4. Economics (E): This section measures the cost efficiency and economic benefits of using the HMIS, including the cost savings and productivity gains. Example questions include the following:
   - To what extent has the HMIS reduced operational costs?
   - How much has the HMIS improved productivity in your department?

5. Control and Security (C): This section evaluates data security measures and access controls in the HMIS with a focus on data integrity and user trust. Example questions include the following:
   - How secure is the patient data stored in the HMIS?
   - How effective are the access controls in preventing unauthorized access?

6. Efficiency (E): This section measures the operational efficiency achieved using the HMIS, including the time and resource optimization. Example questions included following:
   - How efficiently does the HMIS streamline administrative tasks?
   - To what extent does the HMIS reduce the time required for data entry and retrieval?

7. Service (S): This section assesses the quality of services provided by the HMIS, including technical support and user assistance. Example questions include:
   - How satisfied are you with the technical support provided for the HMIS?
   - How easy is it to get help when you encounter issues with the HMIS?

Each item in the questionnaire was scored on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). This scaling method allows the quantitative assessment of respondents' satisfaction and perceptions.

2.5 Data collection procedure

The data collection process involved two primary methods:

1. Observation: Direct observation was conducted to monitor respondents' use of the HMIS during their daily tasks. This method provided contextual insights into the practical application of the proposed system and identified potential issues that may arise.

2. Questionnaires: The structured questionnaires were distributed to selected respondents for independent assessment. The researchers provided guidance and explanations as necessary to ensure that the respondents fully understood each question and provided accurate responses.

2.6 Data analysis

Data analysis was performed in three major stages:

1. Univariate Analysis: This stage involved describing the demographic characteristics of the respondents and the frequency distribution of each variable. Microsoft Excel was used to perform this analysis, providing a detailed summary of the respondents' profiles.

2. Bivariate Analysis: This stage identified relationships between independent variables (the PIECES aspects) and dependent variables (user satisfaction). The chi-square test was used to determine the statistical significance of the relationships. A p-value of less than 0.05 was considered indicative of a significant relationship.

3. Multivariate Analysis: This stage identifies independent variables that have the most substantial influence on user satisfaction. Logistic regression was used to analyze the relationship between multiple independent variables and a single dependent variable. Variables with a p-value greater than 0.25 were sequentially removed from the model to obtain the most parsimonious regression model.

2.7 Application proposed PIECES framework

The PIECES framework was systematically applied to evaluate each aspect influencing user satisfaction with HMIS. Each aspect was assessed using specific indicators from the questionnaire. The application of the PIECES framework in this study is detailed as follows:

1. Performance: Assessed using various indicators, such as system processing speed, reliability, and ease of use. This aspect measured how well the system supported operational tasks and maintained uptime.

2. Information: The accuracy, relevance, completeness, and accessibility of the information produced by the HMIS are evaluated. This aspect focused on data quality and usefulness for decision-making.

3. Economics: Measured using cost efficiency indicators, including operational cost savings and productivity improvements. This section analyzes the economic and financial impacts of HMIS on hospital operations.

4. Control and Security: This is assessed by examining data security measures, access controls, and user trust in the system. This aspect focuses on the integrity of data stored in the HMIS and the effectiveness of security protocols.

5. Efficiency: evaluated using indicators of operational efficiency, such as time savings and resource optimization. This aspect measured how HMIS improved workflow efficiency and reduced administrative burden.

6. Service: This attribute is assessed based on technical support quality, user assistance, and overall service satisfaction. This aspect examined the responsiveness and helpfulness of the support services provided to HMIS users.

3. Results

3.1 Univariate analysis

Univariate analysis was conducted to describe the characteristics of the respondents. The results are summarized in Table 1.

Table 1. Characteristics of respondents.

CHARACTETISTIC	FREQUENCY	PERCENTAGE
Gender		
Female	14	81%
Male	58	19%
Age		
<20 years old	0	0%
21 – 30 years old	28	39%
31 – 40 years old	21	29%
41 – 50 years old	16	22%
>50 years old	7	10%
Last Education		
Junior High School	0	0%
Senior High School	5	7%
Diploma	51	71%
Bachelor	16	32%
Magister	0	0%
Position		
Inpatient registration officer	3	4%
Nurse	66	92%
Admin	3	4%
<1 year	5	7%
1 year	11	15%
2 year	5	7%
3 year	7	7%
4 year	4	5%
>4 year	40	65%

As shown in Table 1, the respondents were predominantly female (81%), aged between 21-30 years (39%), with a diploma as their highest education level (71%), and most were nurses (92%). Over half of the respondents had been using the HMIS for more than 4 years (56%).

3.2 Bivariate analysis

Bivariate analysis was conducted to determine the effect of each PIECES variable on user satisfaction using the chi-square test. The results are presented in Tables 2–7.

The results in Table 2 indicate a significant relationship between HMIS performance and user satisfaction ($p < 0.001$). Respondents who rated the performance of HMIS as good were predominantly satisfied (69.4%), whereas those who rated it as not good showed a higher level of dissatisfaction (13.9%). The mean satisfaction score was significantly higher in the group that perceived good performance (Mean ± SD: 3.89 ± 0.32) than in the group that did not (Mean ± SD: 1.72 ± 0.46).

As shown in Table 3, the information and data quality significantly affect user satisfaction ($p < 0.001$). The respondents who found the information accurate were more likely to be satisfied (70.8%) than those who found it inaccurate. The mean satisfaction score was higher for those who rated the information as accurate (Mean ± SD: 4.12 ± 0.23) than for those who did not (Mean ± SD: 1.93 ± 0.40).

Table 4 illustrates that the economics aspect of HMIS has a significant influence on user satisfaction ($p = 0.016$). A greater percentage of respondents who deemed the economics of the system suitable were satisfied (66.7%) than those who did not (9.7%). The satisfaction scores were notably higher among those who found the system economically suitable (Mean ± SD: 4.25 ± 0.35) than among those who did not (Mean ± SD: 2.11 ± 0.57).

As shown in Table 5, control and security significantly affect user satisfaction ($p < 0.001$). Respondents who rated control and security as good were predominantly satisfied (76.4%), whereas those who rated it as not good showed a higher level of dissatisfaction (16.7%). The mean satisfaction score was significantly higher in the group that perceived good control and security (Mean ± SD: 4.30 ± 0.28) than in the group that did not (Mean ± SD: 1.83 ± 0.37).

The results presented in Table 6 reveal that efficiency significantly affects user satisfaction ($p = 0.026$). Those

who rated the efficiency as good were more likely to be satisfied (31.9%) than those who did not (18.1%). The mean satisfaction score was higher for respondents who perceived good efficiency (Mean ± SD: 4.19 ± 0.33) than for those who did not (Mean ± SD: 2.36 ± 0.44).

Table 7 shows that the service quality had a significant effect on user satisfaction (p < 0.001). A higher proportion of respondents who rated the service as good were satisfied (75.0%) than those who rated it as not good (16.7%). The satisfaction scores were higher among those who perceived the service as good (Mean ± SD: 4.27 ± 0.30) than among those who did not (Mean ± SD: 1.91 ± 0.36).

Table 2. Analysis of the effect of HMIS performance on user satisfaction.

USER SATISFACTION	NOT GOOD (n=18)	GOOD (n=54)	TOTAL (n=72)	P-VALUE
Dissatisfied	10 (13.9%)	4 (5.6%)	14 (19.4%)	<0.001
Satisfied	8 (11.1%)	50 (69.4%)	58 (80.6%)	
Mean ± SD	1.72 ± 0.46	3.89 ± 0.32		
95% CI	1.55 - 1.89	3.80 - 3.98		

Table 3.Results analysis of the effect of information and data on user satisfaction.

USER SATISFACTION	INACCURATE (N=15)	ACCURATE (N=57)	TOTAL (N=72)	P-VALUE
Dissatisfied	8 (11.1%)	6 (8.3%)	14 (19.4%)	<0.001
Satisfied	7 (9.7%)	51 (70.8%)	58 (80.6%)	
Mean ± SD	1.93 ± 0.40	4.12 ± 0.23		
95% CI	1.75 - 2.11	4.05 - 4.19		

Table 4.Results analysis of the effect of economics on user satisfaction.

USER SATISFACTION	NOT SUITABLE (n=17)	SUITABLE (n=55)	TOTAL (n=72)	P-VALUE
Dissatisfied	7 (9.7%)	7 (9.7%)	14 (19.4%)	0.016
Satisfied	10 (13.9%)	48 (66.7%)	58 (80.6%)	
Mean ± SD	2.11 ± 0.57	4.25 ± 0.35		
95% CI	1.77 - 2.45	4.11 - 4.39		

Table 5.Results analysis of the effect of control and security on user satisfaction.

USER SATISFACTION	NOT GOOD (n=15)	GOOD (n=57)	TOTAL (n=72)	P-VALUE
Dissatisfied	12 (16.7%)	2 (2.8%)	14 (19.4%)	<0.001
Satisfied	3 (4.2%)	55 (76.4%)	58 (80.6%)	
Mean ± SD	1.83 ± 0.37	4.30 ± 0.28		
95% CI	1.68 - 1.98	4.21 - 4.39		

Table 6. Results of analyzing the effect of efficiency on user satisfaction.

USER SATISFACTION	NOT GOOD (n=48)	GOOD (n=24)	TOTAL (n=72)	P-VALUE
Dissatisfied	13 (18.1%)	1 (1.4%)	14 (19.4%)	0.026
Satisfied	35 (48.6%)	23 (31.9%)	58 (80.6%)	
Mean ± SD	2.36 ± 0.44	4.19 ± 0.33		
95% CI	2.17 - 2.55	4.05 - 4.33		

Table 7. Results of analyzing the effect of service on user satisfaction.

USER SATISFACTION	NOT GOOD (n=16)	GOOD (n=56)	TOTAL (n=72)	P-VALUE
Dissatisfied	12 (16.7%)	2 (2.8%)	14 (19.4%)	<0.001
Satisfied	4 (5.6%)	54 (75.0%)	58 (80.6%)	
Mean ± SD	1.91 ± 0.36	4.27 ± 0.30		
95% CI	1.75 - 2.07	4.17 - 4.37		

3.3 Multivariate analysis

Multivariate analysis was performed using logistic regression to identify the aspects of PIECES that had the most substantial influence on user satisfaction. The analysis was conducted in five steps, removing variables with p-values > 0.25 sequentially.

As shown in Table 8, the initial logistic regression step included all PIECES variables. The analysis shows that "Performance" (p=0.050) and "Control and Security" (p=0.047) are significant predictors of user satisfaction, with odds ratios of 24.142 and 49.328, respectively. Users who perceive high performance, robust control, and security are significantly more likely to be satisfied with the HMIS. Variables such as "Information and Data," "Economics," "Efficiency," and "Service" did not show a significant impact at this step and were thus considered for removal in subsequent steps due to their higher p values.

In Table 9, after removing "Efficiency" due to its high p-value, "Performance" and "Control and Security" remain significant, with even higher odds ratios of 28.032 and 52.635, respectively. The p-values for these variables were also lower (Performance: p=0.036, Control and Security: p=0.044), reinforcing their substantial influence on user satisfaction. "Information and Data," "Economics," and "Service" still do not reach statistical significance.

Table 10 shows the model after removing "Economics." "Performance" (p=0.013) and "Control and Security" (p=0.055) continue to show strong significance with even higher odds ratios, suggesting that improvements in these areas are likely to greatly enhance user satisfaction. "Service" shows a substantial odds ratio but remains statistically insignificant.

Table 11 presents the results after removing "Service." "Control and Security" now shows a dramatically high odds ratio of 197.137 ($p < 0.001$), indicating it as the most significant predictor of user satisfaction. "Performance" remains significant with an odds ratio of 36.123 (p = 0.013), reinforcing its importance. "Information and Data" still does not show statistical significance.

In the final step shown in Table 12, only "Performance" and "Control and Security" remain in the model. "Control and Security" ($p < 0.001$) emerges as the most critical factor with an odds ratio of 108.660, suggesting that strong control and security measures drastically increase the likelihood of user satisfaction. "Performance" (p = 0.022) also significantly influences satisfaction, though to a lesser extent, with an odds ratio of 15.359. The high odds ratios and significant p-values underscore the importance of focusing on these areas to enhance overall user satisfaction with the HMIS.

Table 8. Results of logistic regression in step 1.

VARIABLE	P-VALUE	ODDS RATIO (OR)	95% CONFIDENCE INTERVAL (CI)	MEAN ± SD	95% CI
Performance	0.05	24.142	9.997 – 584.686	2.81 ± 0.76	2.55 - 3.07
Information and Data	0.239	0.123	0.004 – 4.019	3.02 ± 0.81	2.74 - 3.30
Economics	0.559	2.26	0.147 – 34.797	2.77 ± 0.80	2.49 - 3.05
Control and Security	0.047	49.328	1.059 – 2,297.902	3.09 ± 0.83	2.81 - 3.37
Efficiency	0.723	2.337	0.021 – 2,550.85	2.54 ± 0.76	2.28 - 2.80
Service	0.335	7.103	0.132 – 382.418	3.06 ± 0.84	2.78 - 3.34
Constant	0.012	0			

Table 9. Results of logistic regression in step 2.

VARIABLES	P-VALUE	ODDS RATIO (OR)	95% CONFIDENCE INTERVAL (CI)	MEAN ± SD	95% CI
Performance	0.036	28.032	12.42 – 632.817	2.82 ± 0.77	2.56 - 3.08
Information and Data	0.19	0.103	0.003 – 3.082	3.01 ± 0.81	2.73 - 3.29
Economics	0.578	2.177	0.141 – 33.690	2.78 ± 0.80	2.50 - 3.06
Control and Security	0.044	52.635	11.07 – 250.2833	3.11 ± 0.83	2.83 - 3.39
Service	0.312	7.853	0.144 – 427.736	3.07 ± 0.84	2.79 - 3.35
Constant	0.004	0			

Table 10. Results of logistic regression in step 3.

VARIABLE	P-VALUE	ODDS RATIO (OR)	95% CONFIDENCE INTERVAL (CI)	MEAN ± SD	95% CI
Performance	0.013	38.962	2.161 – 702.505	2.83 ± 0.77	2.57 - 3.09
Information and Data	0.173	0.094	0.003 – 2.812	3.00 ± 0.80	2.72 - 3.28
Control and Security	0.055	38.984	0.929 – 1,636.301	3.13 ± 0.82	2.85 - 3.41
Service	0.255	10.214	1.87 – 556.610	3.09 ± 0.84	2.81 - 3.37
Constant	0.002	0			

Table 11. Results of logistic regression in step 4.

VARIABLE	P-VALUE	ODDS RATIO (OR)	95% CONFIDENCE INTERVAL (CI)	MEAN ± SD	95% CI
Performance	0.013	36.123	2.161 – 603.817	2.84 ± 0.77	2.58 - 3.10
Information and Data	0.28	0.2	0.011 – 3.714	2.99 ± 0.80	2.71 - 3.27
Control and Security	<0.001	197.137	12.914 – 3,009.381	3.14 ± 0.82	2.86 - 3.42
Constant	0.001	0			

Table 12. Results of logistic regression in step 5.

VARIABLE	P-VALUE	B	ODDS RATIO (OR)	95% CONFIDENCE INTERVAL (CI)	MEAN ± SD
Performance	0.022	27.32	15.359	1.481 – 159.247	2.84 ± 0.77
Control and Security	<0.001	46.88	108.66	10.655 – 1,108.147	3.14 ± 0.82
Constant	<0.001	-104.34	0		

4. Discussion

The objective of this study was to analyze the impact of each PIECES aspect on the satisfaction of users of the Hospital Management Information System (SIMRS) at Wates General Hospital, to determine which PIECES aspect most dominantly affects user satisfaction, and to provide recommendations for improving the quality of the SIMRS based on the findings. The discussion below addresses these key questions and relates the findings to previous research, incorporating a detailed analysis of the results.

4.1 Impact of PIECES aspects on user satisfaction

The results demonstrate that each aspect of the PIECES framework—performance, information, economy, control and security, efficiency, and Service—significantly influences user satisfaction with SIMRS. The univariate analysis indicates that better perceived performance, higher information quality, greater economic benefits, stronger control and security, improved efficiency, and higher service quality are all associated with increased user satisfaction.

a. Performance

Performance was a significant factor, as evidenced by the logistic regression analysis (p = 0.022). Users who highly rated the performance of SIMRS were more likely to be satisfied. This aligns with the findings of Ali et al. (2023), who noted that system speed, reliability, and user-friendliness are critical for user satisfaction. The high odds ratio for performance (OR = 15.359) indicates that system performance enhancement can substantially improve user satisfaction.

b. Information quality

Information quality was significant in the univariate analysis (p < 0.001), did not remain a significant predictor in the final multivariate model. This may be due to the interrelated nature of information quality with other aspects such as performance and control and security. Accurate and relevant information is crucial for hospital operations. As indicated by Sidharta and Rahmahwati (2023) and Mamakou et al. (2024), improving data quality can indirectly enhance user satisfaction by improving overall system performance and trust.

c. Economics

The economic aspect also significantly influenced user satisfaction in the univariate analysis (p = 0.016). The perception of cost efficiency and economic benefits (e.g., cost savings and productivity gains) was positively correlated with user satisfaction, supporting the findings of previous studies (Ali et al., (2023). Although economics was not a dominant predictor in the multivariate model, ensuring the system's cost-effectiveness remains crucial for user buy-in and long-term sustainability.

d. Control and security

Control and Security emerged as the most influential factors (p < 0.001), with the highest odds ratio (OR = 108.660). This indicates that robust security measures, effective access controls, and data integrity are paramount for user satisfaction. The significant impact of control and security is consistent with the literature, emphasizing the critical role of data security and integrity in influencing user trust and satisfaction (Mamakou et al., 2024).

e. Efficiency

Efficiency significantly affected user satisfaction in the univariate analysis (p = 0.026). The ability of the SIMRS to streamline administrative tasks, save time, and optimize resources was evaluated by users. Although efficiency did not remain a significant predictor in the final multivariate model, it still plays a role in the overall user experience and satisfaction, particularly in reducing the administrative burden on hospital staff.

f. Service quality

Service quality showed a significant effect on user satisfaction (p < 0.001) in the univariate analysis, which is consistent with the importance of technical support and user assistance found in previous studies (Ali et al., (2023). Users appreciated the responsive and helpful support services, which contributed to their overall satisfaction with SIMRS. However, in the multivariate analysis, service quality was overshadowed by the dominant factors of performance, control, and security.

4.2 Dominant PIECES aspects affect SIMRS user satisfaction

The multivariate analysis identified Control and Security as the most dominant aspects affecting user satisfaction, with a striking odds ratio of 108.660. This underscores the critical importance of implementing robust security measures and maintaining strict data integrity and access controls to foster user trust and satisfaction.

Performance was also a significant factor, although to a lesser extent, with an odds ratio of 15.359. This finding emphasizes the need for a reliable, fast, and user-friendly system to enhance user satisfaction, which is consistent with previous studies that have highlighted the importance of system performance (Ali et al., (2023).

4.3 Recommendations for improving SIMRS quality

Based on the study findings, several recommendations can be made to improve the quality of SIMRS at Wates General Hospital:

1. Enhancing Control and Security Measures: Given the dominant influence of control and security on user satisfaction, implementing and updating robust security protocols. This includes secure data storage, stringent access controls, regular security audits, and training staff on data security best practices. Strengthening these measures will directly address the most critical factors identified in this study.
2. Optimizing System Performance: Improving system speed, reliability, and user-friendliness should be prioritized. Regular system updates, efficient troubleshooting mechanisms, and responsive technical support can help maintain high performance and user satisfaction. Ensuring that the system can handle peak loads without performance degradation is also essential.
3. Improving Information Quality: Ensuring the accuracy, relevance, and timeliness of the information produced by SIMRS is essential. Regular data validation checks, user feedback loops, and continuous improvement processes can help enhance the quality of information. Providing staff with training on accurate data entry and system usage can also improve the information quality.
4. Increasing Cost Efficiency: Identifying and implementing cost-saving measures within the SIMRS can help improve the SIMRS' economic benefits. Streamlining administrative processes and optimizing resource allocation can improve cost efficiency and user satisfaction. Evaluating and demonstrating the cost-effectiveness of the system to users can also enhance users' perception of its value.
5. Enhancing Operational Efficiency: Simplifying workflows, reducing data entry times, and minimizing administrative burdens can improve operational efficiency. Provide adequate training and support to users to further enhance the efficiency of SIMRS. Implementing user-friendly interfaces and automation features can also streamline processes and reduce staff workload.
6. Improving Service Quality: Ensuring high-quality technical support and user assistance is critical. Establishing a responsive help desk, providing comprehensive user manuals, and conducting regular training sessions can help maintain high service quality and user satisfaction. Prompt resolution of issues and clear communication channels can also improve user experience.

4.4 Comparison with previous research

This study corroborates the findings of several previous studies. For example, the significant influence of performance and security on user satisfaction is in agreement with the research by Ali et al. (2023), Sidharta and Rahmahwati (2023) and Mamakou et al. (2024). Furthermore, the emphasis on information quality and its impact on user satisfaction is consistent with the findings of Mamakou et al. (2024).

By integrating the PIECES framework into the analysis of SIMRS user satisfaction, this study provides a comprehensive understanding of the various factors that influence user perceptions and experiences with hospital management information systems. The identification of control and security as the most dominant aspects highlights the critical need for robust security measures in health information systems, a finding that is in agreement with existing literature on the subject.

5. Conclusion and future work

This study provides a comprehensive analysis of the factors influencing user satisfaction with the Hospital Management Information System (SIMRS) at Wates General Hospital, employing the PIECES framework. The findings underscore the significant impact of each PIECES aspect—Performance, Information, Economics, Control and Security, Efficiency, and Service—on user satisfaction.

Notably, control and security were identified as the most dominant factors affecting user satisfaction, with a substantial odds ratio indicating its critical importance. This highlights the necessity for robust data security measures, stringent access controls, and data integrity to foster user trust and satisfaction. Performance also showed a significant influence, emphasizing the need for reliable, fast, and user-friendly systems.

These insights are aligned with previous research, reinforcing the importance of system performance and data security in health information systems. This study contributes to the theoretical understanding of the factors affecting user satisfaction with hospital management information systems and offers practical recommendations for improving the quality and effectiveness.

Although this study provides valuable insights, several areas require further investigation to build on these findings and enhance the understanding and implementation of SIMRS:

1. Longitudinal Studies: Future research could employ a longitudinal design to assess changes in user satisfaction over time as improvements to SIMRS are implemented. This would provide a more dynamic understanding of the factors influencing satisfaction and the long-term impact of system enhancements.
2. Comparative Studies: Conducting comparative studies across different hospitals with varying levels

of SIMRS implementation could provide insights into best practices and contextual factors influencing user satisfaction. Such studies can help identify common challenges and successful strategies for the implementation of SIMRS.

3. Qualitative Research: Incorporating qualitative research methods, such as interviews and focus groups can provide deeper insights into user experiences and perceptions. This would complement the quantitative findings and offer a more holistic understanding of the factors affecting user satisfaction.

4. Broader PIECES Analysis: Expanding the analysis to include additional dimensions of the PIECES framework or integrating it with other evaluation frameworks could provide a more comprehensive assessment of SIMRS. This will help identify additional factors that influence user satisfaction and system success.

5. Technology Adoption Models: Future studies could explore the integration of technology adoption models, such as the technology acceptance model (TAM) or the unified theory of acceptance and use of technology (UTAUT), to understand the factors influencing user acceptance and satisfaction with SIMRS.

6. Impact on Clinical Outcomes: Investigating the direct and indirect effects of SIMRS on clinical outcomes and hospital performance indicators can provide a more complete picture of its effectiveness. This will help demonstrate the tangible benefits of SIMRS beyond user satisfaction.

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Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this paper..

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