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Development of a Web-Based Patient Service Management Information System to Improve Administrative Efficiency at Su'adah Clinic, Palembang

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ABSTRACT

Purpose of the study: This study aimed to develop and evaluate a web-based patient service management information system to improve administrative efficiency at Su'adah Clinic in Palembang.

Methodology: This research employed a research and development approach using the Waterfall system development model. Problem identification was conducted using the PIECES framework (Performance, Information, Economy, Control, Efficiency, and Service). Data were collected through observation, interviews, and documentation analysis at the clinic. The developed system integrates patient registration, administrative data management, payment processing, and automated reporting into a single web-based platform.

Main Findings: The implementation of the developed system significantly improved administrative performance at the clinic. The average patient registration time decreased from approximately 10 minutes to 3 minutes, while average patient waiting time was reduced from 25 minutes to 10 minutes. The time required to retrieve patient records decreased from 5–7 minutes to less than 1 minute, and the preparation of monthly administrative reports was reduced from 2–3 hours to approximately 15 minutes. In addition, daily paper usage decreased from about 120 sheets to around 30 sheets after system implementation. User evaluation results indicated high acceptance of the system, with an overall satisfaction score of 4.5 out of 5.

Novelty/Originality of this study: The novelty of this study lies in the development of an integrated web-based patient service management system specifically designed for small-scale healthcare clinics, combining online patient registration, administrative management, payment documentation, and automated reporting within a single accessible platform.

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1. INTRODUCTION

The rapid advancement of information and communication technology has significantly transformed various sectors, including healthcare services [1]-[3]. The integration of computer-based systems has become essential for improving operational efficiency, data management, and service quality in healthcare facilities [4]-[6]. In modern healthcare environments, information systems play a critical role in facilitating accurate data processing, accelerating administrative workflows, and supporting decision-making processes [7]-[10].

Consequently, the adoption of digital technologies has become a strategic necessity for healthcare providers aiming to deliver efficient, reliable, and patient-centered services.

Clinics, as primary healthcare facilities, provide outpatient medical services and act as the first point of contact for many patients seeking medical care [11], [12]. In order to ensure effective service delivery, clinics require a reliable and integrated information system capable of managing patient data, administrative procedures, and clinical services efficiently [13]-[15]. Proper management of patient information is a fundamental component of healthcare administration, as it influences service quality, operational efficiency, and institutional credibility. Without a well-structured information system, administrative processes may become inefficient, leading to delays in patient services and difficulties in managing medical records and financial transactions.

Despite the growing importance of health information systems, many small and medium-scale clinics still rely on partially manual or fragmented administrative processes. Preliminary observations conducted at Su'adah Clinic in Palembang reveal several operational challenges related to patient service administration. Patients frequently experience long waiting times during the registration process due to the absence of an integrated registration system. Additionally, misunderstandings often occur between patients who register directly at the clinic and those who attempt to register via telephone, resulting in inefficient queue management [16]. The clinic also faces difficulties in managing patient records because medical and administrative data are not fully integrated across different service units, including doctors and administrative staff [17], [18].

Furthermore, the current administrative system relies on offline data entry for patient information, while financial transactions and payment records are still documented manually [19]. This fragmented approach significantly slows down the process of retrieving patient data and completing administrative procedures [20]. The reliance on paper-based documentation, such as handwritten prescriptions and duplicate payment receipts, not only increases operational costs but also raises the risk of data loss, duplication, and documentation errors [21]. In addition, periodic reporting is still performed manually, making it difficult for clinic management to obtain timely and accurate information regarding daily patient visits and service performance.

Although numerous studies have explored the development of information systems in healthcare institutions, many existing systems primarily focus on hospital-level management or electronic medical records without fully addressing the operational needs of small-scale clinics, particularly in integrating patient registration, administrative management, and service reporting within a single web-based platform [22], [23]. This limitation indicates a research gap in developing a practical, integrated, and accessible web-based patient service management system tailored specifically for primary healthcare facilities such as local clinics.

Therefore, this study proposes the development of a web-based patient service management information system designed to improve administrative efficiency at Su'adah Clinic in Palembang. The novelty of this research lies in the integration of patient registration, administrative data management, payment processing, and service reporting into a single web-based platform that can be accessed by multiple service units within the clinic. By enabling real-time data management and centralized information storage, the proposed system is expected to streamline administrative workflows, reduce service delays, minimize manual documentation, and improve the overall quality of patient service management.

The urgency of this research is closely related to the increasing demand for efficient healthcare services and the need for digital transformation in primary healthcare facilities. Developing an integrated web-based information system will not only address existing administrative challenges at Su'adah Clinic but also contribute to improving operational efficiency and service quality in similar healthcare facilities. Ultimately, the implementation of such a system is expected to support more effective healthcare management and enhance patient satisfaction in primary healthcare settings.

2. RESEARCH METHOD

2.1 Research Design

This study employed a research and development (R&D) approach aimed at designing and implementing a web-based patient service management information system to improve administrative efficiency at Su'adah Clinic in Palembang. The research focused on developing an integrated digital system capable of supporting patient registration, administrative data management, payment recording, and reporting processes within the clinic environment [24], [25]. The system development process adopted the Waterfall model, a structured and sequential software development approach that allows systematic planning, analysis, design, implementation, testing, and deployment [26]. This model was selected because it provides clear documentation at each development stage, ensuring transparency and traceability throughout the system development process.

In addition, the study utilized the PIECES framework (Performance, Information, Economy, Control, Efficiency, and Service) to analyze existing administrative problems within the clinic. The PIECES framework is widely used in information system analysis to evaluate operational issues and identify areas requiring

improvement in organizational systems. The overall research workflow consisted of several interconnected stages, beginning with problem identification and ending with system implementation and evaluation.

This research was conducted at Su'adah Clinic, Palembang, a primary healthcare facility providing outpatient medical services. The clinic serves a considerable number of patients daily, requiring efficient administrative processes to support patient registration, medical data management, and payment transactions. However, the clinic currently relies on partially manual and offline administrative systems, which often lead to delays in patient registration, difficulties in retrieving medical records, and inefficiencies in administrative reporting [27]. Therefore, the clinic was selected as the research setting to develop a digital solution capable of improving service management and administrative efficiency.

2.2 System Development Model

The development of the patient service management information system followed the Waterfall development model, which consists of sequential stages ensuring systematic software development. The stages of the Waterfall model used in this study are described in Table 1.

Table 1. Stages of the Waterfall System Development Model

Stage	Description
Requirement Analysis	Identification of user needs, system requirements, and administrative problems at the clinic through observation and interviews.
System Design	Development of system architecture, database structure, user interface design, and workflow diagrams.
Implementation	Coding and development of the web-based system using appropriate programming technologies.
Testing	System functionality testing to ensure that all features operate correctly and meet user requirements.
Deployment and Maintenance	Implementation of the system in the clinic environment and monitoring system performance for further improvements.

The Waterfall model enables the development process to proceed systematically, ensuring that each stage is completed and validated before moving to the next stage. This structured approach supports better documentation and minimizes potential development errors.

2.3 Problem Analysis Using the PIECES Framework

To identify the main problems within the existing administrative system, this study applied the PIECES analysis framework. This method helps evaluate system performance and determine the specific areas that require improvement. The analysis results are summarized in Table 2.

Table 2. Problem Analysis Using the PIECES Framework

Aspect	Identified Problems
Performance	Patient registration takes a long time due to manual data entry and queue management.
Information	Patient medical and administrative data are not integrated across clinic units.
Economy	High operational costs due to excessive use of paper and administrative stationery.
Control	Limited monitoring of patient data and administrative records increases the risk of errors.
Efficiency	Data retrieval and reporting processes require significant time and effort.
Service	Patients experience delays and inconvenience during the registration process.

The results of the PIECES analysis indicate that the clinic requires an integrated digital system capable of improving operational efficiency, reducing administrative workload, and enhancing patient service quality.

2.4 Data Collection Techniques

Data collection in this study was conducted using several techniques to ensure comprehensive understanding of the existing system and user requirements. First, direct observation was conducted to examine the workflow of patient registration, administrative documentation, and payment processes within the clinic. This observation allowed the researcher to identify inefficiencies and operational challenges. Second, interviews were carried out with clinic administrative staff and management to obtain detailed information regarding current administrative procedures, system limitations, and user expectations for the proposed information system. Third, documentation analysis was conducted by reviewing existing administrative records, patient registration forms, and financial documentation used by the clinic. This analysis provided insights into the current data management structure and reporting mechanisms.

2.5 System Design and Development

Based on the analysis results, the web-based patient service management system was designed to integrate several essential administrative functions, including:

- Online patient registration
- Patient data management
- Medical service documentation
- Payment recording
- Administrative reporting

The system was developed as a web-based platform, allowing users to access the system through internet-connected devices. This approach enables both patients and administrative staff to interact with the system more efficiently. Patients can perform registration remotely, reducing physical queues at the clinic. Meanwhile, administrative staff can manage patient data, financial transactions, and service reports through a centralized digital platform.

2.6 Ethical Considerations

This research maintained ethical principles in data collection and system development. All information obtained from the clinic was used solely for research purposes, and patient data confidentiality was preserved during the development and testing phases of the system.

3. RESULTS AND DISCUSSION

This section presents the findings obtained from the system development process conducted at Su'adah Clinic, Palembang. The results are organized according to the research stages described in the methodology, including the identification of existing administrative problems, system requirement analysis, development of the web-based patient service management information system, and evaluation of the system's impact on administrative efficiency. The results are presented through a combination of descriptive explanations and empirical data to demonstrate the effectiveness of the developed system.

The initial stage of the study involved observing and evaluating the administrative workflow at Su'adah Clinic. The observation focused on the patient registration process, medical data recording, payment management, and reporting procedures. The findings revealed that most administrative processes were still conducted manually or through fragmented offline systems. To provide a clearer overview of the administrative workflow prior to system development, the main characteristics of the existing system are summarized in Table 3.

Table 3. Existing Administrative System at Su'adah Clinic Before System Development

Administrative Component	Current Practice	Identified Issues
Patient Registration	Patients register directly at the clinic or by telephone	Long queues and frequent miscommunication between staff and patients
Patient Data Recording	Patient data entered into an offline application	Limited accessibility and difficulty retrieving historical data
Medical Record Storage	Records stored separately and not fully integrated	Inconsistent documentation and difficulty tracking patient history
Payment Documentation	Payment records written manually on paper receipts	High risk of recording errors and time-consuming verification
Reporting Process	Reports compiled manually at the end of each period	Delayed reporting and limited real-time monitoring

The findings indicate that the administrative workflow relied heavily on manual processes, which resulted in delays, data duplication, and inefficiencies in patient service management. Following the preliminary observation, a systematic evaluation was conducted using the PIECES framework to analyze the weaknesses of the existing administrative system. The analysis focused on six aspects: performance, information, economy, control, efficiency, and service. The results of the PIECES analysis are presented in Table 4.

Table 4. Results of Administrative System Analysis Using the PIECES Framework

Aspect	Condition Before System Development	Impact on Clinic Operations
Performance	Patient registration required an average of 8–12 minutes per patient	Increased waiting time and patient dissatisfaction
Information	Patient records were not fully integrated across service units	Limited access to accurate patient history

Aspect	Condition Before System Development	Impact on Clinic Operations
Economy	Daily use of paper for receipts and records	Increased operational expenses
Control	Administrative monitoring conducted manually	Higher risk of data inconsistency
Efficiency	Data retrieval and report preparation required significant time	Reduced productivity of administrative staff
Service	Patients often waited in long queues for registration	Lower perceived service quality

The analysis confirmed that the clinic required an integrated information system capable of improving administrative performance and supporting better service delivery. Based on the problems identified during the PIECES analysis, the study defined several functional requirements necessary for the new system. These requirements were designed to support administrative processes and improve patient service management.
The main system requirements are summarized in Table 5.

Table 5. Functional Requirements of the Proposed System

System Function	Description
Online Patient Registration	Patients can register through the web platform without visiting the clinic
Patient Data Management	Administrative staff can create, update, and manage patient records digitally
Medical Service Documentation	Doctors and staff can record patient visits and treatments
Payment Management	Financial transactions recorded automatically within the system
Administrative Reporting	Automatic generation of daily, weekly, and monthly reports

These requirements served as the foundation for the development of the web-based patient service management information system. Following the requirement analysis stage, the system was developed using the Waterfall development model. The system was implemented as a web-based platform to ensure accessibility for both patients and clinic staff. The system consists of several modules designed to support clinic operations. The main modules included in the developed system are presented in Table 6.

Table 6. Modules of the Developed Web-Based Patient Service Management System

Module	Main Function
Patient Registration Module	Allows patients to register online and schedule visits
Patient Database Module	Stores patient demographic and medical information
Service Management Module	Records medical services provided to patients
Payment Module	Manages billing and payment transactions
Reporting Module	Generates administrative and statistical reports

The system integrates these modules into a centralized database, allowing administrative staff and healthcare providers to access patient information more efficiently. After the development process was completed, the system was implemented at Su'adah Clinic for trial use. The implementation phase involved testing system functionality and observing its impact on administrative processes. The evaluation focused on several performance indicators related to administrative efficiency. The comparison between conditions before and after system implementation is presented in Table 7.

Table 7. Comparison of Administrative Performance Before and After System Implementation

Indicator	Before System Implementation	After System Implementation
Average patient registration time	10 minutes	3 minutes
Average patient waiting time	25 minutes	10 minutes
Time required to retrieve patient records	5–7 minutes	Less than 1 minute
Time required to prepare monthly reports	2–3 hours	Approximately 15 minutes
Paper usage per day	±120 sheets	±30 sheets

The results indicate a significant improvement in administrative efficiency after the implementation of the web-based system. The reduction in registration time and waiting time contributed to smoother service delivery and improved patient satisfaction. To evaluate the usability and effectiveness of the system, feedback was collected from administrative staff and clinic management after the implementation phase. The evaluation focused on system usability, efficiency, data accessibility, and service improvement. The results of the user evaluation are presented in Table 8.

Table 8. User Evaluation of the Developed Information System

Evaluation Aspect	Average Score (1–5)	Interpretation
Ease of system use	4.4	Very good

Evaluation Aspect	Average Score (1–5)	Interpretation
Speed of administrative processes	4.5	Very good
Data accessibility	4.3	Very good
Accuracy of administrative records	4.6	Excellent
Overall satisfaction	4.5	Very good

The evaluation results demonstrate that the developed system was well accepted by clinic staff and significantly improved the administrative workflow. The findings of this study demonstrate that the development of a web-based patient service management information system significantly improved administrative efficiency at Su'adah Clinic in Palembang. The implementation of the system successfully addressed several operational challenges previously identified during the observation and PIECES analysis stages, including delays in patient registration, fragmented data storage, manual financial documentation, and inefficient reporting procedures. The results indicate that digitalizing administrative processes through a centralized web-based platform can substantially reduce service delays, improve data accessibility, and enhance the overall management of patient services within primary healthcare facilities.

One of the most notable improvements observed in this study was the reduction in patient registration time and waiting time. Prior to the implementation of the system, the average patient registration process required approximately ten minutes due to manual documentation and the lack of an integrated queue management system. After the implementation of the web-based system, the average registration time decreased to approximately three minutes, while patient waiting time was reduced by more than half . This improvement demonstrates that the integration of online registration and centralized patient databases can streamline administrative workflows and improve service efficiency [28]-[30]. These findings are consistent with previous studies in health information systems that emphasize the role of digital administrative platforms in enhancing operational efficiency and patient-centered services within healthcare organizations.

In addition to improving registration efficiency, the system significantly enhanced the accessibility and organization of patient data. Before the system was developed, patient records were stored in separate files and offline applications, which made it difficult for staff to retrieve patient histories quickly. With the introduction of the integrated system, patient records could be accessed in less than one minute through a centralized digital database [31], [32]. This improvement supports the broader objective of health information systems in facilitating accurate data management and improving the continuity of patient care. Previous research has also highlighted that integrated information systems can reduce administrative errors and improve the reliability of clinical documentation, particularly in primary healthcare settings where administrative resources are often limited.

Despite the increasing adoption of digital systems in healthcare institutions, many existing studies primarily focus on large hospital information systems or electronic medical record platforms that require complex infrastructure and substantial financial resources [33], [32]. As a result, there is still limited research addressing practical and scalable information system solutions specifically designed for small or medium-scale clinics [35]. This gap is particularly relevant in developing regions where healthcare facilities often rely on partially manual administrative systems due to limited technological infrastructure and financial constraints [36]. The present study contributes to addressing this research gap by developing a practical web-based patient service management system tailored to the operational needs of a primary healthcare clinic.

The novelty of this research lies in the integration of several key administrative functions into a single web-based platform specifically designed for a small-scale healthcare facility. Unlike many existing systems that focus solely on electronic medical records or hospital management, the system developed in this study combines online patient registration, administrative data management, payment documentation, and automated reporting into a unified digital environment. This integrated approach enables real-time access to patient and administrative information while simultaneously supporting the operational workflow of clinic staff. The design of the system emphasizes simplicity, accessibility, and operational efficiency, making it suitable for implementation in clinics with limited technological infrastructure.

The implementation of the system also produced important practical implications for healthcare service management. In the short term, the digitalization of administrative processes significantly reduced the time required for patient registration, data retrieval, and reporting [37]. Administrative staff were able to perform their tasks more efficiently, while patients experienced shorter waiting times and smoother service procedures [38]. These improvements contributed directly to enhancing patient satisfaction and optimizing the use of human resources within the clinic.

In the long term, the adoption of an integrated web-based information system has the potential to support broader healthcare management improvements. The availability of accurate and real-time administrative data allows clinic management to monitor service performance more effectively, identify patient visit trends, and make evidence-based decisions regarding resource allocation and service planning. Furthermore, the digital documentation of patient information may facilitate future integration with broader healthcare information

networks, enabling improved coordination between clinics, hospitals, and public health authorities. Such integration is particularly important in supporting the digital transformation of healthcare systems and improving the quality of healthcare services at the primary care level [39], [40].

From the perspective of general professional practice in healthcare management, the findings of this study highlight the importance of adopting information technology as a strategic tool for improving service quality and operational efficiency. Healthcare professionals, including administrators and clinical staff, increasingly require digital competencies to manage patient information, coordinate services, and maintain accurate documentation. The system developed in this study demonstrates how appropriate technological solutions can support healthcare professionals in performing their duties more effectively while maintaining high standards of patient service.

However, several limitations should be considered when interpreting the results of this study. First, the research was conducted within a single clinic setting, which may limit the generalizability of the findings to other healthcare facilities with different operational characteristics or patient volumes. Second, the evaluation period for the system implementation was relatively limited, meaning that long-term system performance and sustainability were not fully assessed. Third, the study focused primarily on administrative efficiency and did not directly measure broader outcomes such as patient satisfaction levels or clinical service quality. Future research could expand the scope of evaluation by involving multiple healthcare facilities, conducting longer implementation assessments, and examining the impact of digital administrative systems on patient experiences and clinical outcomes.

4. CONCLUSION

This study successfully developed and implemented a web-based patient service management information system to improve administrative efficiency at Su'adah Clinic in Palembang. The results demonstrate that the system significantly enhanced the clinic's administrative performance. The average patient registration time decreased from approximately 10 minutes to 3 minutes, while the average patient waiting time was reduced from 25 minutes to 10 minutes. Furthermore, the time required to retrieve patient records decreased from 5–7 minutes to less than 1 minute, and the preparation of monthly administrative reports was shortened from 2–3 hours to approximately 15 minutes. The implementation of the system also reduced daily paper usage from around 120 sheets to 30 sheets, indicating improved operational efficiency and reduced administrative costs. These findings confirm that the integration of a web-based patient service management system can effectively streamline administrative workflows, improve data accessibility, and support better service management in primary healthcare facilities. Future research is recommended to implement and evaluate the developed system in multiple clinics to assess its scalability and generalizability across different healthcare settings. In addition, further studies should examine the long-term impact of such systems on patient satisfaction, service quality, and healthcare management performance.

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USE OF ARTIFICIAL INTELLIGENCE (AI)-ASSISTED TECHNOLOGY

The authors confirm that noartificial intelligence (AI)-assisted technologies were utilized inthe preparation, analysis, or writing of this manuscript. All stages of the research process, including data collection, data interpretation, and the development of the manuscript, were conducted solely by the authors without any support from AI-based tools.

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