

Perceived usability of hospital information system and associated factors: Perspectives from healthcare providers in Hospital Al-Sultan Sbdullah, UiTM

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ABSTRACT

Introduction: The successful integration of Hospital Information Systems (HIS) in Malaysia is crucial for enhancing healthcare delivery, yet usability remains a significant concern among healthcare providers. This study aims to evaluate the perceived usability of the locally developed HIS (UniMEDS) and identify associated organisational and technological factors influencing usability among healthcare providers in Hospital Al-Sultan Abdullah (HASA), Universiti Teknologi MARA (UiTM).

Materials and Methods: A cross-sectional study was conducted from May 2025 to June 2025 at HASA, Puncak Alam. Data were collected using a structured online questionnaire incorporating the System Usability Scale (SUS) and items on organisational and technological factors. Incomplete questionnaires were excluded listwise. Descriptive and inferential analyses were performed using SPSS version 29, with $p < 0.05$ considered statistically significant. A SUS score of ≥ 68 was classified as "good" usability.

Results: The analysis involved a total of 164 respondents. UniMEDS was perceived as having good usability by 74.4% of respondents, with a mean SUS score of 68.02 (SD = 15.91). In multivariable analysis, good usability was significantly associated with perceived adequacy of data storage and privacy (AOR = 2.04; 95% CI: 1.15–3.64) and user-friendliness (AOR = 1.91; 95% CI: 1.15–3.16).

Conclusion: Overall, the UniMEDS at HASA achieved a borderline good usability among healthcare providers. Factors related to data storage, privacy, and user-friendliness were key determinants of perceived usability. Enhancing these aspects through user-centred design and secure system optimisation could improve HIS adoption and satisfaction among healthcare providers in Malaysia.

KEYWORDS:

Hospital Information System, Healthcare Providers, HASA, System Usability Scale, UniMEDS

INTRODUCTION

The successful integration and utilization of information and communication technology (ICT) in healthcare services is

becoming increasingly important in the delivery of healthcare in a developing nation such as Malaysia. The Malaysian government has made substantial investments in initiatives and implemented a variety of innovations to integrate Health Information Systems into the local healthcare infrastructure since the Seventh Malaysian Plan (1996-2000).¹ Almost 85% of public hospitals in Malaysia have had trouble adopting and using HIS, which slows the country's progress toward its Vision 2020. Studies have reported that users often face challenges such as slow system response times, inadequate technical support, and lack of customization to local workflows, which undermine system satisfaction and usage.^{2,3} System accessibility, especially in public hospitals, remains compromised due to inadequate infrastructure, including limited computers and unstable network connections.⁴ These issues are made even worse by the absence of specific laws governing data security and digital health standards.⁵ These systemic factors often cause slow adoption of workarounds that can undermine the integrity of the information system.^{6,7} Further analysis of information system quality in Malaysian hospitals reveals that effective HIS implementations can yield substantial benefits, including reduced operational costs and improved service delivery through enhanced resource management.⁸ These findings collectively argue for the necessity of a holistic strategy that accounts for the multifaceted challenges of system complexity, compatibility, financial support, and the impact of government regulations.⁹

Hospital Information Systems are defined as integrated electronic systems that collect, store, retrieve, and display comprehensive patient data and information, including medical history, laboratory results, diagnoses, and billing, for use across various hospital departments.¹⁰ Usability, in the context of this research, refers to the ability of the user to interact with the hospital information system and perform specific tasks effectively.¹¹ It reflects healthcare providers' perceptions of the system's efficacy in facilitating workflow, improving patient care, and meeting clinical requirements. Understanding the specific factors influencing HIS usability within the Malaysian context is essential to enhance both sustainability and efficiency in hospitals.⁸

Recent Malaysian studies have examined HIS user experience primarily in Ministry of Health hospitals^{3,8} but none have comprehensively assessed usability metrics using validated

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tools such as the System Usability Scale (SUS) within a university hospital context. This gap is significant because teaching hospitals operate under more complex environments, involving concurrent clinical service, education, and research functions, which influence system interaction and adoption. This research aims to fill this gap by evaluating the perceived usability of UniMEDS in Hospital Al-Sultan Abdullah (HASA) and identifying factors influencing its usability. Findings from this study are expected to provide valuable insights for the refinement of HIS usability design and policy formulation for future digital health development in Malaysia.

MATERIALS AND METHODS

Study Design and Setting

This study used a cross-sectional study design to look at how healthcare practitioners thought the Hospital Information System (UniMEDS) worked and what factors affected that. The research took place at Hospital Al-Sultan Abdullah (HASA), Puncak Alam, Selangor, Malaysia. The study lasted from October 2024 to July 2025, and data gathering took place across two months, starting in May 2025.

Study Population and Participants

All registered healthcare workers at Hospital Al-Sultan Abdullah, UiTM using the UniMEDS system were part of the study population. Inclusion criteria include all the active UniMEDS users. Exclusion criteria include users with less than three months of experience with the system. The sample size was calculated using Cochran's formula, based on a total UniMEDS user population (N) of 2074. The calculated sample size was approximately 220. To account for a 20% non-response rate, an additional 55 participants were added, resulting in a final target sample size of 275 UniMEDS users. A stratified sampling method was used to ensure representation across various occupational roles within the hospital. Participants were stratified using the International Standard Classification of Occupations (ISCO).¹² From the total of 275 questionnaires distributed, 164 participants' responses (59.6%) were collected and analysed.

Data Collection Method

Data were collected using a self-administered questionnaire distributed via Google Forms. The questionnaire was provided in both Bahasa Malaysia and English to meet the preferences of the healthcare practitioners. Initially, the self-administered questionnaire was distributed to participants via email through Google Forms. After the initial distribution, reminders were sent via WhatsApp messages twice, at weekly interval, to encourage participation and facilitate follow-up with healthcare providers. The objective of this dual-channel strategy was to optimise engagement and reach among the target demographic. The questionnaire included sections on:

Background Information/Demography: Gender, age, education level, job role, working experience, experience in the healthcare sector, perceived experience using computer applications, experience with UniMEDS, frequency of UniMEDS use, and formal training received.

Organizational Factors: Assessed perceptions related to 4 items which are sufficient hardware, reliable internet connection, technical support, and data storage and privacy. These items were measured using a five-point Likert scale (1=Strongly disagree, 5=Strongly agree).

Technology Factors: Evaluated perceptions on 6 items including UniMEDS user-friendliness, ease of finding information, clarity of interface, accessibility, impact of version updates, and the system improvement request process. These items were also measured using a five-point Likert scale. Associated factors affecting usability of UniMEDS were examined using HOT-Fit framework¹³ translated to Malay language and validated by Ahmad Shanniza et al. The framework categorizes evaluation factors and domains that fit and correspond to specific dimensions within the human (H), organisational (O), and technology (T) domains of HIS implementation success and the respective sub-domains (H: system development and system use; O: organisational structure; T: system quality, information quality, and service quality). The internal consistency by Cronbach's alpha (α) for each domain was 0.84 for technology, and 0.96 for organisational structure.³

System Usability Scale (SUS): This validated questionnaire comprised ten items to assess the overall perceived usability of UniMEDS.¹⁴ The SUS scores were calculated by converting responses for odd-numbered items (positive statements) to the scale position minus 1, and for even-numbered items (negative statements) to 5 minus the scale position. The sum of all item scores was then multiplied by 2.5 to yield a total score ranging from 0 to 100. A system or product with a score of ≥ 68 was considered to have good usability. The translated version of SUS into Malay language is called Skala Kebolegunaan Aplikasi Mudah Alih (SKAMA).¹⁵ The Cronbach alpha for the SKAMA questionnaire was determined to be 0.85 (95% CI 0.79-0.91) which is similar to the original English SUS questionnaire. Both authors have granted permission to use these questionnaires.

All responses were automatically recorded in Google Forms and exported to SPSS version 29 for analysis. Incomplete or partially answered questionnaires were excluded listwise, indicating that only fully completed responses were considered in the analysis. Specifically, questionnaires missing any of the ten SUS items, key demographic information, or main organisational and technological variables were excluded. The total number of responses received, exclusions due to incomplete data, and final sample retained are summarised in Figure 1 (Study Flowchart)

Data Analysis

Descriptive and inferential statistics were performed using the Statistical Package for the Social Sciences (SPSS) software version 29.0 (IBM SPSS Inc.). For the first objective, data was analysed using the System Usability Scale where a total score of ≥ 68 will indicate good usability. For the second objective, descriptive analysis of the associated factors will be presented using cross-tabulation (n, %). Factors measured using a 1–5 Likert scale are treated as continuous and reported using mean and SD (Median if data is not normally distributed). Analysis of technology and organization domains using Likert scoring was assessed for normality using the

Table I: Sociodemographic Factors of Healthcare Providers Using UniMEDS (n=164)

Sociodemographic factors	Total
Gender	
Male	52 (31.7)
Female	112 (68.3)
Age	
20-29 years old	29 (17.7)
30-39 years old	106 (64.6)
> 40 years old	29 (17.7)
Educational level	
Diploma	30 (18.3)
Degree	101 (61.6)
PhD/Specialist	33 (20.1)
Job Role	
ISCO Group 2	130 (79.3)
ISCO Group 3	18 (11.0)
ISCO others	16 (9.8)
Working experience	
≤10 years	139 (84.8)
>10 years	25 (15.2)
Working experience in healthcare sector	
<5 years	30 (18.3)
6-10 years	72 (43.9)
11-15 years	44 (26.8)
16-20 years	10 (6.1)
21-25 years	8 (4.9)
Perceived experience using computer application	
Low to moderate	101 (61.6)
High	63 (38.4)
Experience with UniMEDS	
< 1 year	78 (47.6)
1 - 3 years	64 (39.0)
>3 years	22 (13.4)
Frequency of using UniMEDS	
Occasionally	47 (28.7)
Daily	117 (71.3)
Have you undergone formal training on UniMEDS	
No	28 (17.1)
Yes	136 (82.9)

Table II: Comparison of Median Scores for UniMEDS Usability with factors associated with the usability (n=164)

Associated Factors	Usability of UniMEDS		U	p-value
	Poor	Good		
Sufficient Hardware	64.49	88.70	1805.5	0.002*
Reliable connection	66.13	88.14	1874.5	0.006*
Technical	69.21	87.07	2004.0	0.023*
Data storage and privacy	61.30	89.80	1671.5	< 0.001*
User-friendly	55.92	91.65	1445.5	< 0.001*
Sufficient Information	64.15	88.82	1791.5	0.002*
Clean Interface	60.08	90.22	1620.5	< 0.001*
Accessibility	67.04	87.82	1912.5	0.012*
Version update	60.05	90.23	1619.0	< 0.001*
Improvement request (change request)	62.06	89.54	1703.5	< 0.001*

Statistical test used: Man Whitney U. Statistically significant at $p < 0.05$

Table III: Univariate Analysis for Factors Associated with Usability of UniMEDS

Variable	Category	B(S.E)	Wald (df)	OR (95% CI)
Gender	Male	Reference		
	Female	0.100 (0.381)	0.07 (1)	1.11 (0.52,2.33)
Age	20-29 years old	Reference		
	30-39 years old	-0.32 (0.51)	0.39 (1)	0.73 (0.27,1.97)
	40-49 years old	-0.19 (0.66)	0.09 (1)	0.83 (0.23,2.99)
	50-59 years old	-1.34 (1.10)	1.49 (1)	0.26 (0.03,2.25)*
Education level	Diploma	Reference		
	Degree	0.62 (0.47)	1.69 (1)	1.85 (0.73,4.67)*
	Master/PhD	-0.54 (0.53)	1.04 (1)	0.58 (0.21,1.65)
Job Role (ISCO)	ISCO Other	Reference		
	ISCO 2	0.69 (0.56)	1.56 (1)	2.0 (0.67,5.96)*
	ISCO 3	0.18 (0.72)	0.06 (1)	1.2 (0.29,4.91)
Working experience	less than 1 year	Reference		
	1 - 10 years	-0.46 (0.67)	0.48 (1)	0.63 (0.17,2.34)
	more than 10 years	-0.79 (0.77)	1.05 (1)	0.46 (0.10,2.05)
Experience in healthcare	< 5 years	Reference		
	6-10 years	0.163 (0.50)	0.11 (1)	1.18 (0.44,3.12)
	11-15 years	0.09 (0.54)	0.03 (1)	1.09 (0.38, 3.14)
	16-20 years	-0.16 (0.80)	0.04 (1)	0.85 (0.175, 4.10)
	>20 years	-0.50 (0.41)	0.36 (1)	0.61 (0.12, 3.13)
Experience using computer	Low and Moderate	Reference		
	High	0.12 (0.37)	0.10 (1)	1.12 (0.54,2.30)
Experience using UniMEDS	3 months - 1 year	Reference		
	1 year - 3 years	0.31 (0.39)	0.65 (1)	1.37 (0.64,2.90)
	more than 3 years	0.63 (0.60)	1.09 (1)	1.89 (0.57, 6.17)
Frequency using unimedS	Rarely	Reference		
	Monthly	-0.65 (1.28)	0.26 (1)	0.52 (0.04,6.36)
	Weekly	0.65 (0.79)	0.68 (1)	0.52 (0.11,2.46)
	Daily	0.82 (0.54)	1.98 (1)	0.44 (0.14,1.38)*
attended training	No	Reference		
	Yes	0.17 (0.21)	32.46 (1)	1.12 (0.38,3.25)
Organization	domain	0.46 (0.39)	1.36 (1)	1.58 (0.73,3.34)*
	sufficient hardware	0.68 (0.21)	9.94 (1)	1.94 (1.29,2.95)*
	reliable connection	0.65 (0.22)	8.9 (1)	1.91 (1.25,2.94)*
	technical support	0.53 (0.23)	5.24 (1)	1.70 (1.08,2.68)*
	data storage privacy	0.94 (0.25)	13.9 (1)	2.57 (1.56,4.21)*
Technology	domain	1.01 (0.38)	7.1 (1)	2.75 (1.31,5.76)*
	User-friendly	0.95 (0.23)	18.1 (1)	2.60 (1.67,4.03)*
	Sufficient Information	0.71 (0.23)	9.51 (1)	2.03 (1.30,3.19)*
	Clean Interface	0.89 (0.23)	14.58 (1)	2.43 (1.54,3.82)*
	Accessibility	0.36 (0.15)	5.78 (1)	1.43 (1.07,1.92)*
	Version update	0.82 (0.23)	13.13 (1)	2.27 (1.46,3.55)*
	Improvement request (change request)	0.79 (0.23)	11.33 (1)	2.19 (1.38,3.47)*

*Statistical test: Simple Logistic Regression. Statistically significant at $\alpha = 0.25$

Table IV: Multiple Logistic Regression of Factors Associated with UniMEDS Usability

Variable	B	SE	Wald (df)	p-value	aOR	95% CI
Education Level			6.089 (2)	0.048		
Diploma (ref)	-	-	-	-	-	-
Degree	0.871	0.513	2.890 (1)	0.089	2.39	0.88 – 6.53
Master/PhD	-0.238	0.589	0.163 (1)	0.686	0.79	0.25 – 2.50
Data Storage & Privacy	0.715	0.294	5.930 (1)	0.015	2.04	1.15 – 3.64
User Friendly	0.645	0.258	6.222 (1)	0.013	1.91	1.15 – 3.16
Constant	-4.648	1.276	13.270 (1)	<0.001	0.01	-

AOR: adjusted Odds Ratio, CI: Confidence Interval. The Cox & Snell R2 value is 0.175, indicating the proportion of variance explained by the model. The Hosmer and Lemeshow test yield a value of 0.216, suggesting good model fit. Area Under the Curve (AUC) is 73.9% (95% CI: 64.6-83.2). Test employed: Multiple Logistic Regression Analysis (Backward LR Method) Constant value: -4.648 and the model assumption is met. There is no interaction and multicollinearity.

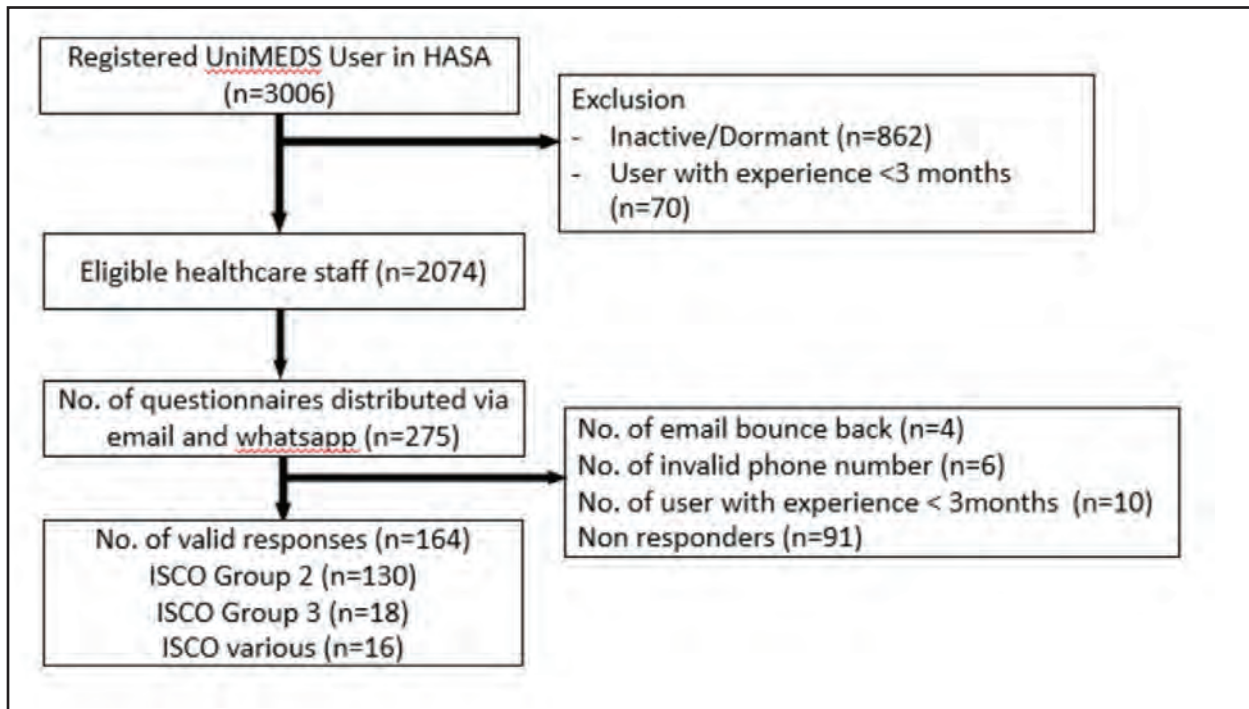


Fig. 1: Flowchart for questionnaire distribution and participant responses

Kolmogorov-Smirnov test. As the assumption of normality was not fulfilled, non-parametric tests were employed. The Mann-Whitney U test was used to compare the median domain scores between participants who reported poor and good usability of UniMEDS. Univariate analysis was conducted using simple logistic regression, followed by multiple logistic regression for multivariable analysis to identify independent predictors of the outcome.

Ethical Consideration

The National Medical Research Register (NMRR), Ministry of Health Malaysia approved this study with ID: NMRR ID-25-00474-7NH. This study has also been approved by the Faculty Ethics Review Committee, Faculty of Medicine, MARA University of Technology (UiTM) with reference number: 100 - FPR (PT.9/19) (FERC-1-25-04). Finally, an approval letter to conduct research was issued by PJI Hospital Al Sultan Abdullah (HASA) with reference number 500-HUiTM (PJI. 18/4/35).

RESULTS

The usability of UniMEDS is identified using SUS questionnaire with a score of 68 and more is considered good usability. The distribution of SUS scores is shown in Figure 2. The scores were normally distributed, with a mean of 68.02 (SD = 15.91).

From the total of 164 respondents, 122 (74.4%) reported good usability and the remaining 42 respondents (25.6%) reported poor usability. The mean (SD) for SUS score was 68.02 (15.91). As shown in Table I, the majority of the respondents are female (68.3%), aged between 30–39 years (64.6%), and holding a degree (61.6%). Most respondents belonged to ISCO

Group 2 (79.3%) which comprises mostly by doctors, nurses, and pharmacists. Most of the respondents had less than 10 years of working experience (84.8%). About 47.6% had been using UniMEDS for less 1 year, and 71.3% reported daily usage. Most participants (82.9%) had undergone formal training on UniMEDS.

When respondents were categorised by usability outcome (poor vs. good usability), several differences emerged. As shown in Table II, respondents in the good usability group reported significantly higher median scores across all assessed factors, including sufficient hardware (median 88.70 vs. 64.49, $p=0.002$), user-friendliness (91.65 vs. 55.92, $p<0.001$), and system reliability (88.13 vs. 63.86, $p<0.001$). Similar trends were observed for clean interface, accessibility, and sufficiency of information, with all comparisons reaching statistical significance (Mann-Whitney U test, $p<0.05$).

On the other hand, usability results did not significantly correlate with sociodemographic traits as gender, age, or educational attainment. Similarly, there was no significant difference in training or years of UniMEDS experience between the poor and high usability groups ($p>0.05$) in the univariate logistic regression (Table III) It indicates that system design elements rather than user background traits were the main drivers of perceived usability. The multivariable logistic regression model included independent variables with p -values under 0.25. Given that some factors may become significant after controlling for confounders, this criteria was put in place to avoid the early exclusion of potentially important variables. According to Hosmer and Lemeshow,¹⁶ using a broad cutoff during this stage can improve the robustness of multivariable model building.

In the multivariable logistic regression model (Table IV), data storage and privacy (AOR=2.04, 95% CI: 1.15–3.64) and user-friendly interface (AOR=1.91, 95% CI: 1.15–3.16) remained significantly associated with good usability of UniMEDS, after controlling for education level. Although education level showed an overall effect ($p = 0.048$), none of its categories reached statistical significance.

DISCUSSION

This study aimed to assess the perceived usability of UniMEDS from the perspective of healthcare providers and to identify factors associated with its usability. System Usability Scale (SUS) developed by John Brooke (1996) remains one of the most widely used and validated tools for assessing perceived usability across various technologies and user populations.^{17,18} The Scale was then translated into the Malaysian language with the title Skala Kebolegunaan Aplikasi Mudah Alih (SKAMA). The average SUS score of 68.02 for UniMEDS indicates that the system satisfies the established criteria for good usability, defined as a score of 68 or higher.¹⁹ This conclusion is supported by a meta-analysis of digital health applications, which determined that a mean System Usability Scale (SUS) score of 68 is suitable for assessing the usability of digital health apps. The research indicated that certain applications, particularly those associated with physical activity, exhibited markedly elevated mean scores (83.28); however, when excluding these outliers, the average SUS score for the broader category of digital health applications was 68.05. This context is significant as it verifies that the UniMEDS score aligns with the established norm for numerous digital health technologies, and attaining a score of 68 is a legitimate indicator of good usability. Nonetheless, as indicated by the reviewer, this score is marginal. While most users find UniMEDS functional, a notable proportion experience difficulties or dissatisfaction during use. This borderline usability suggests a risk of mixed satisfaction levels among users, which can hinder consistent system adoption and long-term engagement. However, significant opportunities for enhancement exist to improve user satisfaction and efficiency, especially in contrast to systems that attain "excellent" ratings, exemplified by the 83.6 score documented in a separate research.²⁰

The findings of this study provide clear, actionable insights for the redesign and iterative improvement of the UniMEDS. The statistically significant association of data storage & privacy (AOR=2.04, 95% CI: 1.15-3.64) and user-friendly interface (AOR=1.91, 95% CI: 1.15-3.16) with good usability suggests that these should be the primary focus of any system enhancement efforts. Users who perceive higher levels of data storage security and privacy are more than twice as likely to report good usability of UniMEDS. Healthcare workers are more inclined to trust and use systems that protect the confidentiality, integrity, and availability of patient information. Inadequate security not only creates legal and ethical concerns, but also reduces user confidence, which may compromise system utilization and care quality. Previous study²¹ has also shown that data security has a direct impact on user satisfaction and the overall success of HIS acceptance. As a result, strengthening data security features

such as secure login procedures, data encryption, and audit trail can boost system usability and user trust.²²

Similarly, a user-friendly design is very consistent with recognized principles of Human-Computer Interaction (HCI) and usability engineering.²³ Non-intuitive interfaces, user-unfriendly designs, and inefficient performance factors will negatively impact the overall user experience.²⁴ Furthermore, a straightforward interface reduces cognitive burden and learning effort, allowing healthcare workers to execute activities more rapidly and focus on patient care rather than system complexities.

Even though many people (82.9%) had undergone formal training on UniMEDS, our results reveal that neither training nor experience with the system were statistically significant determinants of good usability. This indicates that the mere presence of training may be insufficient to affect perceived usability. Several possible explanations can be considered. First, training quality and relevance play an important role; if training sessions focus mainly on technical navigation rather than real-world clinical workflows, their impact on perceived usability may be limited. Second, usability problems rooted in interface design or system architecture cannot be fully mitigated through user training. Even experienced users may remain frustrated if the interface requires excessive steps or lacks intuitive navigation.¹

Similarly, a user's extensive experience with a system that has fundamental flaws will not necessarily lead to a positive perception of its usability. The findings suggest that "user-friendliness" and "data storage & privacy" are more significant determinants of user impression than demographic factors such as training and experience. This aligns with other research emphasising the superior significance of user attitude and knowledge compared to demographic parameters for optimal system use.¹¹

In conclusion, this research provides critical insights into the usability of UniMEDS from the viewpoint of healthcare providers. Although the overall usability was deemed marginally acceptable, there were substantial correlations between system design and reliability, rather than user characteristics or training. These results underscore the necessity of iterative, user-centred redesign to enhance system acceptability and ensure alignment with clinical workflows. This study emphasises the potential for UniMEDS to progress towards global usability standards while simultaneously addressing the distinctive challenges of healthcare delivery in Malaysia by situating the results within both local and international contexts.

The interpretation and generalisability of the research findings are influenced by several constraints. The cross-sectional design utilising self-reported data through an online Google Form just presents a snapshot of the current situation. This strategy facilitated participation for many individuals; nevertheless, it also introduces the potential for self-report and recall bias, particularly if respondents provided socially desirable answers or if non-respondents differed systematically from those who participated. Secondly, while System Usability Scale (SUS) ratings serve as

a widely utilised quantitative measure of perceived usability, they include inherent limitations. They provide a superficial, subjective summary instead of a thorough analysis of specific usability issues, failing to explain the reasons behind users' sentiments or propose viable solutions. Further qualitative research is necessary to obtain a comprehensive understanding of the factors influencing high or low SUS scores. Thirdly, the number of respondents directly influences the precision and statistical power of the results, thereby limiting the sample's representativeness and, thus, the generalisability of the findings. Finally, the study was conducted in a single teaching hospital, which limits the generalizability of the findings to other healthcare institutions in Malaysia. Hospitals vary considerably in their HIS design, implementation strategy, and user population. Therefore, caution should be exercised when extrapolating these results to other settings, especially non-teaching or private hospitals.

CONCLUSION

In conclusion, this study's evaluation of the UniMEDS system provides critical insights that extend beyond Hospital Al-Sultan Abdullah to the broader landscape of national Hospital Information System (HIS) deployment in Malaysia. Data storage and privacy, as well as an easy-to-use interface, play statistically important parts that draw attention to key areas that need strategic focus. In Malaysia, which has had trouble adopting and using these kinds of systems in the past, these things should be at the heart of any future HIS projects that are planned and carried out.

Beyond the local context of UniMEDS, the findings of this study hold broader implications for Malaysia's national digital health strategy. The country's ongoing transformation towards a fully digital healthcare ecosystem depends on the development of Hospital Information Systems (HIS) that are reliable, secure, and adaptable to diverse clinical settings. To achieve this, policymakers and system developers should prioritise strengthening data governance and security frameworks, integrating user-centred design principles during system development, and establishing national usability evaluation standards to guide HIS deployment and benchmarking across healthcare institutions.

Investing in these strategic areas would not only improve the usability and acceptance of HIS among healthcare providers but also promote long-term sustainability of digital health initiatives nationwide. Such efforts will ensure that HIS platforms are aligned with clinical workflows, enhance patient safety, and support data-driven decision-making within Malaysia's healthcare system. Future multi-centre and comparative studies are recommended to validate these findings and further inform the development of Malaysia's evolving digital health policy.

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