

Web-Based System Design And Implementation For Optimizing Pharmaceutical Logistics Management

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ABSTRACT

Medication logistics management plays a crucial role in supporting healthcare services, particularly in ensuring the availability of medicines at community health centers. However, the Sei Kepayang Barat Community Health Center still faces several challenges due to the use of manual systems in recording, monitoring, and reporting pharmaceutical data. These limitations often result in data inconsistencies, delays in information processing, and difficulties in tracking drug stock in real time. This study aims to design and implement a web-based pharmaceutical logistics information system to improve the effectiveness and efficiency of drug management processes. The research employed a qualitative approach through observation, interviews, and literature review to identify system requirements and existing problems. The system was developed using PHP and MySQL, with system design modeled through Unified Modeling Language (UML), flowcharts, and Entity Relationship Diagrams (ERD). The results indicate that the implemented system is capable of integrating key processes, including drug inventory management, procurement, distribution, and reporting. Furthermore, the system enables real-time monitoring of stock levels, reduces human error in data entry, and accelerates report generation. Overall, the web-based system contributes to improving the accuracy, transparency, and efficiency of pharmaceutical logistics management at the health center, thereby supporting better decision-making and enhancing the quality of healthcare services.

INTRODUCTION

Rapid advancements in information technology have brought about significant changes in many aspects of human life (Mukti et al., 2021). The world has now fully entered the digital age, where nearly all human activities rely on technology to simplify tasks, accelerate communication, and enhance work efficiency (Firmansyah & Zhang, 2025). Digital transformation is occurring not only in the industrial and business sectors but also in government, education, and healthcare (Adam et al., 2025). Advances in information technology, particularly web-based technologies, enable data management and exchange to be conducted quickly, efficiently, and in real-time (Nur Anisa et al., 2025). With web-based systems, various administrative activities can be performed anytime and anywhere, without being limited by time or location (Ramadhan & Valentino, 2024). These benefits make web-based systems a crucial foundation for creating more effective, transparent, and accountable public services (Fuad Lubis et al., 2024). Furthermore, the use of information technology also drives a shift in the work paradigm from manual processes to digital automation, thereby facilitating the objective monitoring and measurement of every process (Mutiara, 2023). In the healthcare sector, the use of information technology plays a crucial role in supporting service delivery, administration, and resource management (Nur Sa'adah & Voutama, 2023).

Community health centers, as the frontline of public health services, must be able to provide fast, accurate, and effective services to optimally meet the health needs of the community (Hanifah et al., 2022). One of the key aspects in ensuring the success of health services is proper medication logistics management (Halimah & Suintin, 2020). Sufficient availability of the right types of medications at the right time significantly impacts the quality of care provided to patients (Wijianto, 2021). Medication shortages can hinder patient care, while excess stock can lead to waste and potential expiration. Therefore, the use of a web-based information system is a strategic step to improve the effectiveness and efficiency of pharmaceutical logistics management. Through a web-based system, all management processes can be integrated across the warehouse, pharmacy, and administrative departments, thereby minimizing human error in record-keeping and reporting.

However, at the Sei Kepayang Barat Community Health Center, medication logistics management is still done manually and is not yet supported by an integrated system capable of monitoring medication availability in real time. Staff rely solely on simple records to track incoming and outgoing medication, leading to frequent discrepancies between the records and the actual physical inventory in the warehouse. Additionally, the process of monitoring



medication availability is reactive rather than proactive, as there are no digital tools available to provide early warnings when stock levels are running low. This situation makes it difficult for community health centers to ensure a continuous supply of medicines, especially when demand increases or there are delays in distribution from suppliers. Consequently, the risk of stockouts or unnecessary overstocking is higher.

The quantity of medicines delivered by the procurement department every two months fluctuates. This situation requires community health centers to have an accurate inventory tracking and planning system to ensure the availability of medicines. Currently, logistics management is still done manually, so staff often have difficulty checking available stock. As a result, community health centers struggle to determine the right time to place orders or the appropriate quantity of medicines to meet their needs. In other words, even though medicine supplies arrive regularly every two months, without an integrated system, community health centers still face the risk of stock shortages or surpluses, as well as difficulties in compiling accurate and complete reports.

Based on the above explanation, it can be concluded that pharmaceutical logistics management is a critical component that influences the quality of healthcare services at the Sei Kepayang Barat Community Health Center. The manual system currently in use has led to several issues, such as delayed reporting, recording errors, and low work efficiency (Nasution et al., 2022). Therefore, the development and implementation of a Web-Based System Design and Implementation represent an appropriate solution to optimize the pharmaceutical logistics management process. With this system, it is expected that the performance of health center staff will improve, services to the community will become faster and more accurate, and pharmaceutical management will become more transparent and accountable (Wahdini et al., 2022). This initiative also aligns with the government's vision to achieve a resilient, efficient, and integrated health system through the use of information technology. Thus, the development of a web-based system is not merely a technical innovation but also a strategic necessity to support the improvement of public health services in the digital era. Therefore, the objective of this study is to design and build a web-based information system to assist community health centers in managing pharmaceutical logistics digitally, accurately, and with integration between the warehouse and service departments.

LITERATURE REVIEW

Drug logistics management is an important part of the healthcare service system because it is directly related to the availability of medicines needed by patients. A good logistics system must be able to ensure the availability of drugs in sufficient quantities, on time, and according to requirements. In practice, drug logistics management involves various processes such as stock recording, distribution, procurement, and reporting that require high accuracy and timely information. Therefore, the use of web-based information systems has become one of the widely adopted solutions to improve effectiveness and efficiency in drug logistics management (Ramadhan & Valentino, 2024).

Several previous studies have shown that web-based information systems are capable of improving recording accuracy and facilitating inventory data management processes. According to (Nasution et al., 2022), web-based inventory systems can monitor stock in real-time and reduce recording errors that often occur in manual systems. In addition, the implementation of Supply Chain Management (SCM) in logistics systems is proven to improve coordination among related parties and optimize the distribution process (Fuad Lubis et al., 2024).

However, most existing studies still focus on general inventory management and have not specifically addressed pharmaceutical logistics management in community health centers, which have unique characteristics such as limited resources, fluctuating demand, and the need for a simple yet effective system. Furthermore, several systems developed are not fully integrated between recording, monitoring, and reporting processes, resulting in less optimal decision support (Mukti et al., 2021).

Other studies also indicate that manual systems often cause delays in information delivery and data inconsistencies, increasing the risk of stockouts and overstock conditions (Nur Anisa et al., 2025). These limitations highlight the need for a system that is capable of providing real-time information and integrated monitoring features to support accurate and timely decision-making.

Based on the previous studies, a research gap can be identified, namely the lack of a fully integrated web-based pharmaceutical logistics information system that supports real-time recording, monitoring, and reporting in the context of community health centers. Therefore, this study focuses on designing and implementing a web-based system to improve efficiency, accuracy, and the overall quality of pharmaceutical logistics management.

METHOD

This research has the following stages:

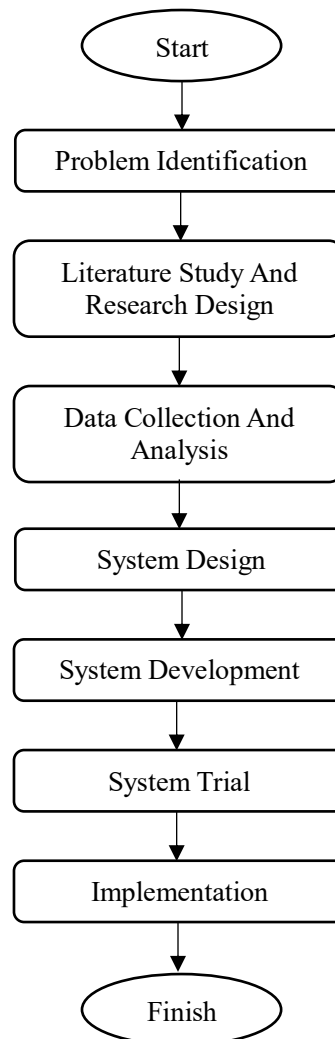


Figure 1. Research Stage

Problem Identification

This stage aims to directly understand the actual conditions in the process of managing medicine logistics at Sei Kepayang Barat Health Center. The analysis was conducted on how medicines are recorded, the stock monitoring mechanism, and the communication pattern with suppliers. From the observations, several obstacles were found, such as manual stock recording, discrepancies between physical stock numbers and administrative data, and delays in knowing which medicines are running low. This situation affects the effectiveness of services and the accuracy of stock information. Therefore, a system is needed that can assist in recording, monitoring stocks, and presenting information quickly and accurately.

Literature Study and Research Design

This stage involves collecting references from theories and previous research related to drug logistics management in healthcare facilities, particularly in the community health center environment, as well as the concept of web-based information systems to support inventory management processes. The literature review covers aspects of drug logistics information systems, inventory recording and distribution mechanisms, concepts of stock management process optimization, as well as methods for software design and development. The results of this literature study serve as a conceptual and methodological basis in determining the most appropriate approach to design and build a web-based system capable of improving the effectiveness and efficiency of drug logistics management at Sei Kepayang Barat Community Health Center.

Data Collection and Analysis

Data collection was conducted through interviews, observations, and documentation related to the drug logistics management process at Sei Kepayang Barat Health Center. The obtained data included types of drugs, inbound and outbound stock activities, drug usage patterns, staff workflow, and ordering mechanisms. This information was analyzed to identify needs and problems in the field, so that the web-based system design developed could truly support the optimization of drug logistics management at the health center.

System Design

This stage is carried out to visualize the structure and flow of the system before it is developed. The design includes the preparation of UML diagrams such as use case diagrams, activity diagrams, sequence diagrams, and class diagrams (Umar et al., 2021), as well as interface design and database design (ERD and table structure). This stage ensures that all user requirements have been clearly formulated before the system is implemented.

System Development

At this stage, the system design is translated into a web-based application using PHP, MySQL, Visual Studio Code, and XAMPP. The main features built include recording incoming and outgoing medicines, real-time stock monitoring, supplier data management, and report generation. This development is a direct realization of the system design in the previous stage.

System Trial

Testing is conducted to determine whether the system works according to requirements and is free from errors. The testing stages are carried out through functional tests, input-output tests, and logic tests to ensure that every feature, including stock monitoring, runs optimally. The test results are used to correct deficiencies before the system is fully implemented.

Implementation

The final stage is the implementation of the system in the operational environment of the health center. The system begins to be used for daily activities such as recording incoming and outgoing medicines, monitoring stock, and preparing reports. The implementation is also accompanied by socialization or training for the staff so that the system adoption process runs smoothly and the system can be used sustainably.

RESULT

Data Analysis

The following is data on the medications most frequently needed, which are supplied every 2 months at the Sei Kepayang Barat Health Center in 2025, as presented in Table 1 below.

Table 1. Data of the Most Frequently Needed Medicines at Sei Kepayang Barat Community Health Center 2025

NO	MEDICINE NAME	2025			
		JAN-FEB	MAR-APR	MAY-JUN	JUL-AUG
1	Paracetamol 500mg tablets	2.500	1.000	-	2.000
2	Simvastatin 10mg tablets	2.000	1.500	-	-
3	Amoksisillin 500mg tablets	-	1.500	1.000	1.000
4	Asam Mefenamam 500mg tablets	-	1.500	1.000	-
5	CTM tablet	2.000	1.000	-	-
6	Antasida Doen Syrup	-	50	50	120
7	Amoksisillin 125mg/5ml syrup	50	-	-	50
8	Ambroxol syrup	60	-	-	60
9	Iron tablets	9.500	-	-	9.500
10	Albendazol tablets	3.200	-	-	3.500

System Design

The system design is built using a use case diagram. The purpose of this design is to explain the requirements in detail. (Prasetya et al., 2022). The design of the use case diagram is presented in Figure 2.

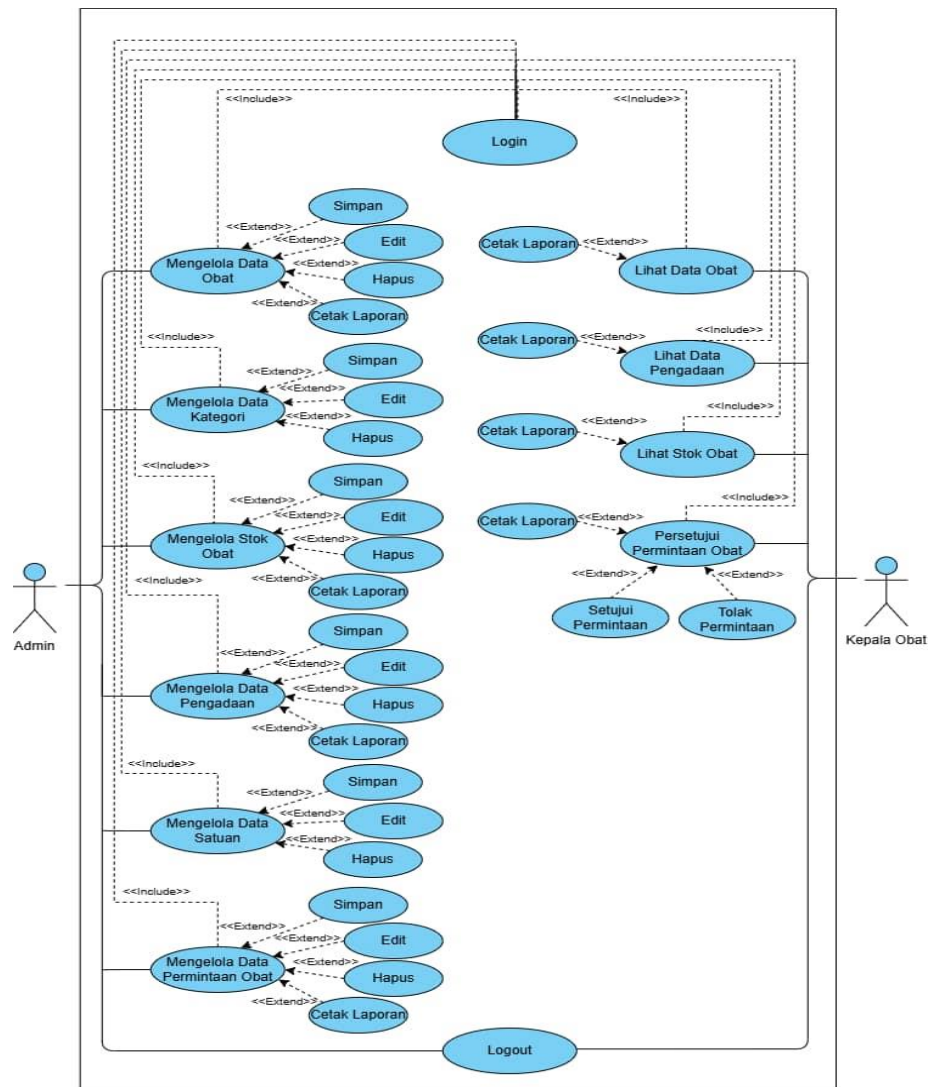


Figure 2. Use Case Diagram Design

Implementation

In this phase, the system design is realized into an application that can be operated and utilized to the fullest according to user needs. Here are the results of its implementation.

- **Login Page**

The login page is the initial page used by users to access the system by entering a username and password.

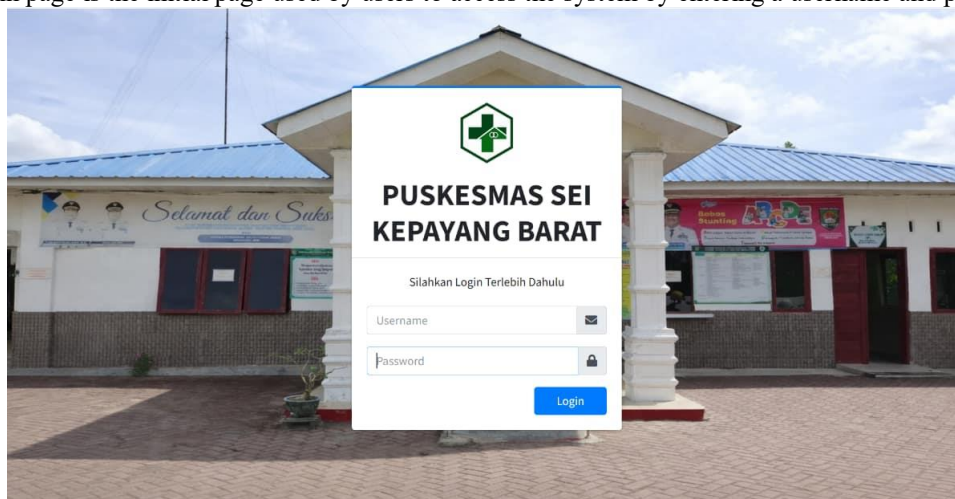


Figure 3. Login Page

- **Main Page of Head of Medicines**

The main page of the Head of Medicine is a dashboard that displays a summary of drug data, requests, and stock, making it easier to monitor inventory and make quick decisions.

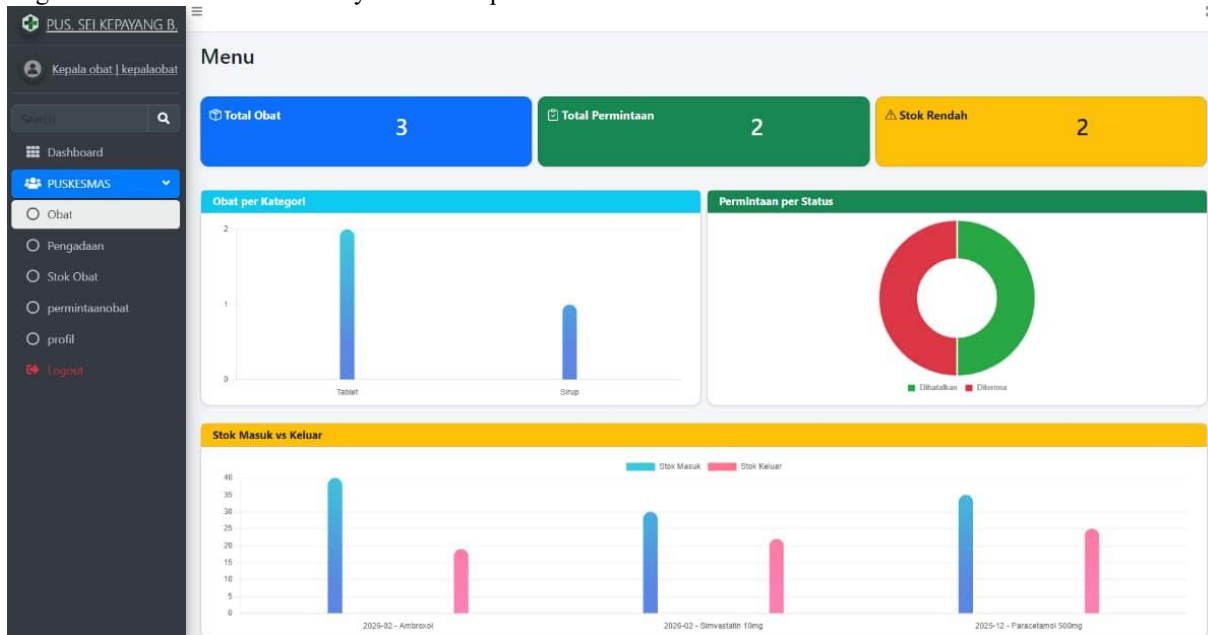


Figure 4. Drug Head Page

- **Drug Data Page**

On this page display, the Head of Medicine can view the medicine data stored in the system completely, including information on stock, category, procurement, and expiration date to facilitate monitoring and management of medicines.

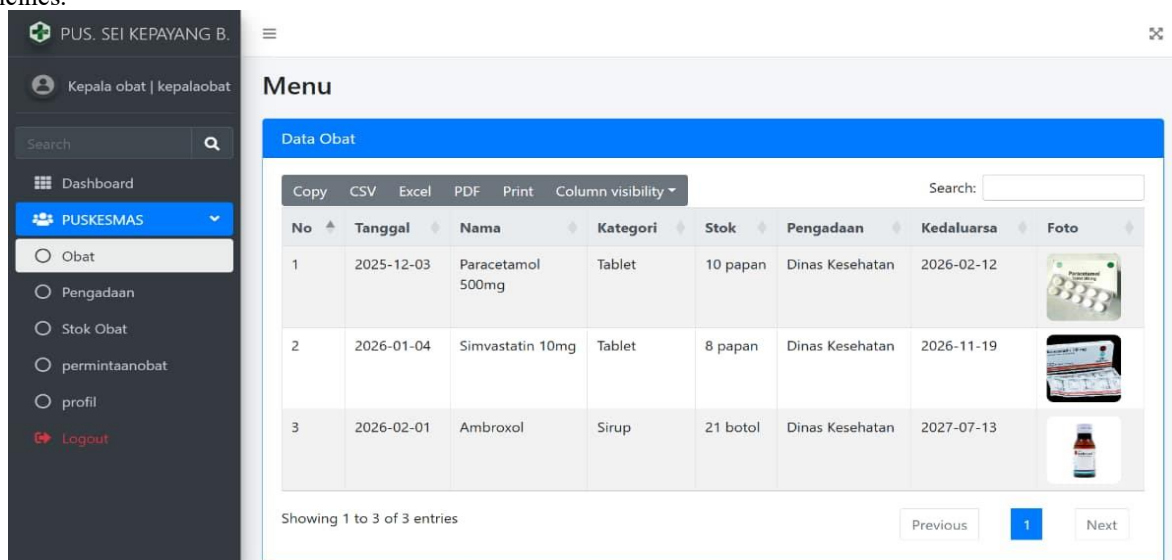


Figure 5. Drug Data Page

- **Procurement Data Page**

On this page display, the Head of Medicine can view drug procurement data containing information on the procurement name, date, letter number, description, and photo as evidence of drug receipt to facilitate the supervision of the procurement process.

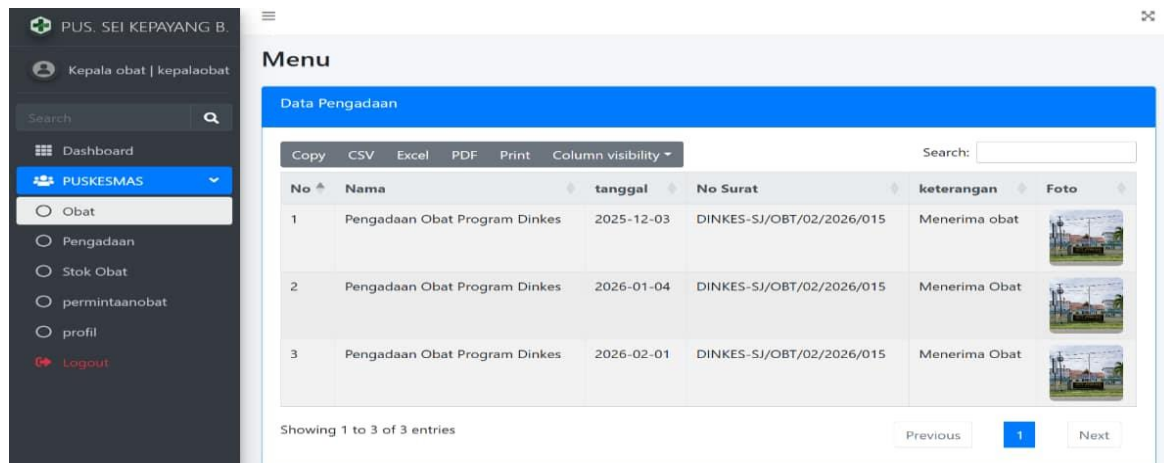


Figure 6. Procurement Data Page

- **Drug Stock Page**

On this page display, the Head of Medicine can view drug stock data showing information on incoming stock, outgoing stock, available stock, source of procurement, as well as expiration dates to monitor the availability of drugs in the warehouse.

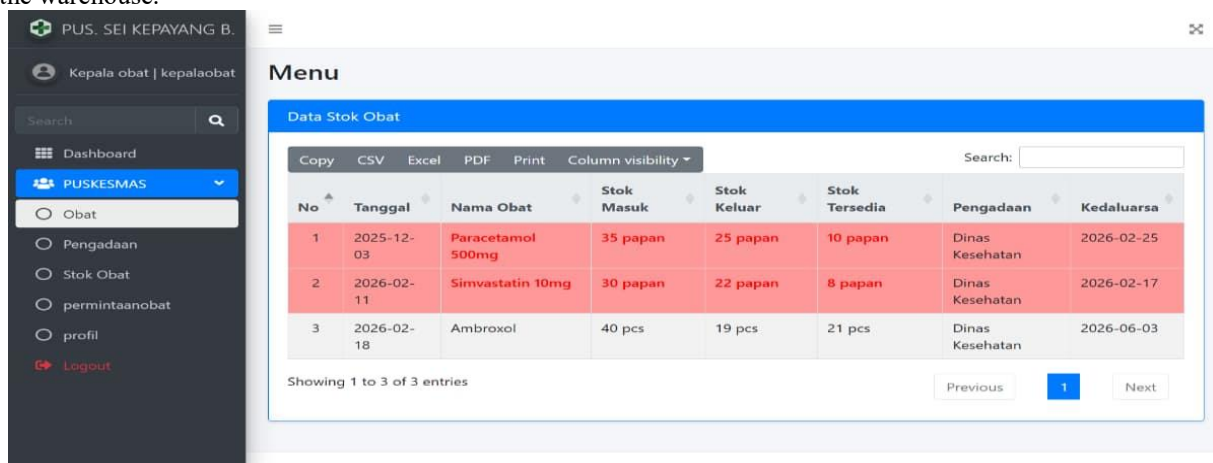


Figure 7. Drug Stock Page

- **Medication Request Page**

On this page display, the Head of Medicine can view drug request data containing information on the date, drug name, category, source of procurement, and request status to monitor and follow up on drug requests.

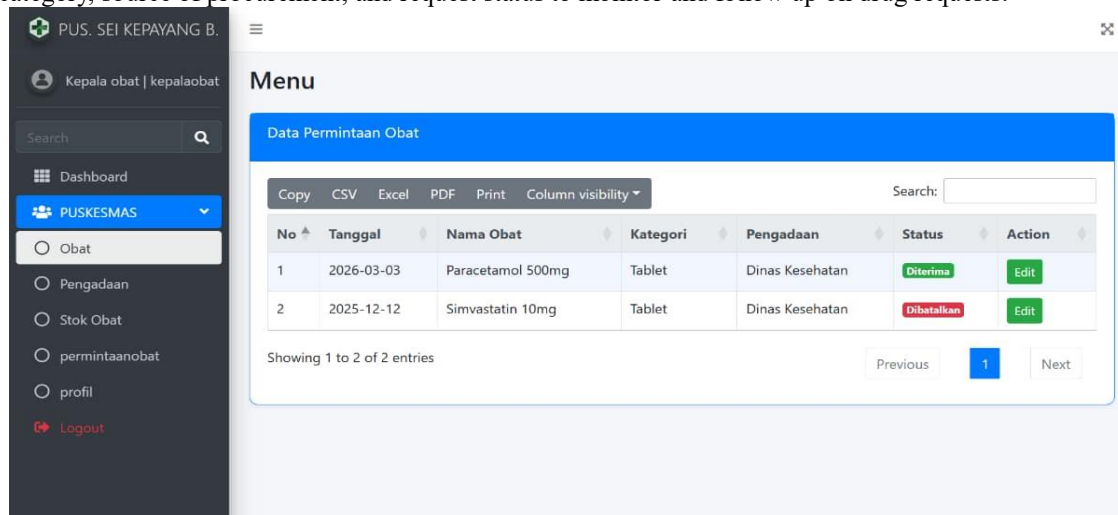


Figure 8. Medication Request Page

- **Page Update Password**

On this page display, the Admin can update the password by entering the old password, the new password, and confirming the new password to maintain account security.

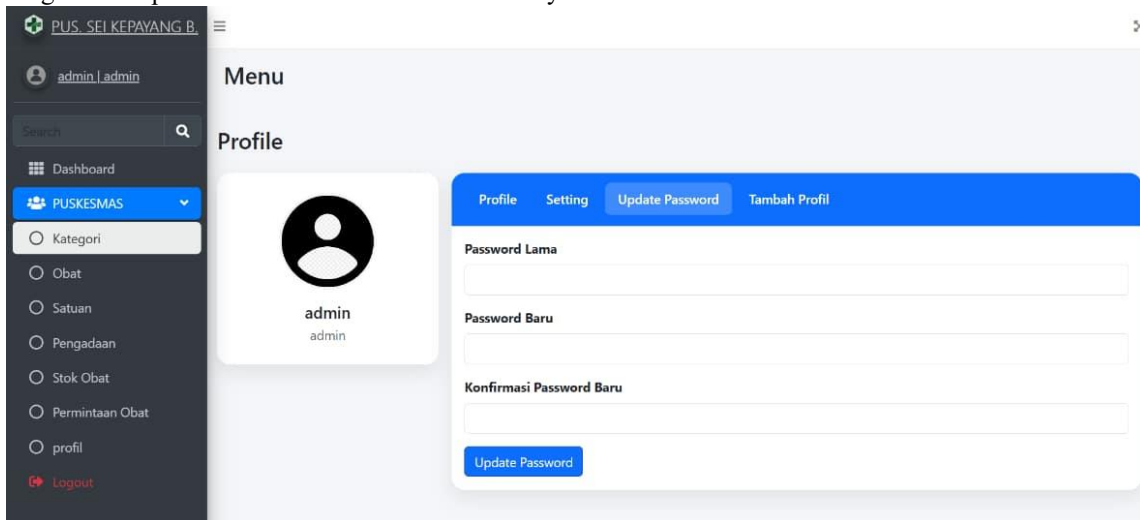


Figure 9. Page Update Password

- **Page Add User**

On this page display, the Admin can add or update profile data to complete the user's data in the system.

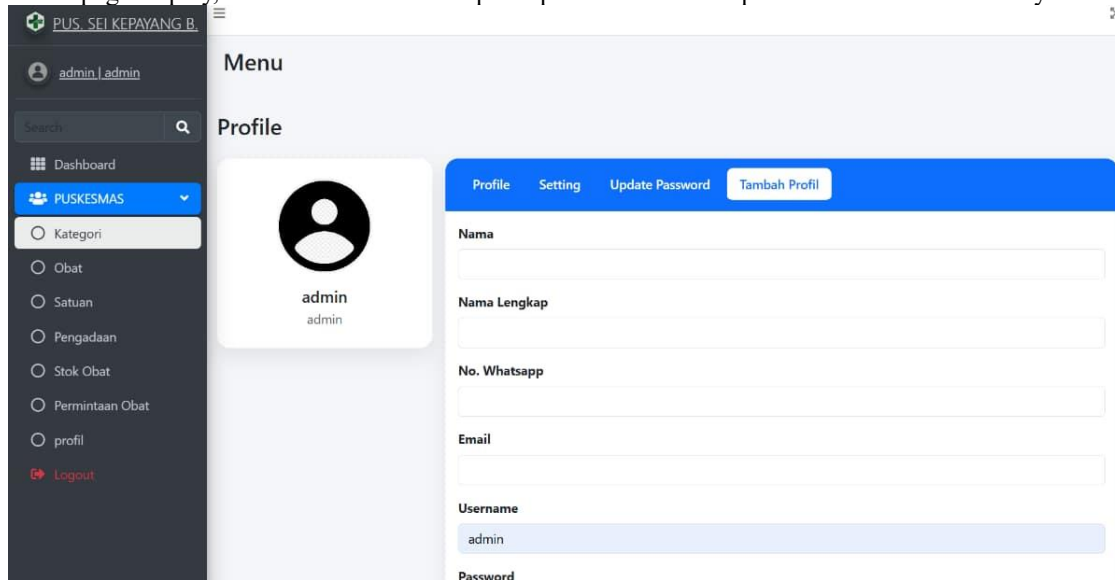


Figure 10. Page Add User

DISCUSSION

Before the implementation of the web-based drug logistics information system, the process of managing drugs at Sei Kepayang Barat Health Center was still carried out manually. Recording of incoming and outgoing drug data was done using books or simple notes, which had the potential to cause recording errors and discrepancies between administrative data and the actual conditions in the warehouse. In addition, the process of searching for drug data took a relatively long time, and stock monitoring could not be done in real-time. This situation caused delays in decision-making, especially in determining the timing and quantity of drug procurement, and increased the risk of stock shortages (stockouts) as well as excess stock (overstock).

After the implementation of the web-based system, there was a significant change in the drug logistics management process. The developed system allows drug data recording to be done in a structured and integrated manner, thereby reducing recording errors and increasing data accuracy. In addition, the real-time stock monitoring feature makes it easier for staff to know drug availability at any time, allowing them to make decisions more quickly and accurately. The data search process also becomes more efficient because all information is stored in a database that can be easily accessed.

The comparison between conditions before and after the implementation of the system shows an increase in efficiency and effectiveness in drug logistics management. Before using the system, the management process tended to be slow, unstructured, and prone to errors. After using the system, the process became faster, integrated, and accurate. In addition, the system also supports automatic report generation, making the administrative and reporting process to relevant parties easier.

Overall, the implementation of a web-based drug logistics information system has a positive impact on the performance of drug management at Sei Kepayang Barat Health Center. The system not only improves operational efficiency but also helps minimize the risk of errors and supports better decision-making in drug inventory management.

CONCLUSION

Based on the research that has been conducted, it can be concluded that the web-based drug logistics information system designed can help manage data of incoming drugs, outgoing drugs, and drug stock in a more structured manner compared to the manual system previously used at Sei Kepayang Barat Health Center, and this system facilitates staff in monitoring drug stock availability in real-time, thereby reducing the risk of drug shortages or excess stock, and the implementation of a web-based system makes the drug logistics reporting process faster, more accurate, and supports decision-making in drug inventory management.

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