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Online Registration Application Quality and User Satisfaction: A WebQual 4.0 and EUCS-Based Study at a Private Hospital in Indonesia

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ABSTRACT

Introduction: The digitalization of hospital services increasingly requires high-quality online registration applications to enhance efficiency and user experience. Ineffective registration processes characterized by long queues, delays, and occasional system bottlenecks remain a major barrier to service efficiency and patient satisfaction in many hospitals. Online registration applications are expected to address these issues, yet limited studies have specifically examined how the quality of such applications influences user satisfaction, particularly in private hospitals in developing regions. This study examines how application quality, measured using the WebQual 4.0 dimensions, influences user satisfaction based on the End-User Computing Satisfaction (EUCS) model. This integration allows a more comprehensive understanding of how system usability, information attributes, and service interaction collectively shape user perceptions in digital health settings.

Methods: A quantitative cross-sectional design was employed using validated instruments adapted from the WebQual 4.0 and End-User Computing Satisfaction (EUCS) models. Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). To strengthen analytical depth and support theoretical interpretation, qualitative insights obtained from open-ended responses were incorporated to triangulate and enrich the quantitative findings.

Results: The Study found that application quality significantly influenced user satisfaction ($p < 0.001$). All WebQual 4.0 dimensions, Usability, information quality, and service interaction showed positive and substantial contributions to the model. These findings align with core assumptions of the EUCS model, which posits that user satisfaction emerges from perceptions of system usefulness, information relevance, and overall performance quality. Qualitative responses supported the quantitative findings, indicating that users generally perceived the application as easy to use and informative. However, some noted occasional technical issues and suggested improvement to enhance system performance.

Conclusion: Usability, information quality, and service interaction play critical roles in shaping user satisfaction with online hospital registration applications. The findings underscore the theoretical relevance of integrating WebQual 4.0 and EUCS, demonstrating that multidimensional system quality is essential for optimizing patient experience in digital hospital services. These results highlight the need for continuous system refinement to improve usability and service responsiveness, ultimately strengthening digital transformation efforts and enhancing patient-centered service delivery in hospital settings.

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INTRODUCTION

The advancement of information and communication technology has significantly influenced healthcare services (1). Inadequate technology can lead to a decline in service quality (2). In Indonesia, the rapid growth of information technology is reflected in the increasing number of internet users (3). Which has enhanced healthcare delivery through more effective and efficient digital solutions (4). According to the 2024 survey conducted by the Indonesian Internet Service Providers Association (APJII), internet users in Indonesia reached 79.5%, showing a positive growth trend over the past five years, with 93.9% of mobile internet users accessing the internet daily (5). This development presents a strong opportunity for hospitals to implement digital services, particularly an online registration system (6).

Previous studies have shown that ease of use and a positive user experience are critical factors determining the success of digital health services, including online registration systems in hospitals (7). International studies have shown that *usability*, *information quality*, and *service interaction* are key dimensions that shape user satisfaction in digital health systems. The WebQual 4.0 framework emphasizes usability—defined as the ease with which users can operate an application—as a critical determinant of user satisfaction. This aligns with the findings of Kitsios et al. (2023), who highlight that digital service designs prioritizing ease of use, efficiency, and clarity of information significantly enhance the user experience and promote sustained utilization of digital services in the healthcare sector (8).

Information quality is also a crucial dimension in system evaluation. Accurate, relevant, and easily understandable information can enhance users' trust in an application. In their evaluation of a hospital registration portal, Ouajdouni et al. (2024) found that users' perception of information quality was significantly associated with patient satisfaction, particularly in a web-based medical scheduling system (9). A similar finding was reported by Radwan et al. (2024), who stated that information clarity and system reliability are key indicators of the success of online registration systems in healthcare services (10).In the post-pandemic era, online registration system offers multiple advantages for patients, such as reduced waiting times, minimized crowding, improved service quality, and greater satisfaction (11). By enabling patients to register remotely via smartphones or computers, hospitals can streamline administrative processes and enhance overall service efficiency (12). Shorter waiting times also strengthen patient satisfaction and loyalty (13). However, in practice, many systems still face issues such as technical errors, limited access, and slow responses, indicating that their potential benefits have not been fully realized (14).

Long queues and inefficient registration processes remain key factors reducing hospital service quality. Excessive waiting times not only delay care and strain resources but also diminish patient satisfaction (15). Conversely, digital queuing systems can reduce congestion and cross-infection risks, offering a more comfortable experience (16). Previous evidence indicates that the more satisfied users are with a digital system, the more likely they are to continue using it, making user satisfaction an essential foundation for sustaining long term system adoption (17).

Despite the digital transformation of healthcare, many hospitals still struggle with system quality and user satisfaction. Technical problems, poor usability, and weak responsiveness are common barriers (18). Previous research has often examined general system quality without confirming consistent links between application quality and user satisfaction, and most studies have focused on large urban hospitals rather than regional or faith-based institutions (19). Additionally, research has concentrated more on telemedicine, electronic medical records, or general health apps (20). With fewer studies examining online registration systems despite their role as patients' first point of contact (21).

Recent empirical studies underscore the relevance and critical role of online patient portals and web-based scheduling systems in modern healthcare delivery. For instance, a large-scale cross-sectional survey of a national patient portal in Europe reported high usability ratings (mean SUS = 74.3) and a strong association between patient experiences and perceived usability, highlighting that clear navigation, comprehensive information, and overall user experience significantly influence patient satisfaction (22). Online appointment systems in private and university hospitals have been shown to reduce no-show rates and improve outpatient efficiency, demonstrating broader benefits beyond convenience (23). Evaluations using UX tools such as UEQ also show positive user responses with room for improvement in engagement and novelty features (24). Moreover, recent studies confirm that system quality—including accuracy, timeliness, and ease of use—strongly predicts user satisfaction in outpatient settings (25).

However despite these developments, the literature still lacks comprehensive studies — especially in developing country contexts — that integrate both system-level quality frameworks (e.g., WebQual 4.0 / EUCS) and user-experience or behavioral models to evaluate online registration system. This presents a critical conceptual gap because fragmented approaches may fail to capture how technical attributes and user perceptions interact to shape satisfaction. The WebQual 4.0 framework (Barnes & Vidgen, 2002) provides a comprehensive model for evaluating website quality from the user perspective, comprising three main dimensions: usability, information quality, and service interaction quality (26). Meanwhile, the End-User Computing Satisfaction (EUCS) model proposed (27).

Integrating these frameworks enables the simultaneous assessment of interface design, service responsiveness, and system output quality, offering a more holistic explanation of how multiple dimensions collectively influence satisfaction. Poor application quality has been shown to reduce user satisfaction (28). However, many studies assess only one dimension, for example Abdullah (2018), examined system quality alone resulting in limited understanding (29). This study addresses this gap by analyzing the integrated dimensions of system quality, information quality, and service interaction. Furthermore, most prior research has been conducted in developed countries; thus, Indonesia's context—with varied digital literacy, infrastructural limitations, and cultural influences—requires further exploration (30). Unlike Pratama (2024), who relied solely on closed-ended responses, this study includes open-ended questions to capture deeper user insights (31).

This study contributes theoretically by integrating WebQual 4.0 and EUCS to evaluate online registration system quality in a private hospital setting—an approach rarely explored in Indonesian health service research. By demonstrating how usability, information quality, service interaction, content, accuracy, format, and timeliness jointly influence satisfaction, this study enhances the theoretical clarity of how multidimensional system quality shapes users' perceptions in digital hospital registration services.

Based on this background, this study aims to analyze the influence of online registration application quality on user satisfaction in a private hospital. The findings are expected to contribute to the development of digital-based hospital management and the improvement of hospital service quality.

METHODS

Research Design and Setting

This study employed a quantitative research approach with a cross-sectional design to analyze the effect of online registration application quality on user satisfaction. The study was conducted at Sarkies 'Aisyiyah Hospital Kudus**,** involving patients who used the hospital's online registration application. Sarkies 'Aisyiyah Hospital Kudus is a private, faith-based hospital owned by one of the largest Muslim organizations in Indonesia, Muhammadiyah. The hospital, classified as a Class C facility, serves patients from diverse social and economic backgrounds. This context provides a relevant setting for examining how online registration application quality influences user satisfaction in accessing hospital registration services. The selection of this site also strengthens contextual relevance, as private and faith-based hospitals are underrepresented in existing digital health system evaluations.

Population and Sample

The study population consisted of outpatients who used the online registration application at Sarkies 'Aisyiyah Hospital, Kudus. To ensure alignment with methodological alignment for PLS-SEM requirements, sample adequacy was determined using the 10-times rule and supported by power analysis recommendations. Based on the model structure, which includes three predictor constructs leading to one endogenous construct the minimum required sample was 30 participants. Thus, the final sample size of 65 respondents exceeded the threshold and provided sufficient statistical power for the hypothesized model. Population data were collected from November 2024 to January 2025, showing an average of 77 users per month**.** The application is relatively new and operates alongside other registration modes, such as BPJS online and manual registration. Consequently, the number of online registration users remains limited, indicating the need for further evaluation to support its future development. This sampling context reflects real-world utilization patterns and enhances ecological validity, as users were drawn directly from routine service flows.

Consecutive sampling was applied by inviting all eligible outpatients who used the online registration application during the study period. Every user who met the inclusion criteria was approached consecutively after

completing the registration process and was provided with a secure Google Form link. Of the total 77 users recorded across November 2024 to January 2025, 65 agreed to participate and completed the questionnaire, resulting in a response rate of 84.4%. No eligible users were skipped during recruitment, ensuring sequential enrollment. Potential selection bias—such as users who were in a hurry or unfamiliar with digital tools—was minimized by offering assistance during questionnaire completion when needed. This procedure strengthens transparency and aligns with reporting standards for observational studies by clearly outlining recruitment flow and bias mitigation strategies.

The inclusion criteria for this study were as follows: participants were required to be at least 18 years old, be active users of the online registration application, and either patients themselves or family members directly involved in using the application. In addition, respondents needed to have internet access and express willingness to participate by completing the questionnaire in full. The exclusion criterion was patients who were unable to communicate due to health-related conditions.

Research Instrument

The questionnaire items were directly adopted from the validated WebQual 4.0 and EUCS instruments without modification. Because the original constructs and wording were retained, full translation and cultural adaptation procedures were not required. Nevertheless, an internal review was conducted by the research team to ensure linguistic clarity and contextual suitability for Indonesian hospital users. Using an unmodified validated instrument also supports content validity and comparability with previous studies employing the same frameworks.

Since the instrument was used without modification, its psychometric properties needed to be confirmed in this study. Therefore, the validity and reliability of the questionnaire were re-evaluated in this study using indicators such as outer loading, average variance extracted (AVE), composite reliability, Cronbach's alpha, and discriminant validity (HTMT).

The questionnaire consisted of three dimensions of application quality based on the WebQual 4.0 framework, namely usability, information quality, and service interaction. Meanwhile, the user satisfaction variable was measured using the End-User Computing Satisfaction (EUCS) instrument, which includes five dimensions: content, accuracy, format, ease of use, and timeliness (32).

A five-point Likert scale was used, ranging from *strongly disagree (1)* to *strongly agree (5)* (33). Additionally, the questionnaire included open-ended questions designed to strengthen and complement the responses obtained from the closed-ended items. The inclusion of open-ended items provides qualitative depth, enabling triangulation with quantitative findings and enhancing interpretive validity.

Data Collection Procedure

Data were collected through an online questionnaire distributed via Google Forms. The questionnaire was shared with respondents who met the inclusion criteria and were users of the hospital's online registration application. Before completing the questionnaire, respondents were required to provide their informed consent through an introductory page on the Google Form. This page contained patient identification, an explanation of the study, instructions for completion, and a consent statement. Respondents were asked to answer 29 closed-ended questions and three open-ended questions aimed at exploring their impressions, challenges, and suggestions for improving the application. The online administration ensured standardized delivery of items and reduced interviewer bias during data collection.

Data Analysis

Data collected from the Google Form were analyzed using SmartPLS software. The analytical process included importing the dataset, constructing models for the dependent and independent variables, and conducting several stages of statistical analysis (34):

Descriptive Statistics

This stage analyzed the demographic characteristics of respondents (age, gender, education, occupation, and frequency of using the online registration application) and the distribution of responses for each research indicator.

SmartPLS Analysis

PLS-SEM analysis (SmartPLS version 4) included assessment of outer loadings, construct reliability, convergent validity (AVE), discriminant validity, and evaluation of the inner model. This analytical framework is appropriate for exploratory models and complex constructs, particularly when sample sizes are moderate.

Open-ended Question Analysis

Responses to open-ended questions were manually coded and categorized to identify themes reflecting user barriers and expectations. These qualitative findings complemented the quantitative analysis and provided deeper insights for application improvement. Manual coding ensured contextual sensitivity in interpreting participants' narratives.

Ethical Considerations

This study was approved by the Health Research Ethics Committee of Universitas Muhammadiyah Yogyakarta under approval number 089/EC-KEPKFKIKUMY/III/2025. All respondents provided informed consent before completing the online questionnaire. Participant confidentiality was strictly maintained throughout the research process. No personal identifiers were stored, ensuring compliance with data protection standards for minimal-risk digital survey research.

RESULTS

This study involved 65 respondents who used the online registration application at Sarkies Aisyiyah Hospital, Kudus. The characteristics of the respondents were analyzed based on gender, age, education, occupation, and frequency of using the application.

Table 1. Respondent Characteristics (N=65)

Characteristics	N	%
Gender		
Man	14	22%
Women	51	78%
Age		
<30 Years	38	58%
31-40 Years	20	31%
41-50 Years	6	9%
>50 Years	1	2%
Education		
Elementary School	0	0%
Junior High School	2	3%
Senior High School	26	40%
College	37	57%
Work		
Housewife	3	5%
Civil Servants	2	3%
Private	54	83%
Health Workers	6	9%
Number of uses of the application		
1-2x	43	66%
3-5x	15	23%
>5x	7	11%

Source: Primary Data

Based on Table 1, the characteristics of respondents show that users of the online registration application were predominantly female (78%), with the majority aged below 30 years (58%). This indicates that the application users were mostly from the younger age group. In terms of education level, the largest proportion of respondents were university graduates (57%), suggesting that most users had higher education backgrounds. Regarding occupation, the majority worked in the private sector (83%). In terms of frequency of use, most respondents had used the application 1–2 times (66%), indicating that the users were relatively new to utilizing the system. These demographic patterns suggest that early adoption of the online registration system is more common among young, well-educated individuals with greater digital literacy, which aligns with global trends in digital health utilization.

Overall, the findings suggest that the online registration application users were predominantly young, well-educated women working in the private sector, and were relatively new users of the application.

Table 2. Descriptive statistics (Mean scores per item)

Mark	Mean Total	Number of Items	Average Mean Score
X1 Usability Dimensions	15.63	4	3.91
X2 Information Quality Dimensions	26.63	7	3.8
X3 Service Interaction Dimensions	18.75	5	3.75
Y Dimensions of User Satisfaction	52.76	14	3.77

Source: Processed using SmartPLS 2024

Table 2 presents the descriptive analysis results of the research variables, which show mean values approaching 4. The usability dimension (X1) obtained the highest mean score per item of 3.91 (total mean = 15.63; 4 items), while the service interaction dimension (X3) recorded the lowest mean score per item of 3.75, and the user satisfaction variable (Y) had a mean score of 3.77. These descriptive results indicate a generally favorable perception of the online registration application, although dimensions with lower scores, such as service interaction, highlight areas requiring enhancement.

The outer model test was conducted to examine the validity and reliability of the measurement model. The analysis included factor loadings, Average Variance Extracted (AVE), Discriminant Validity, and Composite Reliability. An indicator is considered to meet convergent validity if it has an outer loading value ≥ 0.70 and an AVE value ≥ 0.50 (35).

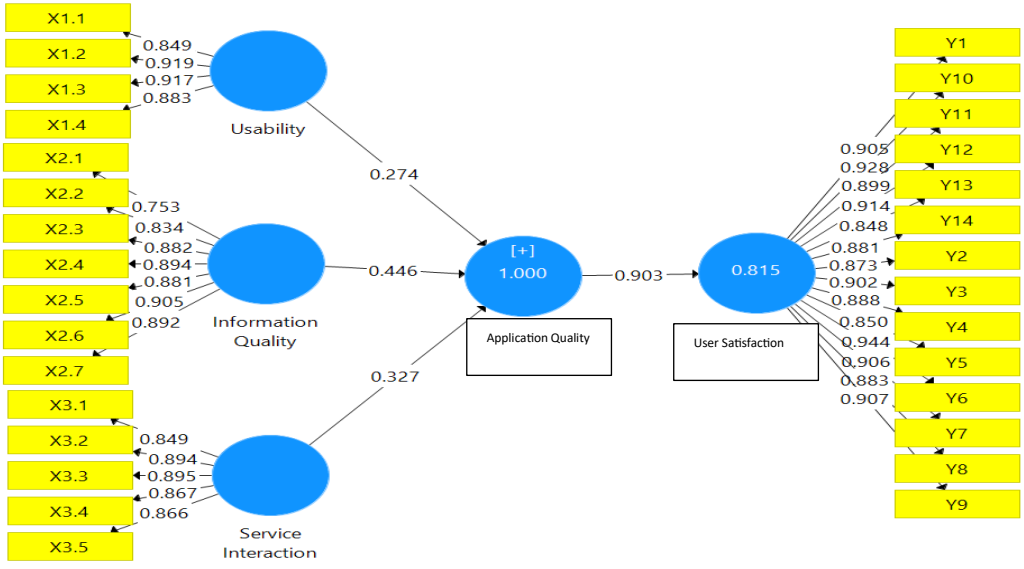

Figure 1. Outer Loading Result (SmartPLS)
Source: Processed using SmartPLS 2024
Note: X1 = Usability, X2 = Information Quality, X3 = Service Interaction, Y = User Satisfaction

Based on Figure 1, the results of the Outer Loading (Validity Test) indicate that almost all indicators have values greater than 0.70, ranging from 0.753 to 0.919 for the application quality indicators (X) and from 0.848 to 0.944 for the user satisfaction indicators (Y). One indicator, X2.1, had a loading value of 0.753, which is at the lower threshold but still above the acceptable limit of 0.70. These results demonstrate that all questionnaire indicators meet the criteria for convergent validity and can be further used in the subsequent analysis.

Table 3. Reliability: Cronbach's Alpha, Composite Reliability, AVE

	Cronbach 's Alpha	**Rho_A**	***Composite Reliability***	***Average Variance Extracted (AVE)***	**Reliability**	**Validity**
Usability	0.915	0.916	0.940	0.797	Reliable	Valid
Information Quality	0.943	0.945	0.954	0.747	Reliable	Valid
Service Interaction	0.923	0.924	0.942	0.764	Reliable	Valid
Application Quality	0.971	0,972	0.974	0.764	Reliable	Valid
User Satisfaction	0.981	0.981	0.983	0.801	Reliable	Valid

Source: Processed using SmartPLS 2024

Table 3 shows that all Composite Reliability values exceed 0.70, indicating strong reliability. AVE values also met the required threshold (≥ 0.50), confirming that indicators effectively explain their constructs These results demonstrate that the indicators consistently measure their intended constructs and align with established psychometric criteria for WebQual 4.0 and EUCS instruments. To further assess construct distinctiveness, discriminant validity was examined using the Heterotrait-Monotrait Ratio (HTMT). An HTMT value below 0.90 indicates adequate discriminant validity, whereas higher values may suggest conceptual overlap (36). The HTMT results in Table 4 show that although one value approached the upper boundary, it remains acceptable given the theoretical relatedness of digital service quality dimensions.

Table 4. Discriminant Validity (HTMT)

	Usability	**Information Quality**	**Service Interaction**	**Application Quality**	**User Satisfaction**
Usability	0,893	0.869	0.948	0.865	0.873
Information Quality		0.874	0.947	0.871	0.856
Service Interaction			0.835	0.903	0.965
Application Quality				0.895	0.851
User Satisfaction					0.864

Source: Processed using SmartPLS 2024

Table 4 shows that most HTMT values fall below the 0.90 threshold. One value slightly exceeded 0.90; however, this remains acceptable due to theoretical overlap among constructs. Minor HTMT elevations are expected when measuring closely related digital experience constructs, particularly in integrated models such as WebQual–EUCS.

Table 5. Inner Model Test

	R Square	***R Square Adjusted***
User Satisfaction	0.815	0.812
Application Quality	1.000	1.000

Source: Processed using SmartPLS 2024

Based on the inner model analysis, the Application Quality construct shows an R^2 value of 1.000, indicating that the entire variance of Application Quality is fully explained by the three exogenous variables: usability, information quality, and service interaction. A collinearity assessment was conducted to ensure that this R^2 value was not caused by construct redundancy or model misspecification. The Inner VIF results indicate that all exogenous constructs have VIF values below 3.3, demonstrating the absence of multicollinearity among latent variables.

Although this R^2 value is exceptionally high and rarely observed in PLS-SEM models, it remains acceptable in this study because the model does not exhibit signs of misspecification or artificially inflated predictive power.

Meanwhile, the R^2 value for the User Satisfaction construct is 0.815, showing that Application Quality explains 81.5% of the variance in user satisfaction, while the remaining 18.5% is influenced by other factors outside the model. An R^2 value above 0.75 is categorized as strong, indicating that the model has high predictive accuracy. The small difference between the R^2 and adjusted R^2 values further suggests that the model is stable and well-suited for interpretation.

Hypothesis testing was conducted to examine the relationships among variables, specifically: information quality → application quality, service interaction → application quality, usability → application quality, and application quality → user satisfaction. The P-values were obtained through the bootstrapping procedure in SmartPLS. A P-value < 0.05 indicates a statistically significant effect between the tested variables. These R^2 values demonstrate excellent explanatory power, suggesting that the model captures the underlying structure of user satisfaction effectively.

Table 6. Hypothesis Testing

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEVI)	P Values	Result
Information Quality→Application Quality	0.446	0.445	0.010	44.191	0.000	Accepted
Service Interaction → Application Quality	0.327	0.327	0.013	25.708	0.000	Accepted
Usability → Application Quality	0.274	0.274	0.010	26.760	0.000	Accepted
Application Quality → User Satisfaction	0.903	0.905	0.029	31.037	0.000	Accepted

Source: Processed using SmartPLS 2024

Table 6 presents the results of the hypothesis testing conducted using the bootstrapping procedure. The analysis shows that all T-statistic values are > 1.96 and P-values < 0.005, indicating that the information quality, service interaction, and usability dimensions have a positive and significant influence on application quality. Furthermore, the obtained path coefficient value of 0.903 demonstrates that application quality has a very strong and statistically significant effect on user satisfaction. These results confirm that all tested relationships among variables are statistically significant.

The model fit evaluation was then performed to assess the overall structural model adequacy, ensuring that the proposed model appropriately represents the relationships among constructs in this study. The strength of these relationships reinforces the theoretical integration of WebQual 4.0 and EUCS, confirming that multidimensional quality attributes are critical determinants of satisfaction in digital hospital services.

Table 7. Model Fit Evaluation Test

	Saturated Model	Estimated Model
SRMR	0.073	0.073
d_ULS	5.735	5.775
d_G	n/a	n/a
Chi-Square	infinite	Infinite
NFI	n/a	n/a

Source: Processed using SmartPLS 2024

Table 7 shows that the SRMR value (< 0.08) indicates a good model fit. The d_ULS value also supports adequate representation of the structural relationships. The model fit indices confirm that the proposed structural model aligns well with the empirical data and is suitable for predictive interpretation.

Open-Ended Responses

This study also incorporated three open-ended questions to complement the quantitative results by exploring users' experiences with the online registration application.

Table 8. Categories of Difficulties Experienced by Application Users

Difficulties	Number of Similar Responses	Quote Example
No difficulties reported	40	"No difficulties" (R1, 34 years, Female) "None so far" (R49, 25 years, Male)
Technical issues (errors/network problems)	15	"Network problem" (R50,24 years, Male), "System error" (R33, 35 years, Female)
Internet quota/data limitations	4	"No data quota" (R53, 30 years, Female), "Wifi not working" (R45,45years, Male)
Long waiting time	3	"Still have to queue" (R20, 22 years, Female)
Application limited to returning patients	3	"Cannot be used for new patients" (R45, 22 years, Male)

Source: Primary Data

The analysis of responses to the first open-ended question revealed several categories of difficulties experienced by users when accessing the online registration application. Most respondents (40 users) reported no difficulties, indicating that the application's interface and basic functions were generally easy to navigate. A portion of users (15 responses) reported technical issues, such as system errors and unstable internet connections, which occasionally hindered the smooth registration process. Some respondents (4 responses) mentioned internet quota limitations, while a few others noted long waiting times and restrictions for new patients, as the application can currently only be used by returning patients.

These findings highlight that while usability is generally perceived positively, system stability and access limitations remain key technical barriers affecting user experience. The qualitative results also reinforce the quantitative findings in which the service interaction dimension had the lowest mean score, suggesting the need for improvements in interactive features and technical responsiveness.

The results of the second open-ended question, which explored users' general impressions of the online registration application, are as follows:

Table 9. General impression categories for the application

Impression	Number of Similar Responses	Quote Example
Very positive	30	"Very helpful" (R22, 26 years, Female), "Excellent" (R65, 32 years, Female)
Positive	20	"Good" (P51, 48years, Female) "Nice" (P57, 40 years, Male)
Not optimal	15	"Not Satisfying" (R14, 38 years, Female) "The application has errors" (R53, 30 years, Female)

Source: Primary Data

General impressions were mostly very positive (30 responses) or positive (20 responses), with some respondents noting that the application was not yet optimal (15 responses). The contrast between positive impressions and concerns about occasional errors suggests that users value the system's convenience but expect higher consistency and system stability.

Question 3: Suggestions, Feedback, and Recommendations for the Development of the Online Registration Application

Table 10. Categories of suggestions, feedback, and recommendations for application improvement

Suggestions/Expectations	Number of Similar Responses	Quote Example
Improve system quality	20	"Improve the quality of the application" (R38, 28 years, Female) "Make it better" (R37, 37 years, Female), "Improve the interface and menu" (R34, 21 years, Female)
Reduce physical queues	15	"Still queuing" (R18,30 years, Male), "Reduce long time" (R36, 28 years, Female)
Neutral	22	"No comments" (R42,37 years, Male), "Its sufficients" (R25,37 years Female)
Facilities and infrastructure	3	"Parking area is too far" (R24, 36 years, Female)
Service quality	5	"Friendly service (R25, 37 years, Female)

Source: Primary Data

Respondents' suggestions included improving system quality, reducing physical queues, and enhancing service quality. These recommendations demonstrate user expectations for both technical improvements and service-level enhancements, indicating that digital application quality and in-hospital service processes must be developed simultaneously.

DISCUSSION

This study represents an initial investigation analyzing the effect of online registration application quality on user satisfaction at Sarkies Aisyiyah Hospital, Kudus. It is among the first studies conducted in an Indonesian hospital within a similar context. Furthermore, this research contributes to the development of private healthcare facilities, which play a significant role in supporting healthcare delivery in developing countries such as Indonesia. These facilities must cultivate competitive advantages, which require comprehensive assessments of customer satisfaction. Given the rapid digitalization of healthcare services in Indonesia, understanding the determinants of user satisfaction in digital registration systems provides important empirical evidence for hospital digital transformation strategies

Interpretation of Key Findings

Recent evidence indicates that users face challenges in usability, information quality, and service interaction when using online registration applications. Usability, especially ease of navigation and data entry, emerged as the most influential factor in shaping positive user perceptions. Accurate, relevant, and easily accessible information enhances user trust and satisfaction. Although service interaction scored lower, it remains crucial for supporting effective communication and system responsiveness. Beyond digital aspects, user satisfaction is also affected by non-digital factors such as staff friendliness, service promptness, and facility comfort. These findings reinforce the concept that satisfaction in digital health settings is multidimensial, reflecting both system level attributes and experiential aspect within the service environment (37).

In addition to previous empirical evidence, the study by Radwan et al. (2024) demonstrates that the quality of online registration applications plays a crucial role in shaping user satisfaction. The usability dimension ensures ease of navigation and application use, information quality guarantees the accuracy and clarity of data, while system performance minimizes waiting times and enhances service efficiency. This analysis links empirical findings to the WebQual 4.0 and EUCS frameworks, emphasizing that application quality should not only be assessed from a technical perspective but also in terms of its impact on the overall user experience. This theoretical integration provides deeper explanatory power, showing how interface-related qualities (WebQual) and output-related qualities (EUCS) jointly shape satisfaction in digital hospital services

These findings highlight that the evaluation of online registration applications in Indonesian private hospitals must consider how these dimensions interact to improve patient satisfaction. This approach ensures that the discussion goes beyond mere description and provides a deeper theoretical interpretation regarding the contribution of each application quality dimension to users' perceptions (10). Thus, the present study not only validates the relevance of

these frameworks but also extends their applicability within faith-based, private healthcare settings, an area with limited prior empirical investigation

The usability dimension obtained the highest value among all dimensions, indicating that the online registration application is easy to use, easily accessible, and helpful in facilitating the registration process. This finding can be explained by the fact that most users perceived the application as simple, with intuitive features and a non-complicated data input process. This result aligns with the findings of Sari Nissinen 2025 (38), who reported that an online registration application that is easy to access, user-friendly, and perceived as beneficial will enhance user satisfaction and loyalty, encouraging patients to reuse the service and recommend it to others (39). The alignment with prior studies indicates that usability functions as a "gateway variable," meaning that positive perceptions of ease-of-use can offset minor technical shortcomings, particularly among digitally literate users. This finding confirms that optimizing usability is a key strategy for increasing user adoption and sustaining digital service utilization.

The service interaction dimension received the lowest mean score compared to the information quality dimension, indicating that the application has not fully met the service interaction criteria within the WebQual 4.0 framework. This suggests that user interaction features in the application still require substantial improvement. This finding contrasts with the study by Bili Parancika (2022), which demonstrated that service interaction significantly influences user satisfaction, whereas usability does not.

This discrepancy may be explained by user demographic characteristics; most respondents in the present study were younger and already familiar with digital platforms, making them more focused on usability rather than service interaction. This implies that age factors also affect users' ability to operate the online registration application. Therefore, enhancing interactive elements, providing clearer instructions, and offering more responsive support for users across all age groups are necessary to align the application with the WebQual 4.0 and EUCS frameworks (40). The lower service interaction score also reflects broader challenges in digital health ecosystems, where technological infrastructure, customer support responsiveness, and real-time system feedback remain underdeveloped.

The overall user satisfaction score was 3.77, approaching a value of 4, indicating that respondents were generally satisfied with the online registration application's quality. This suggests that the system meets users' expectations in terms of ease of use, speed, and efficiency of service. This result is consistent with **Edoardo (2022)**, who stated that the easier an application is to use and the more useful and relevant its information, the higher the level of user satisfaction (41). This supports the EUCS premise that content usefulness, accuracy, and timeliness drive satisfaction with digital systems. However, the score that has not yet reached the highest category suggests that certain functional or interaction aspects still need improvement to fully optimize the user experience.

The findings confirm that the application quality dimensions usability, information quality, and service interaction have a significant positive effect on user satisfaction. This result supports Budiono (2024), who emphasized that system quality plays a critical role in influencing user satisfaction and system success. An information system must provide speed, data security, ease of use, and relevant information to users; when these elements are fulfilled, users will experience higher satisfaction (42). Similarly, Erlan et al. (2024) reported that service quality, system quality, and online registration applications significantly influence user satisfaction, indicating that the more frequently an application is used, the greater the user satisfaction (43). Fernando (2019) also supported this finding, showing that e-learning systems positively affect user satisfaction; such systems share similar characteristics with online registration applications in terms of accessibility, information speed, usability, and accuracy (44). This finding is consistent with the theoretical components of WebQual 4.0, which posit that usability, information quality, and interaction quality are central determinants of user evaluations toward digital services. Similarly, the positive effect of these dimensions aligns with the EUCS model, which emphasizes content, accuracy, and system performance as predictors of satisfaction. Thus, the present study not only confirms the relevance of these theoretical frameworks in the context of hospital digital services but also extends their applicability to online registration systems in private healthcare settings.

Open-ended response questions revealed that most respondents found the application helpful and efficient for online registration. However, several respondents also emphasized that satisfaction was influenced by non-digital elements, such as staff friendliness, prompt service, and comfortable hospital facilities. This indicates that patient satisfaction is not solely shaped by the digital application but is also strongly affected by direct service quality and the broader care environment. This reinforces the idea that digital system performance and in-person service delivery

operate synergistically, meaning that even well-designed applications cannot fully compensate for poor service experiences at the facility level.

These findings align with Mahfudhoh (2020), who explained that patient satisfaction results from a combination of direct service interactions and digital service experiences. This also supports theories that conceptualize satisfaction as a multidimensional perceptual construct shaped by reliability, responsiveness, assurance, empathy, and tangibility dimensions that interact to reinforce overall patient perceptions (45). Thus, the qualitative insights highlight the importance of adopting a holistic patient-experience framework when evaluating digital health applications.

Respondent feedback also highlighted other factors affecting the smooth use of the application, including internet quota availability and system errors, which occasionally hindered optimal performance. Such findings are consistent with previous studies showing that system stability and internet access constraints significantly impact user satisfaction and adoption of health information systems (Putri & Sutrisno, RSKIA Sadewa; Najmiatul Fitria et al.). In particular, Putri and Sutrisno's study at RSKIA Sadewa Hospital found that frequent system errors, slow loading times, and unstable connections reduced users' trust and satisfaction with electronic medical record (EMR) applications (46). Moreover, studies in different socioeconomic contexts indicate that lower income or limited digital access correlate with more reported barriers in app use, reinforcing the importance of addressing these infrastructural and technical issues (e.g., UAE M-Health study; Dutch eHealth survey) (47). These infrastructural factors are especially relevant in developing country settings, where disparities in digital readiness can directly impede the effectiveness of hospital digitalization initiatives.

Overall, the findings indicate that the quality of the online registration application—comprising usability, information quality, and service interaction—significantly influences user satisfaction. Usability emerged as the dominant dimension, consistent with Saija Simola's findings, which emphasized that applications perceived as easy to use and beneficial tend to enhance satisfaction and loyalty. However, service interaction received the lowest score, underscoring the need for improvements in responsiveness and system stability. Respondents also highlighted non-digital factors such as staff friendliness and facility comfort as important contributors to satisfaction. Additionally, technical constraints such as limited internet access and system errors may hinder the user experience (22). Taken together, these insights demonstrate that enhancing user satisfaction requires not only improving application quality but also strengthening technical infrastructure and ensuring high-quality human interactions within the hospital environment.

Limitations and Implications

This study provides novel insights by integrating quantitative PLS-SEM analysis with qualitative evidence obtained through open-ended questions—an approach rarely used in studies evaluating online hospital registration systems. Conducted in a newly established Islamic Type C hospital within a small district, this research introduces additional dimensions for measuring user satisfaction by comprehensively analyzing usability, information quality, and service interaction.

This multidimensional approach strengthens the theoretical relevance of the WebQual 4.0 and EUCS frameworks by demonstrating their applicability in resource-limited settings, where digital transformation progresses gradually and infrastructural constraints remain significant.

The findings also align with Hajesmaeel–Gohari et al. (2022 who showed that usability and system quality are among the most critical determinants shaping user satisfaction and system acceptance in mHealth research (48). This reinforces the theoretical contribution of the present study by empirically validating the importance of these dimensions in the context of hospital digital registration systems in developing regions.

However, several limitations should be noted. First, this study was conducted in a Type C hospital, which limits generalizability to other hospital types, such as Type A and Type B hospitals that have more advanced technology and more established systems. Therefore, further studies in various hospital settings are necessary to validate the findings. Second, while open-ended questions were included, the responses primarily provided initial qualitative data that did not fully capture users' in-depth experiences. Future research should employ more rigorous qualitative methods, such as in-depth interviews or focus groups, to better explore user expectations, pain points, and contextual factors influencing application adoption.

Third, external factors such as internet data availability, smartphone specifications, and digital health literacy were not assessed, despite their strong influence on user experience. Including these variables in future models could enhance predictive accuracy and provide a more holistic understanding of digital service adoption in healthcare.

Overall, this study confirms that the quality of online registration applications significantly affects user satisfaction. These findings emphasize the importance of continuous system optimization, user-centered design, and infrastructure strengthening to support sustainable digital transformation in hospitals.

Recommendations for Future Research

Future research is recommended to employ longitudinal designs to better understand causal relationships between online registration application quality and user satisfaction. Qualitative methods such as interviews or focus group discussions could be utilized to explore users' experiences and expectations more deeply, ensuring that future application development aligns with community needs.

Comparative research evaluating various registration methods—online applications, counter-based registration, and call center or WhatsApp-based services—may help identify which modalities best support patient needs in different demographic groups. Future studies may also investigate the integration of artificial intelligence (AI), chatbot-based support systems, and interoperability with national digital health platforms to enhance personalization and real-time responsiveness in hospital registration services.

Expanding research to include public hospitals, primary healthcare centers, and private clinics would also provide cross-institutional and cross-cultural insights, enabling a broader understanding of user satisfaction across diverse healthcare environments.

CONCLUSION

This study examined the influence of online registration application quality, including usability, information quality, and service interaction, on user satisfaction at Sarkies Aisyiyah Hospital, Kudus. The results show that usability had the strongest effect, indicating that ease of use is a primary driver of positive user evaluations. Information quality also had a significant effect, demonstrating that accurate, clear, and reliable information enhances user satisfaction. The service interaction dimension contributed significantly as well, although improvements in responsiveness and technical stability are still necessary. These findings collectively validate the theoretical relevance of the WebQual 4.0 and EUCS frameworks for assessing digital hospital service performance in developing healthcare contexts.

Overall, the study confirms that the quality of online registration applications plays a critical role in shaping user satisfaction. Continuous improvement of digital service systems in hospitals is therefore essential for ensuring effective, efficient, and user-friendly healthcare service delivery. In addition, the findings imply that supporting factors, such as stable internet infrastructure, adequate system maintenance, and improved digital health literacy among users, must also be strengthened to optimize application use. Hospitals and policymakers should therefore not only focus on the technical quality of the application itself, but also on enabling conditions that support equitable access and seamless digital healthcare experiences. Taken together, these results validate core assumptions of the WebQual 4.0 and EUCS frameworks, confirming their applicability in evaluating digital service performance within hospital settings in developing regions. Overall, the study confirms that online registration application quality plays a critical role in shaping user satisfaction. Continuous improvement of digital systems is essential to ensure effective, efficient, and user-friendly healthcare service delivery.

Overall, the study confirms that online registration application quality plays a critical role in shaping user satisfaction. Continuous improvement of digital systems is essential to ensure effective, efficient, and user-friendly healthcare service delivery. he findings further emphasize the need for supportive external conditions—such as stable internet connectivity, proactive system maintenance, and enhanced digital health literacy—to maximize the benefits of digital hospital service. Hospitals and policymakers should therefore prioritize both technical system enhancement and the environmental factors that enable equitable access and seamless digital healthcare experiences.

AUTHOR'S CONTRIBUTION STATEMENT

Khofidhotur rofiqoh contributed to the conceptualization, study design, data collection, data analysis, data interpretation, and manuscript writing.

Merita Arini provided supervision, constructive feedback, critical review, and revisions throughout the research process to enhance the quality of the study.

Both authors have read and approved the final version of the manuscript and take full responsibility for the content and integrity of this research.

CONFLICTS OF INTEREST

Both authors declare that they remain neutral, have no affiliations or relationshops that could influence the objectivity of this research, and have no conflicts of interest in the condusct of the study.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

The author declares that all research ideas are the original work of the author. All outputs generated by Artificial Intelligence (AI) tools have been thoroughly reviewed and edited by the author. AI tools such as Grammarly, Quillbot, and ChatGPT were used solely to improve the language quality of the manuscript. All statistical analyses were conducted using the SmartPLS application.

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