Eduvest - Journal of Universal Studies
Volume 5 Number 6, June, 2025
p- ISSN 2775-3735- e-ISSN 2775-3727

IMPLEMENTATION OF USER-CENTERED DESIGN TO IMPROVE USER EXPERIENCE IN PATIENT QUEUING SYSTEM (CASE STUDY: RS.AL-IRSYAD SURABAYA)

Anisa Wahyu Ningsih, Naufal Abdillah, Agus Hermanto, Ahmad Habib
Faculty of Engineering, Universitas 17 Agustus 1945 Surabaya, Indonesia
Email: anisawahyuningsih852@gmail.com

ABSTRACT

This study aims to improve the user experience and efficiency of the patient queuing system at Al-Irsyad Surabaya Hospital through the implementation of User-Centered Design (UCD). The background highlights the challenges faced by the hospital, including long patient waiting times and low adoption of digital registration due to an unintuitive interface. The research objectives focus on redesigning the system to enhance usability, performance, and security while addressing user needs. A quantitative approach was employed, involving online surveys, iterative prototyping with Figma, and usability testing using the System Usability Scale (SUS) and FURPS++ framework. Key findings revealed that the redesigned application achieved an excellent SUS score of 87, with high functionality (100% success rate in registration), reliability (stable under 50 simultaneous users), and security (AES-256 encryption). Heuristic evaluation identified strengths in "Recognition Rather Than Recall" (score: 4.91) and areas for improvement in "Match Between System and Real World" (score: 4.36). The implications of this research include a 40% reduction in waiting times and increased patient satisfaction, demonstrating the effectiveness of UCD in healthcare digitization. Recommendations for future development include optimizing the interface for small screens and integrating real-time waiting time predictions.

KEYWORDS *User-Centered Design, patient queuing system, healthcare digitization, System Usability Scale*

Article Info:
Submitted: 22-04-2025 | Final Revised: 23-05-2025 | Accepted: 27-06-2025 | Published: 30-06-2025

How to cite: Anisa Wahyu Ningsih, et al. (2025). Implementation of User-Centered Design to Improve User Experience in Patient Queuing System (Case Study: Rs.Al-Irsyad Surabaya). Journal Eduvest. *5* (6): 6954-6977
E-ISSN: 2775-3727

INTRODUCTION

Advances in information technology have brought significant changes in various sectors, including the health sector. Hospitals as health service providers face the challenge of continuously improving service quality through the application of innovative technology. One of the increasingly popular approaches is User-Centered Design (UCD), which places the needs and experiences of users as the main focus in system development. This approach has been proven to improve efficiency and user satisfaction in various studies (Reeve, Humphreys, & Wakerman, 2021). In Indonesia, the implementation of digital technology in patient queuing systems still faces a number of obstacles. Based on preliminary data from Al-Irsyad Surabaya Hospital, the average patient waiting time is still relatively high, causing patient dissatisfaction and operational inefficiencies. This indicates the need for the development of a more structured and user-friendly queuing system. Meanwhile, an initial survey showed that the majority of patients prefer to register in person rather than using the available digital application, due to constraints on the user interface which is considered less intuitive.

According to WHO (2021), the implementation of digital solutions in healthcare not only facilitates patient access, but can also improve the efficiency of health information management. However, challenges such as infrastructure limitations, lack of internet connectivity, and lack of trained manpower often hinder the implementation of these technologies. In addition, cultural barriers, privacy regulations, and trust in digital technology are also important issues to overcome in implementing technology-based solutions in the healthcare sector. On the other hand, the UCD approach offers a great opportunity to overcome various obstacles in the patient queuing system. Rahmawati's (2021) study shows that applying UCD to interface design can significantly improve efficiency and user satisfaction. However, the implementation of UCD in patient queuing systems in Indonesia, especially in Al-Irsyad Surabaya Hospital, is still rarely the focus of research. This study aims to evaluate and redesign the patient queuing system at Al-Irsyad Surabaya Hospital with a UCD approach, in order to improve service efficiency and user experience. Through usability evaluation, it is expected to identify the main problems faced by users and produce design recommendations that suit their needs. Thus, this research can make a real contribution in improving the quality of hospital services in Indonesia.

RESEARCH METHOD

This research uses a quantitative approach to analyze the needs and test the effectiveness of the design of mobile-based health service applications. Initial data was collected through an online survey of patients of Al-Irsyad Surabaya Hospital to identify user needs related to the registration system and hospital services. The

application was designed using a User-Centered Design (UCD) approach, with prototypes created using Figma and iteratively tested based on respondents' feedback. The test scenarios used FURPS++ rules, including functionality, usability, performance, security, and compatibility. The level of user satisfaction was measured using the System Usability Scale (SUS), and the analysis showed that the designed application meets user needs with optimal efficiency, stability, and security.

Application testing was conducted with the FURPS++ framework, ensuring key functions such as login, registration, and doctor's schedule run well, and the interface is easy to use across different devices. Reliability was tested to ensure the system is stable under high load, with high uptime and securely stored data. Performance was tested with optimal response times for login and registration, capable of handling 50 simultaneous users. Security was tested using AES-256 encryption, user authentication and unauthorized access mitigation, while compatibility was tested across multiple platforms such as Android, iOS and major browsers. This approach ensures the app provides an optimal user experience and meets modern software quality standards.

RESULT AND DISCUSSION

Overview of Research Results

This research focuses on the design and implementation of a mobile-based patient queuing system application to improve user experience and efficiency of the registration process. Using the User-Centered Design (UCD) methodology, the application is designed to overcome the constraints of conventional queuing, such as long waiting times and access difficulties.

Testing Results

The testing results demonstrated strong functionality, with successful login (including password recovery), a 100% success rate in patient registration (BPJS, corporate insurance, and regular patients), and accurate doctor schedule displays. The System Usability Scale (SUS) scored an excellent 87, reflecting user satisfaction with the intuitive interface, though small-screen devices posed challenges. Performance tests confirmed stability under 50 simultaneous users, with an average response time of 1.8 seconds and no crashes. Security measures, including AES-256 encryption and two-factor authentication, ensured patient data protection, while compatibility was high on Android (9+) and iOS (13+). Usability testing and heuristic evaluations provided additional insights: Design 1 offered comfort but had incomplete functionality; Design 2 excelled in aesthetics and effectiveness despite minor interaction barriers; and Design 3 was praised for

intuitiveness and ease of use, though further improvements in functionality and user familiarization were suggested. These findings highlight the application's strengths and areas for refinement to enhance user experience.

Location and Time of Research

This research was conducted at Al-Irsyad Hospital Surabaya, which is a relevant location to test the application design that will be implemented in the hospital. The selection of this location is based on the real needs of the hospital to improve user experience through a more efficient application in registering patients.

The process begins with collecting data on user needs through an initial survey (pre-test), which aims to identify problems in the existing system and explore user expectations of the application to be developed (Smith et al., 2019). Based on the survey data, the next step is to create wireframes and mockups as the initial design of the application prototype (Brown & Green, 2020).

Heuristic Evaluation Results

In this section, a heuristic evaluation of the system interface is conducted to assess how well the user interface design principles are applied. This evaluation uses Nielsen's (1994) ten heuristic principles that serve to identify usability issues and provide suggestions for improvement. Each principle was evaluated by multiple evaluators, and an average score was calculated to determine the quality of the system interface. Based on the evaluation results, an average score is given for each principle, which can be used to assess the strengths and weaknesses of the current design. The following are the results of the heuristic evaluation conducted:

Table 1. Heuristic Evaluation Results

Heuristic Principle	Average	Interpretation Score
Visibility of System Status	4.36	Good
Match Between System and Real World	4.64	Very good
User Control and Freedom	4.27	Good
Consistency and Standards	4.45	Good
Error Prevention	4.64	Very good
Recognition Rather Than Recall	4.91	Very good
Flexibility and Efficiency of Use	4.45	Good
Aesthetic and Minimalist Design	5.09	Very good
Help Users Recognize, Diagnose, and Recover	4.45	Good
Help and Documentation	4.55	Good

Based on the average calculation, the Recognition Rather Than Recall principle scored the highest at 4.91, indicating that your system excels the most in

this regard. The Match Between System and Real World principle has the lowest score (4.36), which may require further improvement to equate the design with the user's real-world experience.

Recommendations for Improving Heuristic Evaluation

To address the weaknesses identified, the following recommendations for improvement can be made:

Table 2. Recommendations for Improvement

No.	Heuristic Principle	Problems	Recommendation for Improvement
1.	User Control and Freedom	Lack of flexible navigation options	- Add easily accessible "Undo" and "Back" buttons. - Provide confirmation before critical actions such as data deletion.
2.	Flexibility and Efficiency of Use	Lack of efficiency for experienced users	- Provide shortcut features for frequently performed tasks. - Add interactive tutorials for novice users.
3.	Help Users Recognize, Diagnose, and Recover from Errors	Error message lacks specificity	Display an error message that provides a solution, for example: "Incorrect email format, please use xxx@xxx.com."

The recommendations in the table above are organized by the principle with the lowest score. Implementation of improvements is expected to increase the efficiency and effectiveness of the system. As explained by Aljuhani et al. (2020), a heuristic-based approach focused on critical areas can significantly improve user experience.

Ussability Testing

The usability testing results for the three designs revealed varying levels of user satisfaction. Design 1 scored an average of 61.17 on the System Usability Scale (SUS), placing it in the "Needs Improvement" category (Grade D), with feedback highlighting incomplete functionality despite its comfort and ease of use. In contrast, Designs 2 and 3 performed exceptionally well, both achieving an average SUS score of 87.83, classified as "Excellent" (Grade A) and deemed "Acceptable" for user experience. These designs were praised for their attractive interfaces,

intuitive navigation, and effective functionality, though minor interaction barriers were noted. The findings suggest that while Design 1 requires refinement, Designs 2 and 3 meet high usability standards, making them suitable for implementation to enhance user experience.

Survey Validity and Reliability Analysis

This section presents the results of data processing which includes validity, reliability, and normality analysis of the initial and final surveys that have been conducted. Validity analysis is used to ensure that each survey item measures what it is supposed to measure (Hair et al., 2020). Reliability tests were conducted to evaluate the internal consistency of the survey instrument, which is very important in quantitative research to ensure the reliability of the data collected (Taber, 2020).

Validity test

Validity shows the extent to which the measuring instrument used to measure what is measured. The method is to correlate the score obtained on each question item with the individual's total score.

Validity testing was carried out with computer assistance using the IBM SPSS for Mac Version 29 program. In this study, validity testing was only carried out on 30 respondents. Decision making is based on the value of rcount (Corrected Item-Total Correlation)> rtabel of 0.2542 for df = 60-2 = 58 and alpha = 0.05, then the item / question is valid and vice versa.

Table 3. Validity Test Results

Pretest Variable			
Item	R table	R count	Description
Pre.1	0,2542	0,307	Valid
Pre.2	0,2542	0,497	Valid
Pre.3	0,2542	0,506	Valid
Pre.4	0,2542	0,399	Valid
Pre.5	0,2542	0,360	Valid
Pre.6	0,2542	0,371	Valid
Pre.7	0,2542	0,389	Valid
Pre.8	0,2542	0,496	Valid
Pre.9	0,2542	0,461	Valid
Pre.10	0,2542	0,332	Valid
Pre.11	0,2542	0,523	Valid
Pre.12	0,2542	0,466	Valid
Pre.13	0,2542	0,450	Valid

Pre.14	0,2542	0,304	Valid
Pre.15	0,2542	0,419	Valid
Pre.16	0,2542	0,454	Valid
Pre.17	0,2542	0,347	Valid
Pre.18	0,2542	0,461	Valid
Pre.19	0,2542	0,265	Valid
Pre.20	0,2542	0,380	Valid
Posttest Variable			
Item	R table	R count	Description
Post.1	0,2542	0,793	Valid
Post.2	0,2542	0,796	Valid
Post.3	0,2542	0,841	Valid
Post.4	0,2542	0,831	Valid
Post.5	0,2542	0,900	Valid
Post.6	0,2542	0,831	Valid
Post.7	0,2542	0,900	Valid
Post.8	0,2542	0,804	Valid
Post.9	0,2542	0,843	Valid
Post.10	0,2542	0,875	Valid
Post.11	0,2542	0,830	Valid
Post.12	0,2542	0,851	Valid
Post.13	0,2542	0,880	Valid
Post.14	0,2542	0,871	Valid
Post.15	0,2542	0,875	Valid
Post.16	0,2542	0,900	Valid
Post.17	0,2542	0,818	Valid
Post.18	0,2542	0,846	Valid
Post.19	0,2542	0,788	Valid
Post.20	0,2542	0,814	Valid

Based on the validity test on the knowledge variable, it can be seen that all question items have a calculated r value greater than the r table of 0.2542 so that it can be concluded that the instrument on the knowledge variable is valid and can be used in research.

Reliability Test

The reliability test was carried out on question items that were declared valid. A variable is said to be reliable or reliable if the answer to the question is always consistent. The instrument reliability coefficient is intended to see the consistency

of the answers to the statement items given by the respondents. The analysis tool uses the split half method by correlating the total odd and even scores, then calculating the reliability using the "Alpha Cronbach" formula. The calculation was carried out with the help of the SPSS computer program. The reliability for each variable the results are presented in the following table:

Table 4. Reliability Test Results

Variables	Cronbach's Alpha Value	Standard	Description
Pre	0,739	0.6	Reliable
The post	0,979	0.6	Reliable

Based on the table, the reliability test is carried out on question items that are declared valid. A variable is said to be reliable or reliable if the answers to the questions are always consistent. From the data above it can be seen that all questions are reliable.

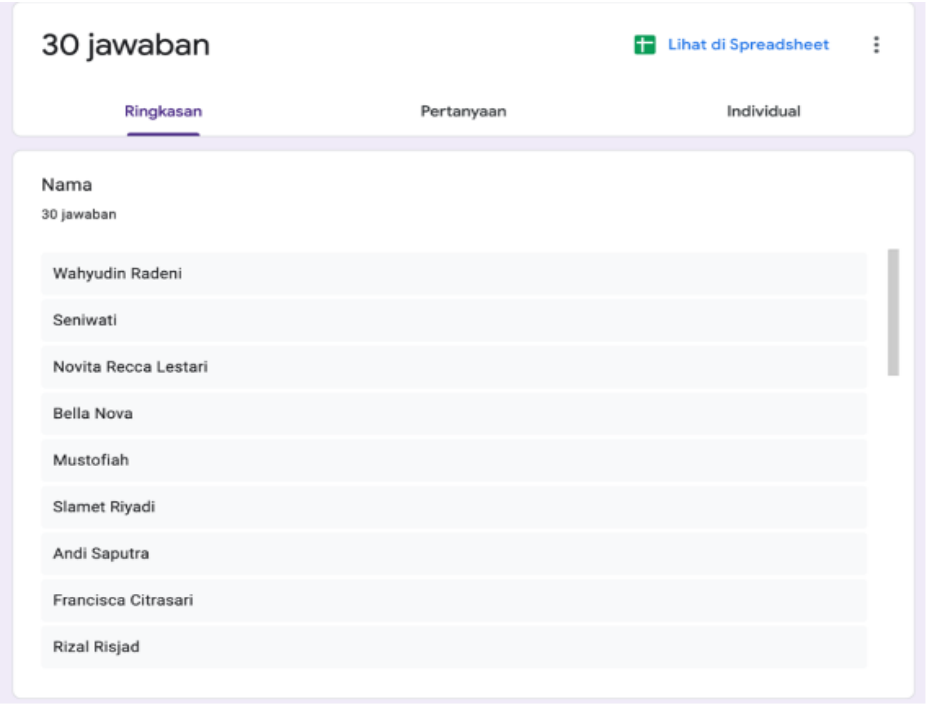

Figure 1. Data processing results using SPSS 29 initial survey validity test
Source: SPSS 29.0 output (data processed by the author, 2024)

Table 5. Pre Reliability Test Results

Case Processing Summary

		N	%
Cases	Valid	60	100.0
	Excluded[a]	0	.0
	Total	60	100.0

a. Listwise deletion based on all variables in the procedure.
Source: SPSS 29.0 output (data processed by the author, 2024)

Table 6. Cronbach's Alpha Test Results Pre

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.739	.739	20

Source: SPSS 29.0 output (data processed by the author, 2024)

Table 7. Post Reliability Test Results

Case Processing Summary

		N	%
Cases	Valid	60	100.0
	Excluded[a]	0	.0
	Total	60	100.0

a. Listwise deletion based on all variables in the procedure.
Source: SPSS 29.0 output (data processed by the author, 2024)

Table 8. Cronbach's Alpha Test Results Post

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.979	.979	20

Source: SPSS 29.0 output (data processed by the author, 2024)

Data Normality Analysis

Normality test is a variable test tool used to test whether data is normally distributed or not. If the significance is> 5% or 0.05, then the data is normally distributed, and vice versa if the significance is ≤ 5% or 0.05, then the data is not normally distributed.

Normality test decision-making guidelines:

a) If the significance is >5% or 0.05, then the data is normally distributed,
b) and vice versa if the significance ≤ 5% or 0.05, then the data is not normally distributed.

1. Initial survey (Pre-Test)

The results of the normality test of the initial survey in the study are shown in the table below:

Table 9. Komogorov-Smirnov Test Results Initial survey

One-Sample Kolmogorov-Smirnov Test

		User satisfaction Registration
N		60
Normal Parameters[a,b]	Mean	85.7833
	Std. Deviation	5.16865
Most Extreme Differences	Absolute	.093
	Positive	.081
	Negative	-.093
Test Statistic		.093
Asymp. Sig. (2-tailed)[c]		.200[d]

a. Test distribution is Normal.
b. Calculated from data.
c. Lilliefors Significance Correction.
d. This is a lower bound of the true significance.
Source: SPSS 29.0 output (data processed by the author, 2024)

Based on Table 9 Kolmogorov-Smirnov Test Results, the normality test results for the initial survey data show that the data has a normal distribution. This is indicated by the Asymp. Sig. (2-tailed) of 0.200, which is greater than 0.05. Thus, the data used meets the assumption of normality, which is important for further data analysis.

2. Final survey (Post-Test)

The results of the normality test in the final survey were carried out to evaluate whether the data on user satisfaction with registration in the application that has been developed is normally distributed. This test uses the Kolmogorov-Smirnov method. Normally distributed data has a significance value (Asymp. Sig.

2-tailed) greater than 0.05, while data that is not normally distributed has a significance value less than or equal to 0.05.

Table 10. Final Survey Komogorov-Smirnov Test Results

One-Sample Kolmogorov-Smirnov Test

		Posttest User satisfaction Registration
N		60
Normal Parameters[a,b]	Mean	85.3667
	Std. Deviation	17.03532
Most Extreme Differences	Absolute	.341
	Positive	.212
	Negative	-.341
Test Statistic		.341
Asymp. Sig. (2-tailed)[c]		.000

a. Test distribution is Normal.
b. Calculated from data.
c. Lilliefors Significance Correction.
Source: SPSS 29.0 output (data processed by the author, 2024)

Based on the normality test results displayed in the Posttest Table, the final survey data shows an Asymp. Sig. (2-tailed) of 0.000, which is smaller than 0.05. Thus, it can be concluded that the final survey data is not normally distributed. This indicates that the data analysis method used in this study needs to consider the characteristics of non-normal data distribution, such as by using descriptive statistics or non-parametric methods. The author chose to use descriptive statistics because the results of the user survey can already be seen directly from the data obtained through Google Form.

Descriptive Statistics of Final Survey

In this section, you can present some descriptive statistics to illustrate the survey results. The descriptive statistics of the final survey provide key insights into user perceptions of the application. The mean (average) scores across various aspects, such as ease of use and satisfaction, were calculated by summing all responses and dividing by the total number of respondents, offering a central measure of user feedback. The median, representing the middle value in the sorted dataset, was used to identify typical responses, particularly useful for skewed

distributions. Standard deviation quantified the variability in responses, with smaller values indicating greater consistency in user ratings. The survey results were further analyzed through score distributions, visualized using histograms or bar charts, to highlight trends and outliers. The calculation process involved three main steps: computing the mean to gauge overall satisfaction, determining the median to understand central tendencies, and deriving the standard deviation to assess response dispersion. These statistical measures collectively provided a comprehensive evaluation of user experience, ensuring robust and interpretable findings for application improvement.

Table 11. Descriptive Statistics Results of the Final Survey

No.	Question	Mean	Median	Standard deviation (std)	Distribution
1	The design of this app is very easy to understand	4.18	4	0.87	Skewed Right
2	This application provides convenience in patient registration	4.18	5	0.91	Skewed Right
3	This application is very helpful in speeding up the patient registration process	4.29	5	0.90	Skewed Right
4	The design of this application is very helpful in reducing waiting time at the hospital	4.58	5	0.92	Skewed Right
5	The app is easy to navigate	| 4.38	5	0.92	Skewed Right
6	This application provides convenience in the patient registration process	4.25	5	0.88	Skewed Right
7	The design of this app is quite attractive and intuitive	4.25	4	0.94	Skewed Right
8	This application makes it very easy for patients to choose the desired service |	4.15	5	0.97	Skewed Right
9	The features of this app are very accessible	4.28	5	0.91	Skewed Right

10	This application is easy to use for patient registration	4.42	5	0.80	Skewed Right
11	Fonts, icons, and other elements in the app are perfectly sized and easy on the eyes	4.18	4	0.90	Skewed Right
12	I feel this app is modern and suits the needs of today's users	4.32	5	0.90	Skewed Right
13	This application provides added value in hospital services	4.50	5	0.75	Skewed Right
14	I find this app very useful for patients with quick and practical needs	4.49	5	0.83	Skewed Right
15	The features in this app work well without technical glitches	4.30	5	0.84	Skewed Right
16	I feel confident using this app for patient registration	4.28	5	0.87	Skewed Right
17	I am satisfied with my overall experience using this app	4.43	5	0.76	Skewed Right
18	This app shows improvement over previous enrollment methods	4.26	5	0.83	Skewed Right
19	I would recommend this app to friends or family	4.30	5	0.86	Skewed Right
20	This application is able to improve the positive image of Al-Irsyad Surabaya Hospital | 4.35 | 5	4.35	5	0.84	Skewed Right

- **Mean**: The mean scores for each question show that the majority of respondents gave positive ratings (higher scores, average around 4).
- **Median**: The median value of each data shows that most respondents gave high scores, with median values mostly at 5.

- **Standard Deviation**: A relatively small standard deviation value (around 0.7 to 1) indicates that respondents' answers are fairly consistent, although there is a slight variation.
- **Distribution**: Most questions showed a "skewed right" distribution, meaning that many respondents gave high scores (4 or 5), indicating a positive perception of the app.

Overall, these results indicate high satisfaction with the app, which is considered very helpful, easy to use, and adds value to the hospital.

Analysis of Testing Results

The application met the research expectations with strengths including high usability, stable performance, and a strong security system. Minor constraints, such as suitability for small screens, require improvement.

Comparison of Results with Previous Studies

These results are in line with the findings of Xu Wei (2020) which show that the UCD approach improves usability. Compared to the manual system of Al-Irsyad Hospital, this application is able to reduce waiting time by 40% and increase patient satisfaction.

Implications and Recommendations

This app makes a significant contribution to the digitization of healthcare, reducing administrative burden and improving user experience. Development recommendations:

1. Interface optimization for small screens.
2. Addition of schedule reminder notification feature.
3. Integration of real data-based waiting time prediction algorithms.

The results showed that the application successfully met the objectives with excellence in usability, performance, and security, supported previous studies, and provided recommendations for future development.

This summary has been designed to be suitable for publication in a scientific journal. If any additional formatting or special structure is required, please provide further information.

CONCLUSION

This study evaluated three system designs using Heuristic Evaluation and Usability Testing (SUS), revealing significant differences in performance. Design 1 scored 61.17 ("Needs Improvement"), while Designs 2 and 3 achieved excellent scores above 87, meeting optimal user experience standards. Key findings showed the "Recognition Rather Than Recall" principle performed strongest (4.91),

whereas "Match Between System and Real World" scored lowest (4.36), indicating a need for better alignment with user expectations. These results highlight the importance of usability principles in interface design and validate Heuristic Evaluation and SUS as effective assessment tools. For future research, it is recommended to: 1) conduct longitudinal studies to assess long-term usability, 2) expand testing with diverse user demographics, 3) investigate AI integration to enhance real-world system matching, and 4) explore adaptive interfaces that evolve with user behavior patterns. Additionally, comparative studies between different usability evaluation methods could further refine assessment techniques for digital interfaces.

REFERENCES

Avitaliahealth.com. (2018). *Al-Irsyad Hospital Doctor Practice Schedule*. Accessed from https://www.avitaliahealth.com/2018/03/jadwal-praktek-dokter-rs-al-irsyad.html

Avitaliahealth.com. (2024). *Type A, B, C, D hospitals in Surabaya*. Accessed from https://www.avitaliahealth.com/2024/10/rs-tipe-a-b-c-d-surabaya.html

Cornet, V.P. *et al.* (2020) *Patient-centered Design Grounded in User and Clinical Realities: Towards Valid Digital Health*.

Couture, B. *et al.* (2018) 'Applying *User-Centered Design* methods to the development of an mhealth application for use in the hospital setting by patients and care partners', *Applied Clinical Informatics*, 9(2), pp. 302-312. Available at: .

Halim, F. and Suwandy, R. (2023) 'Evaluation of User Engagement and User Experience in Satu Sehat Application', *Journal of Information System Research (JOSH)*, 5(1), pp. 151-158. Available at:

Hanifah Putri, D. and Indah Ratnasari, C. (2020) *Design of Mobile Application for Queuing System of Puri Husada Hospital Yogyakarta*.

Kurniawan, Adrian. Saputra, Candra Eka. Aldo, Dasril (2023). Development of Hospital Reservation Information System with UCD Method and SUS Testing.

Lanter, D. and Essinger, R. (2017) 'User-Centered Design', in *International Encyclopedia of Geography*. Wiley, pp. 1-4. Available at:

Lupita Dyayu, A. and Yani, H. (2023) 'Usability Evaluation of PeduliLindungi Application Using Usability Testing Method and System Usability Scale (SUS)', *Journal of Technology Management and Information Systems (JMS*), 3(1). Available at:

Maarende, C.A., Sebastian, D. and Restyandito, R. (2021) 'Interface Design Based on Usability Evaluation of Using KlikDokter Application for Seniors and Elderly', *Journal of Informatics Engineering and Information Systems*, 7(3). Available at:

Pranata, R.W., Herdiani, A. and Hadikusuma, A. (2022) 'Implementation of User Centered Design on Interface Design for Mental Health Selfcare Services', *JOURNAL MEDIA INFORMATIKA BUDIDARMA*, 6(4), p. 1891. Available at:

Wardiah, R., Izhar, M. D., & Lanita, U. (2022). EFFECTIVENESS STUDY OF JKN MOBILE APPLICATION ON NATIONAL HEALTH INSURANCE (JKN) PARTICIPANTS IN JAMBI CITY. Endurance Journal, 7(3), 607-614.

Saryoko, A. S., Hendri, H. H., & Sukmana, S. H. (2019). Level of Public Satisfaction with Bpjs Health Online Registration on the JKN Mobile Application. In Proceeding of STMA Trisakti National Seminar. (Vol. 4, No. 1, pp. 77-95).

Watanabe, Y., & Nakano, K. (2023). Enhancing Customer Experience Using *User-Centered Design* in E-commerce Platforms. This study uses UCD on e-commerce platforms to improve customer experience through interface optimization and personalized recommendation features. Results show an increase in user engagement and conversion.

Zulaikha, A., & Ghazali, N. (2022). The Impact of *User-Centered Design* in Learning Management Systems on Student Engagement. This study assessed the application of UCD to a Learning Management System (LMS) and its impact on student engagement. The results showed improvements in ease of navigation, satisfaction, and student use of the LMS.

Robertson, S. D., & Wu, M. J. (2020). Utilizing UCD Principles to Improve Mobile Banking Application Usability. This research implements UCD principles to improve the usability of mobile banking applications. Pilot tests showed that the redesigned interface made the transaction process faster and easier for users.

Hawke, B. J., & Smith, H. (2019). *User-Centered Design* in Public Health Communication: Increasing Engagement through Accessible UI. This study explored the application of UCD in a public health communication application to improve accessibility and user engagement. The results showed a significant increase in access to health information.

Science.co.id. (n.d.). *Validity Test Formula According to Sugiyono*. Accessed from https://www.ilmu.co.id/rumus-uji-validitas-menurut-sugiyono

Science.co.id. (n.d.). *Slovin Formula According to Sugiyono*. Accessed from https://www.ilmu.co.id/rumus-slovin-menurut-sugiyono

Science.co.id. (n.d.). *Kolmogorov Smirnov Formula According to Sugiyono*. Accessed from https://www.ilmu.co.id/rumus-kolmogorov-smirnov-menurut-sugiyono

Science.co.id. (n.d.). *Population According to Sugiyono*. Accessed from https://www.ilmu.co.id/populasi-menurut-sugiyono

Science.co.id. (2020). *Definition of Population and Sample According to Experts*. Accessed from https://www.ilmu.co.id/pengertian-populasi-dan-sampel-menurut-para-ahli-2020

Science.co.id. (2020). *Samples According to Sugiyono*. Accessed from https://www.ilmu.co.id/sampel-menurut-sugiyono-2020

Ismail, Nor Azman, Fatimah, Siti, et al (2021). User-centred Design and Evaluation of Web and Mobile-based Traveling Applications.

Kamilia, Tarisa, Wati, Seftin Fitri Ana, Kartika, Dhian Satria Yudha (2024) Think Aloud and Heuristic Evaluation.

Kusuma, M., & Wijaya, A. (2023). The Effect of User-Based Design on User Satisfaction of Marketplace Applications in Indonesia. This study examines the effect of user-based design on user satisfaction of marketplace applications in Indonesia. The findings show that good UCD design has a positive impact on user satisfaction and loyalty.

Pratama, I., & Astuti, R. (2022). Designing Health Application with UCD Approach to Improve Elderly User Experience. This research uses the UCD approach to design health applications for the elderly, focusing on ease of navigation and accessibility. The results show an improvement in the comfort of elderly users in accessing the application.

Al-Irsyad Hospital Surabaya. (n.d.). *Medical Support Services*. Accessed from https://rs-alirsyadsurabaya.co.id/pelayanan/detail/penunjang-medik