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Analysis of Drug Management Process Using Lean Concept

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Abstract: This study aims to analyze and improve the efficiency of the drug distribution process in the IFRS pharmacy warehouse of Pasirian Regional General Hospital, Lumajang Regency, using the Lean approach. The main issues identified include a low Inventory Turnover Ratio (ITOR) of less than four times per year and the persistent occurrence of expired drugs amounting to 0.38%. To address these problems, Value Stream Mapping (VSM) and Future State Mapping (FSM) methods were applied to map the drug distribution process, identifying value-added (VA), non-value-added (NVA), and necessary but non-value-added (NNVA) activities. Root cause analysis using the 5 Why method revealed that the primary factors contributing to inefficiency were unscheduled drug distribution, the absence of integration with the Hospital Management Information System (SIMRS), delayed drug requests from service units, and the lack of a withdrawal system based on actual needs. The mapping process showed that, from a total of 33 activities, 13 were classified as VA activities, 11 as NVA activities that could be eliminated, and 9 as NNVA activities that needed to be maintained or simplified. Based on these findings, several improvement recommendations were proposed, including the implementation of a Kanban system, the use of visual management tools, and the integration of drug requests into the SIMRS. These measures demonstrated the potential to enhance distribution efficiency, reduce waste, and improve the ITOR, thereby minimizing the occurrence of expired drugs. The study concludes that applying the Lean approach in healthcare facility logistics is effective in identifying process waste and providing strategic guidance for performance improvement. The results highlight the importance of structured process evaluation, technological integration, and demand-based inventory management in optimizing pharmaceutical distribution systems.

Keywords: 5 Why, Drug Distribution, Lean, Non-Value Added, Value Stream Mapping

1. Introduction

Hospitals, as healthcare facilities, play a strategic role in the national health system. This is affirmed in Law Number 17 of 2023 concerning Health and reinforced by Government Regulation Number 28 of 2024, which states that hospitals are not only places for curative services, but also centers for promotive, preventive, rehabilitative, and palliative care. Hospitals also serve as educational and research facilities for medical personnel. However, to optimally carry out these functions, an efficient and integrated support system is required, one of which is the Hospital Pharmacy Unit (IFRS).

Under Minister of Health Regulation Number 72 of 2016, IFRS is responsible for clinical pharmacy services and the management of pharmaceutical preparations, medical devices, and consumable medical supplies. Efficient pharmacy management is crucial, as it directly impacts the quality of patient care and the hospital's financial efficiency. One important indicator in pharmacy management is the Inventory Turnover Ratio (ITOR). This ratio reflects the efficiency of drug inventory turnover; a low value indicates logistical and stock management issues.

Pasirian Regional Hospital is a Class C hospital with a capacity of 103 beds, providing inpatient care and 11 outpatient clinics. With a population of 89,303 in

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Pasirian District in 2023, the hospital plays a crucial role in healthcare referral services. The bed occupancy rate (BOR) showed an upward trend, reaching 68.9% in 2023 (Figure 1), indicating a significant increase in inpatient visits.

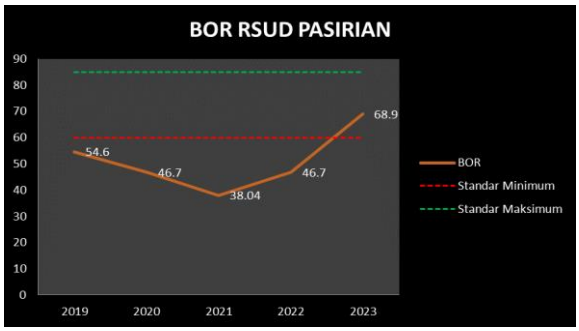

Figure 1. Bed Occupancy Rate (BOR) Value Graph 2019 – 2023

Source: Medical Records Installation Report

However, this surge has also impacted the need for drug logistics. Data shows that BPJS patients account for more than 40% of total outpatient and inpatient visits. The development of the total number of outpatient and inpatient visits at Pasirian Regional Hospital over the past five years is as follows:

Table 1. Number of outpatient visits from 2019 to 2023

NO	Payment Type	2019	2020	2021	2022	2023
1	General	13,216	8,941	6,388	6,182	3,847
2	BPJS	10,536	7,983	7,256	8,663	5,940
3	Private Insurance	-	-	-	-	14
4	Free (PG)	135	178	266	7,868	2
5	Statement of Inability	-	-	3	9	96
6	Ministry of Health	135	178	263	7,859	-
7	Etc	259	395	215	-	-
Amount		24,281	17,675	14,391	30,581	9,899

Source: Medical Records Installation Report (2025)

Table 2. Number of inpatient visits from 2019 to 2023

NO	Payment Type	2019	2020	2021	2022	2023
1	General	4,485	2,762	1,732	2,622	1,683
2	BPJS	4,554	3,563	2,880	4,295	2,847
3	Private Insurance	-	-	-	-	24
4	Free (PG)	533	429	1,048	4,262	448
5	Statement of Inability	47	74	72	154	255
6	Ministry of Health	486	355	976	4.108	4
7	Etc	-	-	-	-	-
Amount		10.105	7,183	6,708	15,441	5,261

Source: Medical Records Installation Report (2025)

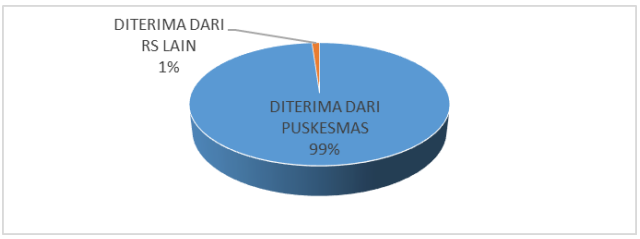

Figure 2. Graph of Hospital Referral Services from Community Health Centers and Other Hospitals 2019-2023 (Processed, 2025)

Tables 1 and 2 show trends in outpatient and inpatient visits by payment type. The majority of patients are BPJS Kesehatan participants, who consistently account for more than 40% of total visits. This indicates that Pasirian Regional Hospital relies heavily on the INA-CBGs financing system, where claims are paid based on diagnosis and treatment. Mismatches between claims and actual costs can lead to losses if spending, particularly on drug procurement, is not controlled.

The increasing number of patients, particularly those from the BPJS (Social Security Agency), creates double pressure. On the one hand, revenue opportunities increase. However, on the other hand, demand for medication procurement soars. Without quality and cost controls, expenses can balloon, leading to stockpiles, expired medications, and logistical inefficiencies.

Therefore, implementing the Lean Hospital approach is highly relevant. Lean Hospital, introduced by Mark Graban, focuses on reducing non-value-added activities in healthcare. In the context of IFRS, waste occurs in seven key areas:

1. Inventory Waste: Expired drugs and stock buildup.
2. Process Waste: The complex process of drug procurement and distribution.
3. Motion Waste: Inefficient storage space layout.
4. Waiting Waste: Waiting time for delivery and service.
5. Defect Waste: Damage to drugs during storage/shipping.
6. Overproduction Waste: Procurement of drugs exceeds needs.
7. Talent Waste: Lack of optimal utilization of pharmaceutical experts.

Several studies have shown that Lean Hospital can improve the drug management system at Jombang District Hospital, showing that management time efficiency can be increased by up to 69% at the usage stage. At Gadjah Mada University Hospital, the drug distribution system was significantly affected by delays from distributors. Meanwhile, the invoice error rate was recorded at 0.58%, dead stock reached 7.89%, and the ITOR was only 6.6 times per year.

Research at Ratu Zalecha Regional Hospital and Kembangan Regional Hospital both found that drug storage and distribution still do not meet efficiency standards. A similar finding was also reported at X Hospital in Bogor City, where high stock levels of expired and expired drugs were found due to procurement inefficiencies. The problem of drug management at Pasirian Regional Hospital is not merely a technical logistical issue, but has a systemic impact on service quality and the hospital's financial sustainability. With the increasing volume of BPJS visits and the large proportion of spending on drugs, efficiency in pharmaceutical management is imperative. The Lean Hospital approach has proven capable of identifying points of waste and offering data- and process-based

improvements. Research focusing on analyzing Lean-based drug management at Pasirian Regional Hospital is a strategic step to ensure that the hospital can maintain high-quality services, be logistically efficient, and financially sustainable.

2. Proposed Method

This study uses a qualitative approach with a case study method to explore in-depth the drug distribution process at the Pharmacy Unit of Pasirian Regional Hospital, Lumajang Regency. This approach was chosen to contextually and comprehensively understand the factors that cause the low Inventory Turnover Ratio (ITOR) and the high number of expired drugs. The research object focused on the drug distribution system at the hospital, while the research subjects included the Head of the Pharmacy Unit, the Head of the Pharmacy Warehouse, and several related staff directly involved in the drug distribution and logistics management process.

Data collection was conducted through in-depth interviews, direct observation of drug distribution flows, and documentation studies of ITOR data, expired drug data, and drug requirement planning documents. Structured and semi-structured interviews were conducted to gather information on operational constraints, procurement policies, and inter-divisional coordination flows. Participatory observations were conducted to map actual activities in the field, particularly those that lead to waste.

The collected data were analyzed using qualitative descriptive analysis techniques and the Lean Hospital approach, specifically with the aid of the Value Stream Mapping (VSM) tool to identify workflows and waste. Root cause analysis was conducted using a Fishbone diagram to identify the factors causing low drug distribution efficiency. Based on the mapping and waste identification results, researchers developed proposals for improving the distribution system in accordance with Lean principles, with the aim of increasing the efficiency and effectiveness of pharmaceutical logistics management in hospitals.

3. Results and Discussion

a. Drug Distribution Efficiency and Low ITOR Values

This study revealed that the drug distribution process at the Pasirian Regional Hospital Pharmacy Unit remains inefficient, as reflected in the low Inventory Turnover Ratio (ITOR) of 1.85 in 2022, far below national efficiency standards. Furthermore, the percentage of expired drugs reached 0.38%, exceeding the 0.1% tolerance threshold. The current drug distribution process still involves numerous manual activities and duplicate records, from request submission and verification, warehouse retrieval, packaging, and delivery to service units. Mapping using the Value Stream Mapping (VSM) approach shows that only 47% of distribution activities are value-added, while the remainder are non-value-added activities that slow down logistics flows and increase the risk of waste.

Analysis of observations and in-depth interviews identified seven of the eight types of waste within the Lean framework, including: waiting (delayed verification due to a lack of human resources), transportation (long distribution distances without an integrated system), inventory (excess stock due to inaccurate planning), motion (inefficient staff movement), overprocessing (dual manual and digital verification), defects (data input errors), and underutilized talent (human resource utilization not appropriate to their role). These findings reinforce the results of the study.[7];[8];[9]; And[10] which emphasizes the importance of eliminating waste in pharmaceutical logistics distribution to reduce costs and increase speed of service.

b. Root Cause Analysis and Contribution of Lean Approach

The use of the 5 Whys method identified the underlying problems as an unintegrated information system, the absence of distribution lead time indicators, delayed SOP updates, and weak evaluation of stock requirements planning. These weaknesses are systemic and interconnected, explaining why distribution is unresponsive to actual needs in service units. Distribution that is not based on historical demand data leads to reactive and inefficient procurement policies.

The application of Lean principles in this context proved appropriate and provided both practical and theoretical contributions. Practically, the Lean approach successfully identified weaknesses in the drug distribution system that had previously escaped managerial evaluation. Theoretically, this study broadens the understanding of the effectiveness of Lean Hospital in the context of Class C hospitals in Indonesia, a field that has not been widely explored in previous studies. These findings support literature such as[11];[12]as well as[13], which emphasizes the importance of information system integration and data-based evaluation in improving hospital logistics distribution.

Through data triangulation and direct confirmation with informants (member checking), the reliability of the data in this study was verified. The results indicate that waste in the distribution process impacts not only logistics efficiency but also the overall quality of pharmaceutical services. This research provides a strong foundation for reforming hospital distribution systems based on Lean principles to ensure optimal medication turnover and more responsive services to patient needs.

4. Conclusions

Factors Causing Low ITOR Values

The low inventory turnover ratio (ITOR) in the Pasirian Regional Hospital Pharmacy Department is caused by various systemic and operational factors. Based on the 5 Whys analysis, the main causes include:

First, drug distribution has not been prioritized in the HR training and development policy, resulting in the lack of routine training to improve the competence of distribution staff despite sufficient personnel. Second, the absence of drug distribution training is due to the absence of strategic management policies and awareness of the importance of distribution as a key process in the pharmaceutical logistics system, due to a lack of supporting analytical or evaluation data. Third, distribution access to outpatient depots is difficult due to the absence of a dedicated logistics route designed into the building structure, due to minimal logistics planning and the absence of technical guidelines to serve as a reference for hospital construction or renovation. Fourth, the insufficient number and capacity of trolleys is due to the lack of evaluation of needs and a monitoring system for distribution facilities, because supporting logistics aspects have not been prioritized in pharmaceutical logistics management. Fifth, double recording occurs due to the suboptimal integration of the digital drug distribution system, which is caused by a lack of management prioritizing strengthening logistics digitalization and HR training.

Sixth, the drugs received do not match the demand because the distribution process is not yet supported by an automated and real-time system, and verification is carried out manually with less than optimal human resources, making it prone to errors. Seventh, drug shortages are caused by inaccurate needs planning, because drug usage data is not optimally recorded and the system does not support integration and automatic minimum stock warnings. Eighth, drug taking errors occur because double checking is not carried out, distribution procedures have not been standardized, and high workloads without a clear quality control system and division of tasks. Ninth, drug distribution is not scheduled and not integrated with SIMRS because the distribution system has not been built within an integrated digital framework, due to the lack of policies and management evaluations related to the importance of system integration. Tenth, drug stocks are not immediately distributed because the request system is still manual and not based on consumption data, and there is no real-time integration of the stock monitoring system between units and warehouses. Eleventh, the lack of implementation of the SIMRS-based stock data retrieval system is caused by the lack of SIMRS development to the pharmaceutical logistics aspect, due to the lack of a strategic policy for digitalizing the logistics system based on real needs. Twelfth, Lack of optimal utilization of the SIMRS system due to the lack of training and SOPs that support the integration of minimum stock limits in the system.

Distribution Flow and Implementation Constraints

Based on process mapping using the Value Stream Mapping (VSM) approach, it is known that the current drug distribution flow consists of 33 stages of activity, with the following details:

First, 13 activities fall into the Value Added (VA) category, which are activities that directly add value to drug distribution services, such as picking, packing, and delivering drugs to requesting units. Second, 20 activities are classified as Non-Value Added (NVA), which are activities that do not add value and tend to be wasteful, such as: manual writing in the requisition book, repeated signatures by officers, physical delivery of documents, waiting for a non-automated verification process. Third, 9 activities from the NVA activities are classified as Necessary but Non-Value Added (NNVA), which are activities that must be carried out by law or policy even though they do not provide direct value, such as physical checking of drugs before distribution and recording receipts by units. These findings indicate that 60.6% of the distribution flow still consists of activities that do not provide direct value, which causes slow distribution times, increased administrative workloads, and the potential for delays in the absorption of drug stocks to service units. The main obstacles to implementing the current distribution system include:

First, reliance on manual processes: causing delays, input errors, and time inefficiencies. Second, the lack of digital integration of demand and stock, where service units often wait until stock runs out before submitting requests. Third, wasteful activities, consisting of 9 overprocessing activities, 3 waiting activities, 2 transportation activities, 1 motion activity, and 2 defect activities.

The Role of Lean in Process Improvement

The application of Lean principles has been proven to systematically map process waste through Current State Mapping in VSM. By using the Future State Mapping (FSM) approach, an ideal distribution process can be designed that eliminates NVA activities, maintains Necessary but Non-Value Added (NNVA) activities such as physical checking, and optimizes Value Added activities, improvements are made by:

First, we removed 11 NVA activities that were no longer relevant when using simRS. Second, we retained 9 NNVA activities with simplified procedures.

Some of the Lean principles applied include:

First,*Pull system*through the implementation of Kanban based on the real needs of the unit through simRS, Second, Implementation of 5S to organize storage space and improve stock visibility, and Third, Reducing drug distribution lead time through the elimination of NVA.

The Impact of Lean Implementation on Efficiency and Reducing Expired Drugs

Following lean-based improvements, there was a significant increase in efficiency, reflected in an increase in the ITOR value from 0.20 in January 2025 to 0.24 in July 2025, and a decrease in NVA activities from 52.14% to 47.86% at the distribution stage. This demonstrates that Lean principles can significantly improve the efficiency of drug circulation and reduce losses due to waste.

Implications

This research provides several important implications from a managerial, operational, and strategic perspective, particularly in efforts to increase the efficiency of drug distribution and optimize inventory management in hospitals.

First, Managerial Implications:

The research results show that most activities in the drug distribution process are still dominated by non-value-added (NVA) activities that do not directly contribute to pharmaceutical services. Therefore, hospital management is required to shift its paradigm from conventional administrative processes to lean process-based management. The Lean approach provides a concrete framework for redesigning workflows, reducing waste, and accelerating decision-making based on real data.

Second, Operational Implications:

By implementing Lean tools such as Value Stream Mapping (VSM) and Future State Mapping (FSM), hospitals can more easily identify points of waste and inefficient activities. The immediate implications are improved drug distribution flows, reduced lead times, and a reduced risk of delays in drug delivery to service units. The use of a Kanban system integrated with the Hospital Management Information System (SIMRS), along with the implementation of 5S principles, can strengthen stock control and improve distribution accuracy.

Third, Implications for Service Effectiveness

Improved drug distribution directly contributes to the quality of pharmaceutical services, accelerates response to service unit needs, and indirectly improves patient satisfaction. A more reliable and efficient distribution system also minimizes the risk of expired drugs, out-of-stock items, and unnecessary stockpiling, which have historically hampered service delivery.

Fourth, Strategic Implications:

More broadly, this research demonstrates that the Lean approach is not only applicable to the manufacturing industry but is also relevant and applicable in the hospital environment. Consistent Lean implementation can drive a transformation in work culture toward more productive, responsive, and value-based performance. Pasirian Regional General Hospital can use this research result as a model for pharmaceutical logistics distribution management that can be replicated in other areas, such as medical device distribution, BMHP, or even other medical support services.

Fifth, Implications for Internal Hospital Policies:

This research demonstrates the urgency of developing new policies and standard operating procedures (SOPs) to support the implementation of a Lean-based distribution system. This includes streamlining workflows, adjusting human resource workloads, and maximizing the use of information technology. With the support of appropriate internal regulations, distribution system changes will be not only technical but also sustainable.

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