

An Information Technology-Based Patient Registration System for Improving Service Quality at the Primary Clinic of the Semarang Health Polytechnic

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Publication Date: 2026/10/13

Abstract:

➤ Background:

The patient registration process, which is still carried out manually, can lead to duplicate entries, long lines, and long wait times, as well as increase the risk of data management errors. The use of information technology in the registration process has the potential to improve administrative efficiency and service quality. This study aims to develop an information technology-based patient registration system and analyze the effectiveness of its implementation on service quality at the Semarang Poltekkes Primary Clinic. The study used the Research and Development (R&D) method with a Rapid Application Development (RAD) approach. The development stages included needs identification, design, development, expert validation, and product testing. System validation was conducted by three experts using Aiken's V and the Intraclass Correlation Coefficient (ICC). The pilot test employed a one-group pretest-posttest design involving 100 respondents selected via purposive sampling. Service quality was measured using the five dimensions of SERVQUAL: tangibles, reliability, responsiveness, assurance, and empathy. Effectiveness was analyzed using the Wilcoxon Signed-Rank Test. The developed system achieved an Aiken's V content validity score of 0.89, classified as "very high." Expert assessment reliability showed a single-measure ICC of 0.999 and an average-measure ICC of 1.000. The system's feasibility assessment yielded an average score of 91.75%, classified as "highly feasible." The results of the Wilcoxon test showed a significant increase across all SERVQUAL dimensions, with a p-value of <0.005. The mean score for tangibles increased from 7.48 to 9.09; for reliability, from 7.48 to 9.05; for responsiveness, from 7.86 to 9.34; for assurance, from 7.43 to 8.91; and for empathy, from 7.31 to 8.93. Thus, the information technology-based patient registration system developed is deemed highly feasible, and its implementation showed significant differences across all SERVQUAL dimensions. The system has the potential to support a more structured, responsive, and accessible service process at the Primary Care Clinic.

Keywords: Patient Registration System; Information Technology; Quality of Care; SERVQUAL; Rapid Application Development.

How to Cite: Isti Nurkhasanah; Bedjo Santoso; Supriyadi (2026) An Information Technology-Based Patient Registration System for Improving Service Quality at the Primary Clinic of the Semarang Health Polytechnic. *International Journal of Innovative Science and Research Technology*, 11(10), 378-384. <https://doi.org/10.38124/ijisrt/26oct218>

I. INTRODUCTION

Digital transformation has become a vital part of healthcare development. The use of information technology can help healthcare facilities manage information, streamline administrative processes, improve data accuracy, and support decision-making. In healthcare, digitization is not limited to electronic medical records but also encompasses administrative processes such as patient registration and queue management [1,2].

The Poltekkes Semarang Primary Clinic still uses an offline system, which requires more time to retrieve patient

data. Similarly, the patient medical record system is still managed manually—by recording medical information on paper, which is then collected in a single location—making it more difficult to identify individual patients based on the records that have been created. The Semarang Poltekkes Primary Clinic, as a primary-level healthcare facility, still faces challenges in managing patient data and handling the registration process, both of which are conducted manually. These manual processes lead to inefficiencies, such as long wait times and difficulties in data recording, which can result in the loss or damage of information.

These conditions call for the integration of technology into the service systems at primary care clinics. The application of information technology in the healthcare sector has proven capable of improving administrative efficiency, reducing human error, and enhancing service quality and patient satisfaction. [3,4]. As the digital era continues to advance, the implementation of information technology (IT) in the healthcare sector has become an urgent necessity; information technology not only improves operational efficiency but also contributes to enhancing the quality of healthcare services [5]. An information technology-based registration system is a solution designed to automate the registration process—from data entry and appointment scheduling to the storage of patient data. Patients can register online without having to visit the clinic in person, which results in shorter wait times, faster service, and greater efficiency for administrative staff [6]. This aligns with research conducted by Utomo I et al., which states that through an information technology-based registration system, the registration process can be conducted online, allowing patients to register from home without having to visit the clinic. This reduces waiting times and long lines at the clinic, thereby improving service efficiency and reducing wait times [7].

The implementation of an information technology (IT)-based registration system at primary care clinics can improve operational efficiency, service quality, and ease of access to and management of patient data. Initial findings at the Poltekkes Semarang Primary Care Clinic indicate that some patients still seek care only after their condition has progressed, suggesting a need to strengthen promotive and preventive efforts. Based on visit data from January–June 2025, the average number of visits reached 21 patients per day for general, dental, and oral health services. This situation highlights the importance of providing easily accessible health education resources to improve public understanding of disease prevention and healthy lifestyle behaviors.

Adding a health education feature to the patient registration app is one strategy for expanding access to health promotion and prevention information. The use of digital media can increase public interest and participation in health education and effectively expand the dissemination of health messages [8]. Integrating the registration system with health education also allows information technology to be used not only for administrative purposes but also to support the rapid and targeted delivery of health information and education [9,10].

In addition to educational aspects, service quality is a key indicator of the success of health care services. Service quality encompasses the dimensions of reliability, responsiveness, assurance, empathy, and physical evidence, all of which influence patients' perceptions of service quality [11]. High-quality service has also been shown to have a positive impact on patient satisfaction, particularly in terms of the speed and accuracy of service [12]. A study at Saptosari Regional General Hospital showed that service quality has a significant effect on outpatient satisfaction, with a p-value of <0.05 [13]. Therefore, the development of an IT-based registration system at the Semarang Polytechnic of Health Sciences Primary

Clinic is expected to improve the efficiency of the registration process, the accuracy of data management, ease of access to services, and public health literacy.

This study focuses on the development and implementation of an IT-based patient registration system integrated with a health education module. The system involves clinic management, administrative staff, medical personnel, and patients to support more effective and efficient service delivery. Thus, the system is expected not only to serve as an administrative solution but also as a promotive and preventive tool in supporting improvements in service quality and public health at the Semarang Polytechnic of Health Sciences Primary Clinic.

II. RESEARCH METHODS AND SAMPLE

This study employed the Research and Development (R&D) method to develop an information technology-based patient registration system and test its use in clinical practice. The system was developed using the Rapid Application Development (RAD) approach.

The research phases included needs assessment, system design, application development, expert validation, and product testing. The RAD approach was chosen because it allows for user involvement in the development process and enables faster system refinement.

The developed system is web-based and designed to support three main user groups: patients, administrators/nurses, and doctors. Patients can register online and access health education, while staff can manage registration and service data according to their respective access rights.

The product trial involved 100 participants, consisting of 96 patients, one registration clerk, two doctors, and one paramedic. The study was conducted at the Semarang Poltekkes Primary Clinic from February to March 2026.

Respondents were selected based on inclusion criteria, including willingness to participate in the study, use of an information technology-based registration system, and the ability to use the system independently or with the assistance of a companion or staff member.

The system was evaluated using an instrument developed based on information system quality indicators and tailored to the study's needs. System validation was performed by three experts: an information technology expert, a medical records expert, and a service quality expert.

Service quality was measured using a questionnaire consisting of 15 statements based on the five dimensions of SERVQUAL, namely:

- Tangibles;
- Reliability;
- Responsiveness;
- Assurance;

- Empathy.

Measurements were taken using a 1–4 Likert scale.

III. RESULTS

➤ Information Collection Result

The results of information gathered through interviews with informants indicate that the patient registration process at the Semarang Poltekkes Primary Clinic is still conducted manually and has not yet been integrated with the existing record-keeping system. Patients must go through several steps, starting from registration at the counter, filling out forms, to waiting in line, while staff members manually re-enter the data into the application. This situation makes the service process less efficient and increases the risk of data entry errors.

In addition, patient wait times tend to increase during peak visit periods because the speed of the registration process does not keep pace with the number of patients. Patient data obtained through manual registration is also not entirely complete or accurate, requiring staff to double-check or reconfirm the information. The existing record-keeping application essentially facilitates the digital storage and retrieval of data but is not yet directly linked to the registration process.

Overall, there are three main issues in the registration process: long lines, duplicate data entry—which increases the workload and extends service times—and the lack of integration between the registration system and the patient data recording system. These findings highlight the need to develop an integrated, information technology-based registration system to improve the efficiency of service delivery, reduce wait times, and enhance the completeness and accuracy of patient data.

➤ Design and Development

The findings of the information gathering process indicate that the patient registration process at the Semarang Poltekkes Primary Clinic is still conducted manually and has not yet been integrated with the existing record-keeping system. This situation leads to long lines, long wait times, redundant data entry, and potential data inaccuracies. In response to these issues, an information technology-based patient registration system was developed to improve the speed, accuracy, and efficiency of service delivery.

The system was designed using the Rapid Application Development (RAD) method, which consists of three main stages: requirement planning, system design, and implementation. During the requirement planning stage, the system requirements were defined as follows: online patient registration; integration of registration data with patient records; reduction of repetitive data entry; improvement of data accuracy; and provision of information on health services and education.

During the system design phase, a web-based application was developed that can be used by patients, administrators/nurses, and doctors according to their respective access rights. Patients can register online, select a clinic and appointment time, and receive a queue number and registration confirmation. Administrators and nurses can manage patient data and queues and perform initial documentation, while doctors can access patient data and record examination results in the electronic medical record. The system also includes a health education section to provide promotive and preventive health information.

System outputs include patient registration data and queue numbers, a queue dashboard, patient data and initial assessments, electronic medical records, reports, and visit histories. During the implementation phase, the design was developed into a web-based application and tested to ensure the system functions according to user needs. The developed system is expected to support a more integrated, effective, and efficient service process at the Semarang Poltekkes Primary Clinic.

➤ Expert Validation

The expert validation panel consisted of three validators: an information and technology (IT) expert, a medical records expert, and a healthcare quality expert. The assessment was conducted using a product/model feasibility analysis questionnaire with the following rating categories: highly feasible, feasible, somewhat feasible, not feasible, and highly not feasible. The results were tested using Aiken's V and the Intraclass Correlation Coefficient (ICC), as shown in the following table:

- Validity Test

Table 1 Expert Validation

Item	Score	Interpretation
1	1,00	Very High
2	1,00	Very High
3	0,83	Very High
4	0,833	Very High
5	0,92	Very High
6	1,00	Very High
7	0,917	Very High
8	0,917	Very High
9	0,833	Very High
10	0,917	Very High

11	1,00	Very High
12	0,917	Very High
13	0,75	High
14	0,833	Very High
15	0,917	Very High
16	0,917	Very High
17	0,75	High
18	0,833	Very High
19	0,833	Very High
20	0,833	Very High
21	0,917	Very High
Mean	0,89	Very High

Based on table 1, the results of the expert validity assessment using Aiken's V approach showed a value of 0.89, which falls into the "very high validity" category. Most test items scored ≥ 0.80 , which falls into the "very high" category, indicating a very high level of agreement among validators

regarding the instrument's content alignment with the aspects being measured. Several items, such as items 13 and 17, scored 0.75; however, this still falls within the "high" category, so they are still considered valid and suitable for use.

Table 2 Reliability Test Results

type of measurement	ICC	Nilai Sig. ($p < 0,05$)	Criteria
Single Measure	0,999	0,000	Sangat Baik
Average Measure	1,000	0,000	Sangat Baik

**Interclass Correlation Coefficient*

Based on table 2, presents the results of the reliability test using the Intraclass Correlation Coefficient (ICC) method. The analysis results show an ICC value of 0.999 for single measures and 1.000 for average measures, with a significance value of 0.000 ($p < 0.05$). An ICC value ≥ 0.90 indicates very good reliability, and a significance value < 0.05 indicates statistically significant results.

Based on these test results, it is evident that the experts' assessment of the development of the Information Technology-Based Patient Registration System exhibits a

very high level of consistency. Thus, the assessment instrument used in this study is deemed reliable..

➤ Product Result

This study was conducted at the Semarang Poltekkes Primary Care Clinic and involved 100 respondents, of whom 96 were patients receiving care at the clinic, 1 was a registration clerk, 2 were doctors, and 1 was a paramedic. The study was conducted over a one-month period from February to March 2026.

Table 3 Frequency Distribution of Gender Characteristics of Respondents

Characteristics	N	F%
Male	45	45,0
Female	55	55,0

Table 3 Based on the analysis of the gender distribution of the respondents, it was found that the majority of respondents were female, totaling 55 people (55.0%). This

indicates that the respondents in this study were predominantly female, although the proportions between the two groups were still relatively balanced.

Table 4 Analysis of Service Quality Effectiveness

SERVQUAL dimation	Pretest	Posttest	Improvement	Asymp. Sig	*p-value
Tangibles	7,48	9,09	1,61	0,000	$< 0,05$
Reliability	7,48	9,05	1,57	0,000	$< 0,05$
Responsiveness	7,86	9,34	1,48	0,000	$< 0,05$
Assurance	7,43	8,91	1,48	0,000	$< 0,05$
Empathy	7,31	8,93	1,62	0,000	$< 0,05$

Based on Table 4, the analysis of service quality effectiveness using the Wilcoxon test revealed a significant difference between the pretest and posttest scores across all SERVQUAL dimensions. In the Tangibles dimension, the average score increased from 7.48 on the pretest to 9.09 on the posttest, an increase of 1.61. The results of the Wilcoxon test showed an Asymp. Sig. value of 0.000 ($p < 0.05$), indicating a

significant difference between the pre- and post-intervention assessments. In the Reliability dimension, the score increased from 7.48 to 9.05, representing an increase of 1.57. The Asymp. Sig. value of 0.000 ($p < 0.05$) indicates that this increase is statistically significant. These results indicate that there was a change in respondents' assessments of the service provider's ability to deliver services consistently, accurately,

and as promised. The Responsiveness dimension showed a score increase from 7.86 on the pretest to 9.34 on the posttest, representing an increase of 1.48. The Wilcoxon test yielded an Asymp. Sig. value of 0.000 ($p < 0.05$).

Thus, there was a significant difference between the pre- and post-intervention scores regarding service responsiveness. The posttest score of 9.34 also indicates that this dimension received the highest rating after the intervention. In the Assurance dimension, the average score increased from 7.43 to 8.91, representing an increase of 1.48. The Asymp. Sig. value of 0.000 ($p < 0.05$) indicates a significant difference between the pretest and posttest results. This suggests an improvement in the assessment of the service assurance aspect, including competence, politeness, and the ability to instill a sense of trust and security in respondents. Meanwhile, the Empathy dimension showed the largest increase, rising from 7.31 on the pretest to 8.93 on the posttest—an increase of 1.62. The results of the Wilcoxon test showed an Asymp. Sig. value of 0.000 ($p < 0.05$), confirming that this change is statistically significant. These findings indicate an improvement in respondents' assessments of the staff's attentiveness, concern, and ability to understand individual needs.

IV. DISCUSSION

➤ Identification and Documentation of Previous Reporting Practices

The information-gathering phase was conducted through interviews with registration staff, nurses, and doctors, as well as observations at the Semarang Poltekkes Primary Clinic. The findings revealed that, prior to the implementation of information technology, the registration system was still conducted manually—from filling out forms and re-entering data by staff to searching for patient records. These conditions led to inefficient service processes, long lines during peak hours, an increased workload for staff, and the risk of errors and data duplication. Furthermore, the registration system was not integrated with patient service records, which slowed down the service process and resulted in relatively long patient wait times.

These findings are consistent with previous research showing that manual registration systems have limitations in terms of efficiency, accuracy, and speed of service, as they carry the risk of data duplication and recording errors. Conversely, the implementation of an information technology-based registration system can expedite service processes, improve work efficiency, and enhance the quality of information and patient satisfaction.

The results of the observation also indicate that the clinic does not yet have health education materials that are easily accessible to patients. In fact, primary health care is oriented not only toward curative aspects but also toward promotive and preventive aspects. Therefore, the development of an information technology-based registration system integrated with patient records and health education features is necessary to support faster, more accurate, more efficient, and patient-centered services..

➤ Design and Expert Validation

The system design in this study utilized the Rapid Application Development (RAD) method, as it allows for phased development with direct user involvement. The requirements planning phase was conducted through observation and interviews to identify the needs of staff and healthcare workers. The results served as the basis for designing a digital registration system that is simpler, faster, and aligned with the service workflow at the Semarang Poltekkes Primary Clinic.

During the design phase, the system was designed with a simple and user-friendly interface, including features for login, digital registration, patient data management and search, service information, health education, and digital data storage. These features were developed to reduce redundant record-keeping, speed up data retrieval, and support promotive and preventive care. Subsequently, during the implementation phase, the system was tested and validated by experts based on functionality, appearance, and ease of use. The validation results showed Aiken's V scores in the high to very high categories and excellent ICC reliability, thereby deeming the system suitable for use.

The system developed is a standalone system, meaning that the entire process—including registration, data management, information storage, and health education—is carried out on a single platform without integration with external systems. This model was chosen because it aligns with the clinic's needs and is simpler to implement. Overall, the application of the RAD method allows for iterative system development tailored to user needs. This is consistent with previous research indicating that user involvement in every stage of RAD development can result in a system that is more relevant, effective, and easy to implement in healthcare services [14,15].

➤ Product Result Test

The results of the study indicate differences between conditions before (pretest) and after (posttest) the implementation of an information technology-based patient registration system at the Semarang Poltekkes Primary Clinic. Descriptively, there was an increase in the average scores across all measured aspects, including physical evidence or appearance and service facilities (tangibles), service reliability, service responsiveness, service assurance, and service empathy.

• Analysis of Service Aspect Effectiveness

Based on the results of the effectiveness test using the Wilcoxon Signed-Rank Test, all aspects of service quality showed a significance value of 0.000 ($p < 0.05$). These results indicate that the implementation of an information technology-based patient registration system has a significant impact on improving service quality at the Semarang Poltekkes Primary Clinic. The increase in average scores across all SERVQUAL dimensions indicates that the use of the application helps make services faster, more organized, and easier to use for both patients and staff. The "responsiveness" dimension showed the greatest improvement, indicating that the digital system is most effective in accelerating service processes and reducing patient

wait times. In addition, improvements in the reliability and assurance aspects indicate that the system helps enhance the accuracy of service delivery and patient data management. Meanwhile, improvements in the tangibles and empathy aspects indicate that the use of the system provides a service experience that is more comfortable, modern, and easy for patients to understand.

Based on these results, it can be concluded that the implementation of the application not only serves as an administrative tool for service delivery but also has a tangible impact on improving the quality of healthcare services. This improvement demonstrates that the digitization of services has a tangible impact on the patient experience during the delivery of healthcare services. Before the system was implemented, administrative processes were conducted manually, resulting in slower and less efficient service delivery. After the system was implemented, the registration process became faster, patient data became more accessible, and the service workflow became more organized. The integrated and user-friendly system has helped create services that are more effective, efficient, and patient-centered.

This view is consistent with previous research indicating that the implementation of digital information systems can speed up service delivery, improve data accuracy, reduce patient wait times, and increase the satisfaction of healthcare service users. The research also indicates that healthcare information systems help make service delivery more effective because the process of managing patient data is conducted in an integrated and more structured manner [16].

• Health Education Features

The health education features within the system provide added value by supporting services that are not only administratively oriented but also focus on promotive and preventive aspects. Although these features were not the primary variables tested, their presence allows patients to access health information more easily during the course of their care. Thus, the developed application serves not only as a platform for patient registration but also as a tool to enhance access to health information.

The implementation of educational features shifts the delivery of information from conventional methods—such as verbal communication, leaflets, and posters—to more practical and easily accessible digital media. Patients can review educational materials as needed while using the app, ensuring that health information is not limited to the time of their appointment. The use of this technology also enhances the convenience and flexibility of accessing information and expands the system's functionality in supporting patient-centered healthcare services.

These findings are consistent with previous research showing that digital health apps can be used as a promotional tool to encourage clean and healthy living behaviors [17]. Other studies have also shown that Android-based health education can improve users' understanding of and interest in health information because the material is presented in a more effective, practical, and interactive manner [18]. Thus,

integrating health education features into the registration system can provide added value in supporting promotive and preventive efforts at healthcare facilities.

V. CONCLUSION

Based on the research findings, it can be concluded that an information technology-based patient registration system is feasible and effective for improving the quality of service at the Semarang Poltekkes Primary Clinic. The findings indicate that the previous system still faced challenges such as manual processes, duplicate record-keeping, long lines, and long wait times for service.

The system was successfully developed using the Rapid Application Development (RAD) method, featuring digital registration, patient data management and search, service information, and health education. Expert validation yielded an Aiken's V score of 0.89, classified as "very high," while the reliability test using the ICC showed good results, thereby confirming the system's suitability for use.

The implementation of the system was proven to improve all dimensions of service quality as measured by SERVQUAL. The Wilcoxon test results showed a p-value of 0.000 ($p < 0.05$) for the dimensions of Tangibles (7.48 to 9.09), Reliability (7.48 to 9.05), Responsiveness (7.86 to 9.34), Assurance (7.43 to 8.91), and Empathy (7.31 to 8.93). Thus, the information technology-based registration system effectively improves service quality, particularly by speeding up processes, increasing orderliness, and providing convenience for both patients and staff.

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