Joinforcs: Journal of informatics and information system
Volume 1, (2) 2026, p. 71-80
E-ISSN : XXXX-XXXX

A Reconsideration of Pharmacy Information System Using The First Expiry, First Out (FEFO) Method

Fitri Purwaningtias [a,1,*], Rafif Hamdillah [b,2]
[a] Department of Informaation System, Universitas Bina Darma, Palembang, Indonesia
[b] Department of Physics, UIN Syarif Hidayatullah, Jakarta, Indonesia
[1] fpurwaningtias@gmail.com, [2]rafif.hamdillah.23@mhs.uinjkt.ac.id
* corresponding author

Article Info

Article History:

Received Feb 01, 2026
Revised Feb 26, 2026
Accepted Mar 13, 2026

Keywords :
FEFO, Hospital, Information System, Medicine, Pharmacy

Abstract

The Hospital Pharmacy is a business unit responsible for managing and distributing pharmaceutical products to support healthcare services. In 2016, the drug inventory data processing system implemented at the Hospital Pharmacy still relied on conventional office software packages. Although these applications supported basic data recording activities, they were limited to data entry functions and lacked capabilities for automated inventory management and analysis. As a result, drug inventory processing activities continued to require manual intervention, leading to inefficiencies, longer processing times, and potential errors in monitoring stock availability and expiration dates. To overcome these limitations, an information system is required to improve the effectiveness and accuracy of medication inventory management by implementing the First Expiry First Out (FEFO) method. The FEFO method prioritizes the distribution and utilization of medications with the nearest expiration dates before products with longer expiration periods. By applying this approach, the system can provide structured inventory management, reduce the risk of expired medication accumulation, minimize drug stagnation, and optimize pharmaceutical storage and distribution processes. The development of a FEFO-based hospital pharmacy information system is expected to enhance operational efficiency by automating inventory monitoring, supporting decision-making, and improving the accuracy of drug dispensing processes. Furthermore, this approach remains relevant in pharmaceutical logistics research over the following decade due to the increasing demand for reliable inventory control systems in healthcare organizations. The implementation of FEFO-based systems represents an important step toward improving medication safety, reducing waste, and ensuring the availability of pharmaceutical products for patients.

1. Introduction

The Hospital Pharmacy is a business unit engaged in the sale of pharmaceuticals within the hospital [1]. Medication inventory management was conducted manually using office software, which serves only as a typing tool without the support of an automated system [2]. As a result, the data recording and processing processes were less effective and efficient, leading to a number of problems such as slow data retrieval, the risk of data redundancy, and inaccuracies in medication stock management due to the lack of implementation of appropriate medication dispensing methods, such as First Expiry First Out (FEFO) [3].

Poorly managed drug inventory data could lead to the accumulation of expired drugs, discrepancies between physical stock and recorded data, and ineffective drug dispensing processes [4]. Therefore, it was necessary to plan for the development of an improved information system to address issues related to the sale and inventory of medications at the Hospital Pharmacy using the FEFO (First Expiry First Out) method. With the implementation of an information technology-based system that incorporates the FEFO method

Joinforcs: Journal of informatics and information system
Volume 1, (2) 2026, p. 71-80
E-ISSN : XXXX-XXXX

and the development of appropriate software, it is hoped that drug data management at The Hospital Pharmacy can improve, reduce the risk of losses due to expiration [5], and accelerate the decision-making process. and arranged in the order of citation as it appears in the text [6].

2. Research Methodology

The research method used in the development of the Pharmacy Information System is known as Evolutionary Prototyping Method, which consists of several stages: research process, system designing, evaluation & iteration, and analysis of results and discussion [7]. Research processes is including problem identification, literature study, and system analysis. System designing is including definition of needs and prototype building.

a. Problem identification, using the FEFO method, following issues frequently arise:
   1. It took a considerable amount of time to search for data, as staff must manually search through printed paper documents, especially if the original typed files have been deleted or edited with updated data.
   2. It was inefficient to generate reports when management needs them quickly, because staff must manually compile the data item by item and then type it up using a computer.
   3. The possibility of data redundancy a condition where the same data was recorded repeatedly due to the absence of data uniqueness validation.
   4. The medication dispensing procedure did not yet use the First Expiry First Out (FEFO) method. The FEFO method distributes medications with the nearest expiration dates first, as the risks associated with delayed distribution are greater.
   5. There was a possibility of discrepancies between recorded inventory and actual physical inventory.
   6. There was a high likelihood of accumulated expired medications because medications received first are not always dispensed first.

b. Literature Study

The research phase of literature study encompasses problem identification, an extensive literature review, and thorough system analysis. This stage must be based on relevant (or at least, important) definitions, concepts, and implementations in order to be effectively applied to the processing of pharmaceutical product databases at The Hospital Pharmacy.

An information system is a system within an organization that is a combination of people, facilities, technology, media, procedures, and controls to establish critical communication channels, process specific types of routine transactions, alert management and others to important internal and external events, and provide an information basis for decision-making [8]. Concurrently, conceptualized an information system as as a collection of computer hardware and software, as well as human resources, that process data using said hardware and software [9]. Some other referrence tells that an information system is an automated system consisting of several components, including: hardware, software, personnel, data, and procedures. There are another reference stated that an information system is an automated system consisting of several components, including: hardware, software, personnel, data, and procedures [10].

FEFO (*First Expired First Out*) is a method similar to FIFO (First In First Out) in terms of managing inventory based on time. However, this method prioritizes products that are nearing their expiration date. By using this method, the company can ensure that the goods that will be released are still fresh and of good quality. Companies that often apply this management method include those in the retail, food and beverage, pharmaceutical, and other industries dealing with perishable inventory.

The information system used in this study is based on the Borland Delphi 7.0 programming language and MySQL Server. Borland Delphi is a tool that can be used to design Windows-based applications, graphics-based applications, and network-based applications. MySQL is a SQL server/client relational database management system originating from Scandinavia; it includes an SQL server, client programs for accessing the server, administrative tools, and a programming interface for writing your own programs. Additionally, the report uses Crystal Report 10, a report-writing application product from Crystal Enterprise designed for personal computers.

Joinforcs: Journal of informatics and information system
Volume 1, (2) 2026, p. 71-80
E-ISSN : XXXX-XXXX

c. System Analysis

Based on the author's observations of the drug inventory and sales procedures in place at the Hospital Pharmacy, the process was as follows:

1. The warehouse department places orders with suppliers for drugs whose inventory levels are running low.
2. The supplier sends the order details for the drugs ordered by the warehouse department. The supplier delivers the ordered medications and provides a purchase invoice to the warehouse department for payment to the supplier.
3. The warehouse department enters the medication order data from the supplier into the medication inventory records.
4. The medications that have been recorded are then stored in the warehouse.
5. Patients provide a prescription and patient information to the pharmacy; the pharmacist then records the list of medications and patient information.
6. The pharmacy dispenses the medications as ordered by the patient.
7. The patient pays for the transaction.
8. The pharmacist issues a sales receipt based on the ordered medication data. The pharmacist then provides the medication and sales receipt to the patient.
9. The administration prepares a medication report to be submitted to the warehouse and reports on patient data, medication data, purchases, and sales to be submitted to the head of pharmacy.

Then based on the existing system, the author developed an information system designed to streamline the medication inventory and sales processes at the Hospital Pharmacy and to facilitate the rapid dissemination of information to management. The data managed included patient records, incoming medications, outgoing medications, and various reports. This information system was developed using the Borland Delphi 7.0 programming language and MySQL Server as the database. It is hoped that this new system will simplify data processing, enable the rapid retrieval of desired information, and support accurate decision-making. It should be noted that although this system was developed using Delphi 7, the core logic of FEFO remains a critical standard in modern pharmaceutical logistics, as evidenced by recent studies.

d. Defining Research Needs

During the requirements definition phase, the author conducted a more in-depth analysis of the system requirements and issues. The following aspects can be analyzed in this case:

1. A feasibility study is a process of analyzing the problem to be investigated by reviewing the key factors that will influence the ability to achieve the desired objectives. Thus, the system developed in this study was assessed for its technical, economic, and operational feasibility.
2. From a technical feasibility perspective, The Hospital Pharmacy Hospital possessed the technical resources necessary to support the implementation of this system in the future. This is based on the availability of several existing computer units at the hospital, ensuring that the system's operations will function effectively.
3. The development of this system's application was expected to benefit The Hospital Pharmacy Hospital, thereby minimizing operational costs as much as possible. In terms of the benefits generated, this system can be useful for its users.
4. The system's application was designed to be as effective as possible so as not to complicate users' ability to easily and quickly obtain the information they need.

e. Prototype Building

The prototype was developed by designing some context diagram. These are context diagram show Figure 1 and Figure 2. Entity Relationship Diagram used for this research.

Joinforcs: Journal of informatics and information system
Volume 1, (2) 2026, p. 71-80
E-ISSN : XXXX-XXXX

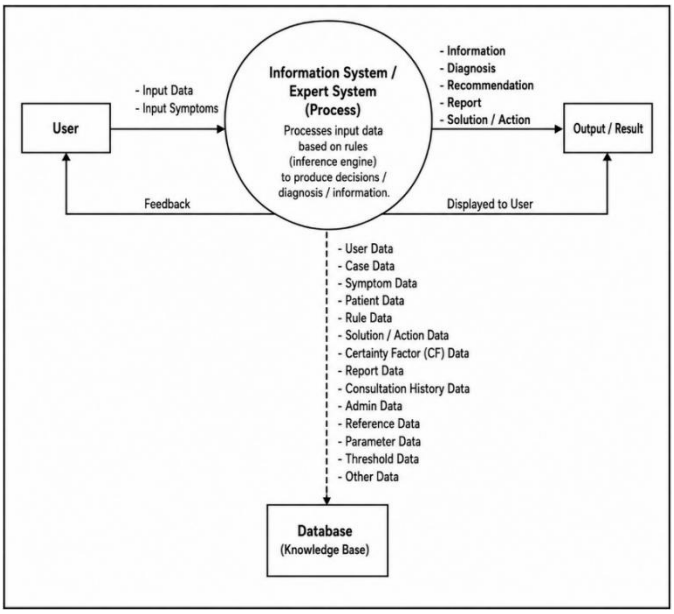

Figure 1. Context Diagram

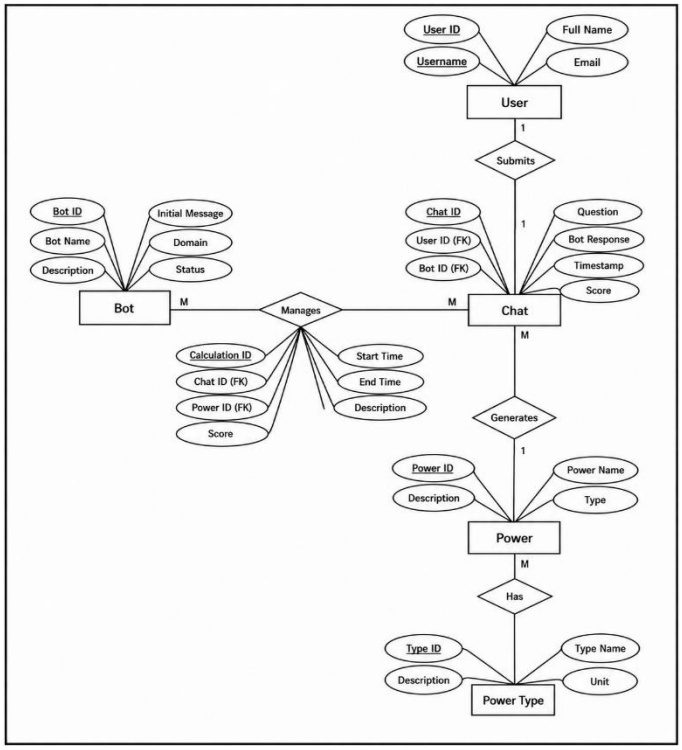

Figure 2. Entity Relationship Diagram

f. Evaluation and Iteration

The system prototype was tested in stages with key users at the Hospital Pharmacy, including warehouse staff, pharmacists, and administrative personnel. Each evaluation cycle focused on testing the functionality of key modules, such as drug data input, recording expiration dates, applying the FEFO rule in the drug dispensing process, and generating inventory and sales reports. User feedback was collected

Joinforcs: Journal of informatics and information system
Volume 1, (2) 2026, p. 71-80
E-ISSN : XXXX-XXXX

through interviews and direct observation regarding ease of use, data access speed, and the accuracy of the FEFO method in determining the order of medications to be dispensed first. Based on this feedback, iterative refinements were made to the interface, transaction flow, and data validation until the prototype was deemed stable, aligned with operational needs, and ready for full implementation.

g. Analysis of Results and Discussion

During the analysis phase, all existing system procedures including ordering medications from the warehouse to suppliers, recording incoming medication data, warehouse storage, filling patient prescriptions, dispensing medications, processing payments, and generating reports for the head of pharmacy were thoroughly analyzed to identify weaknesses and areas for improvement. Subsequently, the proposed system was designed using the FEFO (First Expiry First Out) method to ensure that medications with the shortest expiration dates are dispensed first. The results were discussed by comparing the workflows of the old and new systems, as well as evaluating the effectiveness of implementing FEFO in reducing the risk of expired medication buildup and stock discrepancies. The analysis also included technical, economic, and operational feasibility tests of the built prototype, so that each finding was qualitatively analyzed to serve as a basis for iterative improvements prior to full implementation. Additionally, this section provides a comparative analysis between the developed system and five selected studies conducted in subsequent years to evaluate their respective operational efficiencies and unique features.

3. Results and Discussion

After implementing the logic and design into a Borland Delphi 7.0 application with an SQL Server database and reports using Crystal Reports 10, a Pharmacy Information System was developed in 2016 for the Muhammadiyah Hospital Pharmacy in Palembang. The submenus in the main menu are as follows:

1. Main Page Menu is the main screen that appears when the app is launched.

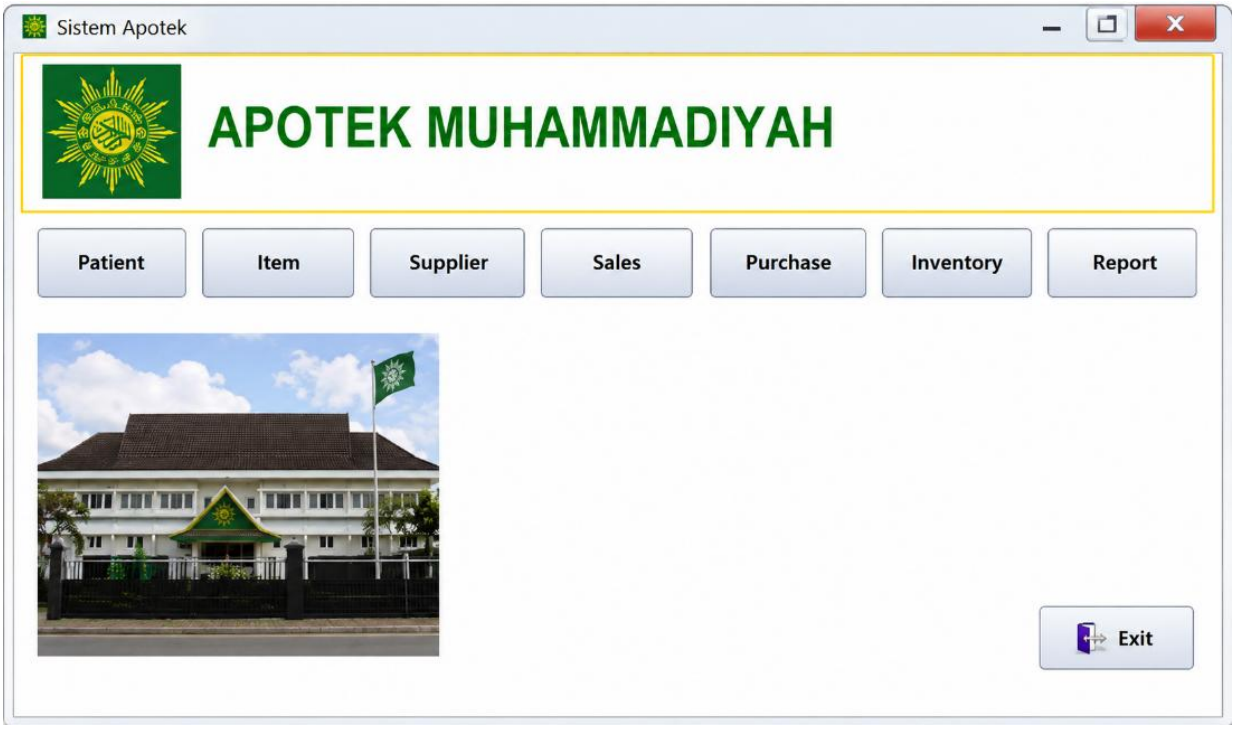

Figure 3. Main Menu Interface

Joinforcs: Journal of informatics and information system
Volume 1, (2) 2026, p. 71-80
E-ISSN : XXXX-XXXX

2. Producent Data Menu is link drive to the “Manufacturer Data Entry”.

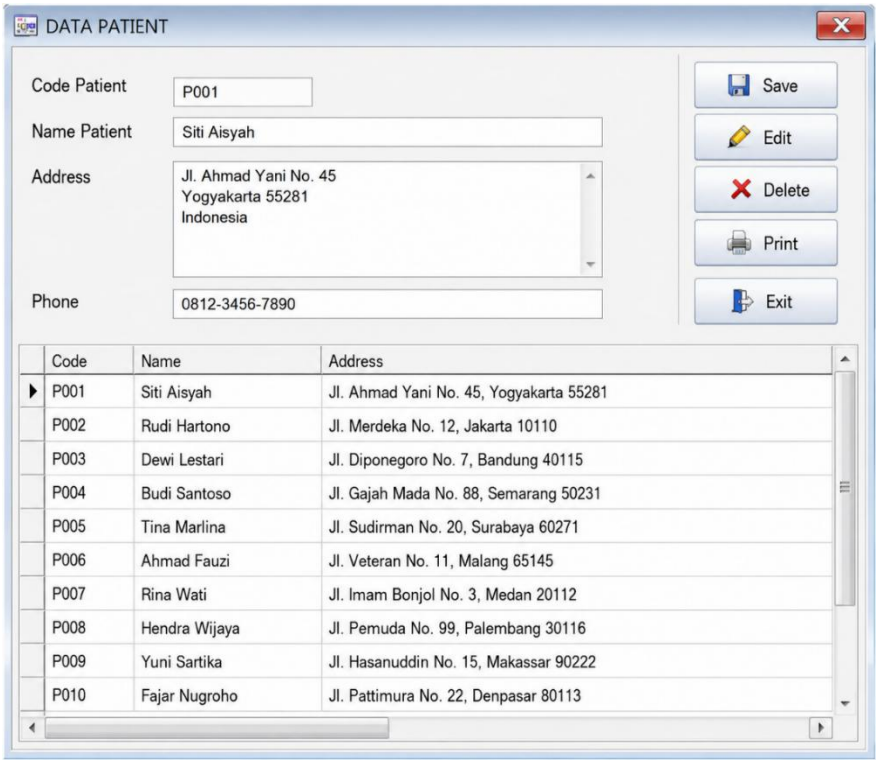

Figure 4. Page Interface of Producent Data

3. Drug Data Menu is used to entry drugs data.

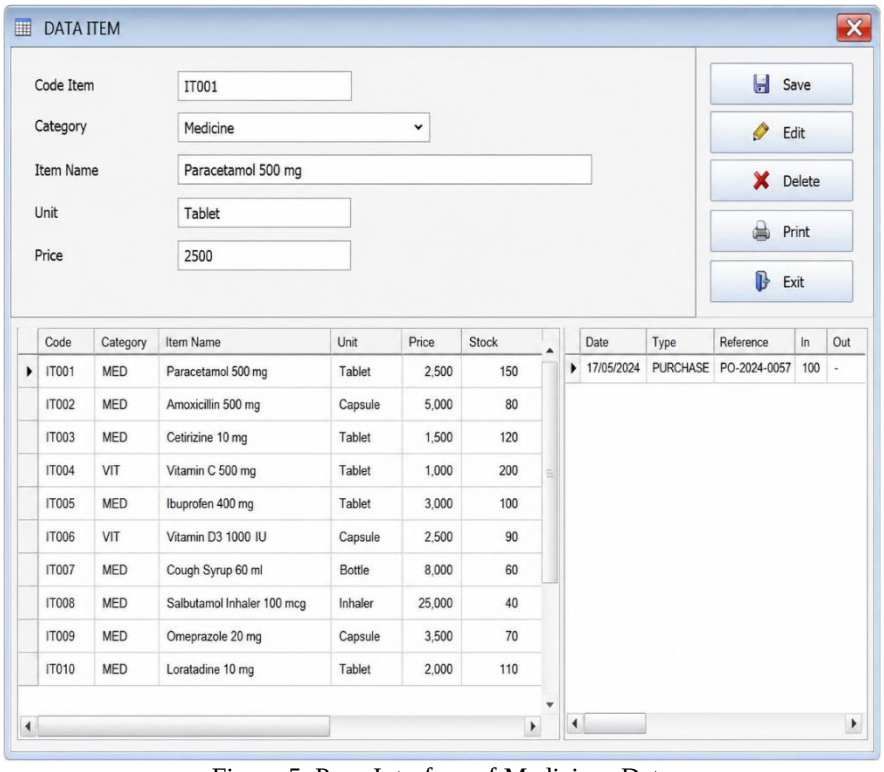

Figure 5. Page Interface of Medicines Data

Joinforcs: Journal of informatics and information system
Volume 1, (2) 2026, p. 71-80
E-ISSN : XXXX-XXXX

4. Supplier Data Menu is used to entry supplier data in Hospital Pharmacy.

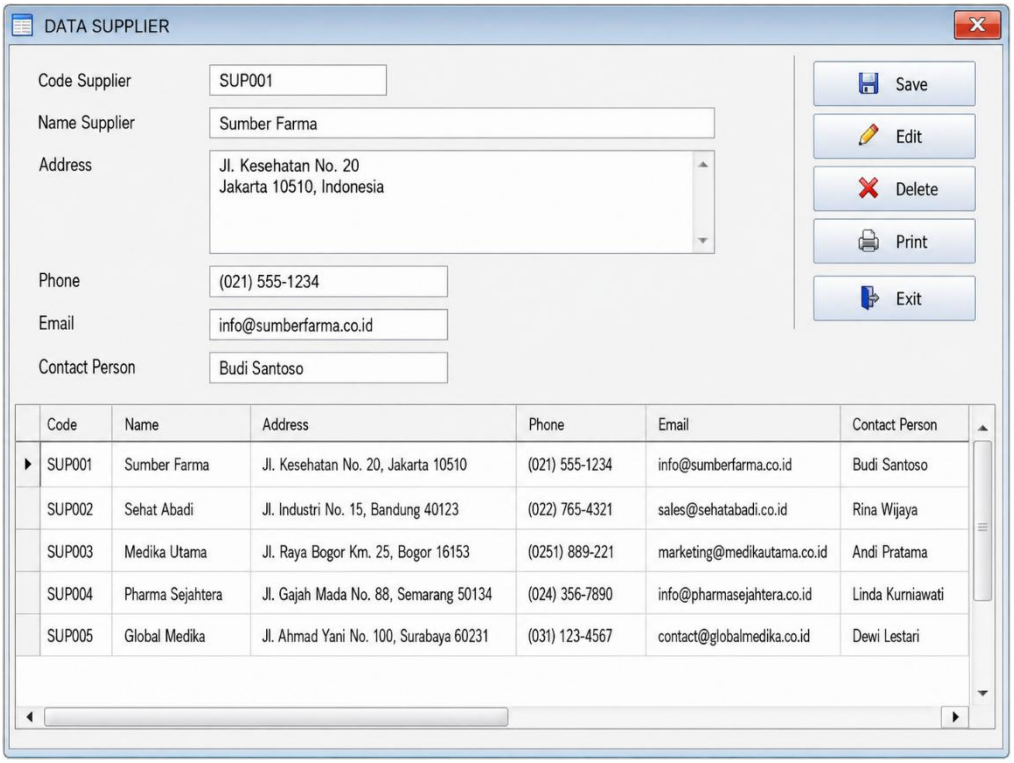

Figure 6. Page Interface of Supplier Data

5. Patient Data Menu is used to entry patient data who used pharmacy services at Hospital Pharmacy.

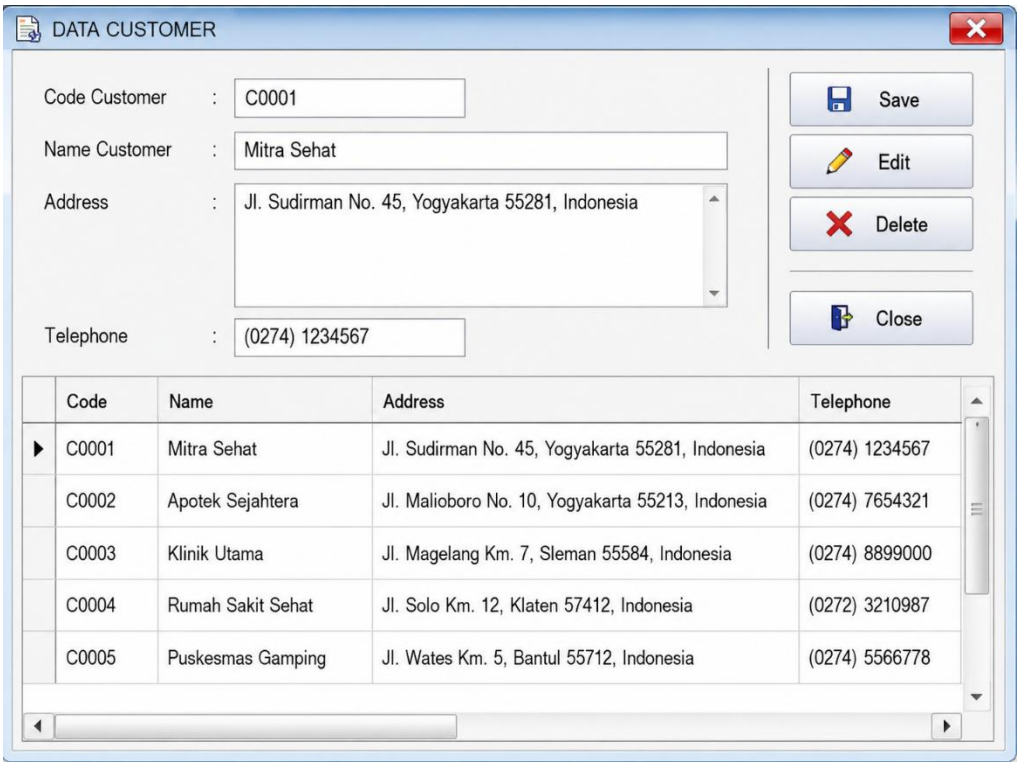

Figure 7. Page Interface of Patient Data

Joinforcs: Journal of informatics and information system
Volume 1, (2) 2026, p. 71-80
E-ISSN : XXXX-XXXX

6. The Purchases menu is a submenu that displays a list of medication purchase transactions and details of medications purchased at the The Hospital Pharmacy.

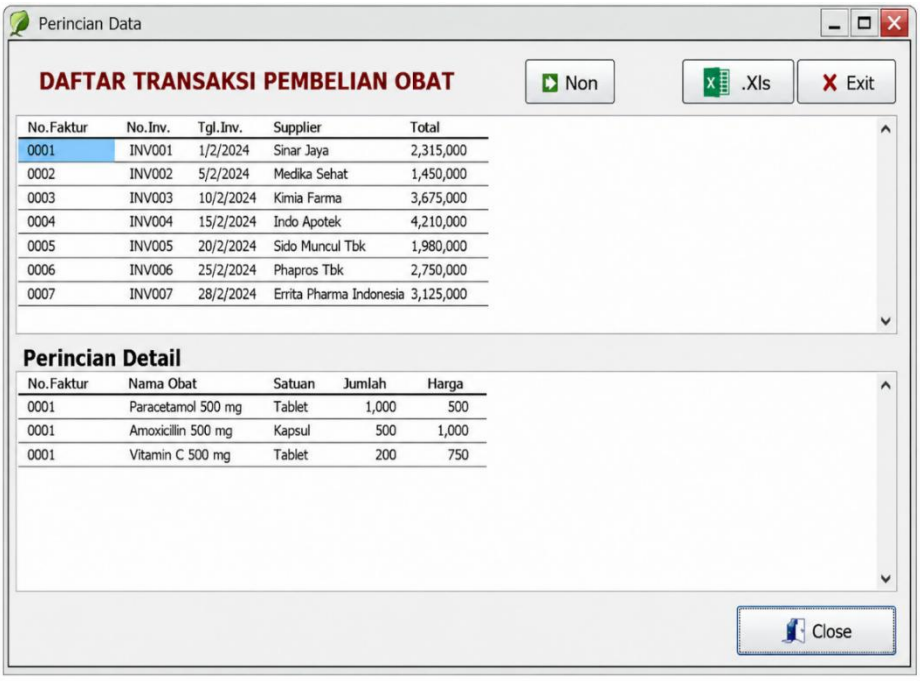

Figure 8. Page Interface of Medicine Buyer Transaction List

Based on the results of the Hospital Pharmacy, the following analysis were reached:

1. This research resulted in a pharmacy information system that can facilitate the processing of medication inventory data at the The Hospital Pharmacy.
2. The application developed can simplify the entry of medication data, patient data, manufacturer data, and supplier data, as well as the generation of reports, thereby helping to streamline work procedures at the The Hospital Pharmacy.

The implementation of a Pharmacy Information System based on the First Expiry First Out (FEFO) method significantly improved the efficiency and effectiveness of medication inventory management at the Hospital Pharmacy. Prior to system development, inventory records were managed manually using office applications that functioned only as data-entry tools. This conventional approach created several operational challenges, including slow data retrieval, data redundancy, inconsistencies between recorded and actual stock, and a high risk of expired medication accumulation.

The developed system addressed these issues by integrating the FEFO principle into the medication management process. Through this approach, medications with the nearest expiration dates are prioritized for dispensing, reducing the possibility of expired products remaining in storage. This finding supports previous studies that emphasized the importance of FEFO in minimizing pharmaceutical waste and improving inventory turnover. By automating expiration-date monitoring and stock management, the system provides greater control over medication distribution activities and contributes to improved patient safety.

The use of the Evolutionary Prototyping Method proved effective for system development because it enabled continuous interaction between developers and end users. Warehouse personnel, pharmacists, and administrative staff were involved throughout the evaluation and iteration stages, allowing the system to be refined according to actual operational requirements. User feedback helped improve interface usability, transaction workflows, and data validation mechanisms, resulting in a more practical and user-friendly application.

Another important contribution of the system is its ability to integrate various operational modules, including patient data management, supplier records, manufacturer information, purchase transactions, medication inventory, and reporting functions. This integration eliminates repetitive data entry and facilitates faster access to information. As a result, management can generate reports more efficiently and make decisions based on accurate and up-to-date information.

From a technical perspective, the system demonstrated feasibility because it utilized existing computer resources available at the hospital. Economically, the system has the potential to reduce operational costs associated with manual record keeping, inventory inaccuracies, and losses caused by expired medications. Operationally, the application simplified routine tasks and reduced the workload of pharmacy staff, leading to improved productivity.

Despite these advantages, several limitations should be acknowledged. The system was developed using Borland Delphi 7.0 and MySQL Server, technologies that may be considered outdated compared to modern web-based and cloud-based solutions. Furthermore, the study primarily focused on a single pharmacy environment, which limits the generalizability of the findings. Future research should evaluate the system in multiple healthcare facilities and explore integration with contemporary technologies such as web platforms, mobile applications, real-time notification systems, and barcode or RFID-based inventory tracking.

Overall, the results indicate that the FEFO-based Pharmacy Information System successfully transformed manual inventory management into a structured and automated process. The implementation not only improved inventory accuracy and reduced the risk of expired medications but also enhanced operational efficiency and decision-making capabilities. These findings demonstrate that FEFO remains a relevant and effective inventory management strategy for modern pharmaceutical logistics and healthcare organizations.

4. Conclusion

Based on the design and comparative analysis results of this study, it can be concluded that the implementation of a Pharmacy Information System using the First Expiry First Out (FEFO) method, developed using Borland Delphi 7.0 and MySQL Server, has proven effective in transforming logistics management at the The Hospital Pharmacy Hospital Pharmacy from manual record-keeping to a systematic process. This new system successfully automates the sorting of medication dispensing based on the nearest expiration date, thereby mitigating the risk of expired medication accumulation, eliminating data redundancy, and aligning the accuracy between inventory records and physical stock in the warehouse. Furthermore, the in-depth integration of modules ranging from patient data management and doctor's prescriptions to manufacturer and supplier records not only reduces the administrative time required for preparing management reports but also strengthens patient safety standards and the efficiency of clinical decision-making. Although the underlying technology was developed, a cross-temporal literature review indicates that the core FEFO logic in this system remains a crucial and relevant gold standard for the architecture of modern pharmaceutical supply chains in the future.

REFERENCES

[1] S. W. Samsul, L. Harlinda, and Sugiarti, "Design and Implementation of Health Supplies Inventory Monitoring System Using First Expired First Out Method," *Indones. J. Data Sci.*, vol. 4, no. 2, pp. 109–119, 2023, doi: https://doi.org/10.56705/ijodas.v4i2.72.

[2] K. Purwantini and V. Kumalasari, "Sistem Informasi Persediaan Obat Menggunakan Metode FEFO Berbasis Multi User di Apotik Assyfa Farma," *J. Ilmu Tek. dan Inform.*, vol. 1, no. 1, pp. 1–10, 2021, doi: https://doi.org/10.51903/teknik.v1i1.25.

[3] Sriyanto and R. D. Ika, "Designing an E-Kanban System to Improve Drug Availability and Minimise Inventory Waste at The Hospital Pharmacy Installation," *J. Tek. Ind.*, vol. 19, no. 2, pp. 70–73, 2024, doi: https://doi.org/10.14710/jati.19.2.70-73.

[4] S. R. Dewi and V. D. Cahaya Putra, "Analisa Penerapan Evaluasi Kinerja Pengendalian Persediaan Obat melalui Sistem Informasi Akuntansi pada Instalasi Farmasi Rumah Sakit Santosa," *J. Account.*

Sustain. Soc., vol. 06, no. 01, pp. 73–82, 2024, doi: https://doi.org/10.35310/jass.v6i1.1250.

[5] M. J. Aqsal Fitrullah, Y. Kristyawan, and S. Kacung, "Sistem Informasi Manajemen Stok Obat pada Apotek JAFNA Menggunakan Metode FEFO," *J. Inform. Teknol. dan Sains*, vol. 7, no. 2, pp. 956–965, 2025, doi: https://doi.org/10.51401/jinteks.v7i2.6029.

[6] F. Sembiring, D. Sukmawan, A. Permana, and M. Jamy F, "Penerapan Metode First Expired First Out (FEFO) pada Sistem Informasi Gudang," *Inf. Technol. Vocat. Educ.*, vol. 1, no. 2, pp. 47–52, 2019, doi: https://doi.org/10.17509/integrated.v1i2.21999.

[7] W. Agustiono, "Applying Evolutionary Prototyping In Developing LMIS : A Spatial Web- Based System For Land Management," in *The 2nd International Joint Conference on Science and Technology (IJCST)*, Bali: UPN Veteran Jatim, 2017. doi: https://doi :10.1088/1742-6596/953/1/012147.

[8] E. Bjarnason, F. Lang, and A. Mjöberg, "An empirically based model of software prototyping : a mapping study and a multi - case study," *Empir. Softw. Eng.*, vol. 28, no. 115, pp. 1–47, 2023, doi: https://doi.org/10.1007/s10664-023-10331-w.

[9] R. T. Aldisa, "Perancangan Sistem Informasi Untuk Pencarian Apotik Dengan Menerapkan Metode Prototyping Berbasis Android," *J. Inf. Syst. Res.*, vol. 3, no. 4, pp. 597–602, 2022, doi: https://doi.org/10.47065/josh.v3i4.1954.

[10] R. D. Setyawan and A. W. Utami, "Rancang Bangun Early Warning System Untuk Pengendalian Persediaan Obat pada Divisi Farmasi Puskesmas Peneleh Surabaya," *J. Emerg. Inf. Syst. Bus. Intell.*, vol. 02, no. 04, pp. 58–68, 2021, doi: https://doi.org/10.26740/jeisbi.v2i4.43405.