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Implementation of The Just-In-Time Method on Drug Inventory Efficiency at The Pharmacy Department of Kaliwates Hospital Jember

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ABSTRACT

Background: During the Covid-19 pandemic, the management of drug inventory and sypply faces a great challenges. A common problem in the management of supplies at the pharmacy installation is the accumulation of drugs that are rarely used, which causes drugs to become damaged or expired, as well as the shortage of drugs that should be available. RSU Kaliwates Jember has implemented a strategy in 2023 to optimize the drug inventory in the Pharmacy department by applying a Just-In-Time strategy in drug purchasing. This study aims to analyze the impact of the strategy in three sector: drug procurement cost, total inventory cost, and inventory day. **Methods:** The analysis applied the Quacy-experimental one group pretest-posttest design. The main goal is to analyze causal relationships by comparing the results of the two tests in order to determine the impact of the treatment. This study is a one-group pretest-posttest research design by comparing the value before and after the implementation of just-In-Time strategy, value at 2022 and 2023. The data was obtained from system management at RSU Kaliwates Jember (SIMRS) for procurement cost, inventory values, an inventory days. **Results:** The analysis showed that there is a significant efficiency in drug procurement cost with a p-value of 0.041. For the total inventory value, the strategy could significantly reduce the value wiyh p-value of 0.006. In addition, the strategy could shorten significantly the inventory days with p-value 0.017. **Conclusions:** This study conclude that the implementation of just-in-time strategy has an impact on improving the efficiency of drug inventory management especially in the reduction of the procurement cost, inventory value and inventory days. The impact of this strategy is worth to further analyze in the other sector such us in the drug wastage due to dead stock or expire drug and drug shortage that could affect the pharmacy care.

Keyword: just-in-time procurement; procurement costs; total inventory value; inventory days.

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INTRODUCTION:

Hospital pharmacy services are a critical component of the healthcare system, delivering patient-centered care through the provision of safe, high-quality, and cost-effective medicines, medical devices, and consumables. Procurement is the activity of fulfilling the planned and approved needs through purchases, either directly or through tenders from distributors, production, or manufacturing of pharmaceutical preparations, whether sterile or non-sterile, or coming from donations or grants (Mumek in Erna and Lalu, 2024). Common issue in managing supplies at the pharmacy department is the accumulation of rarely used drugs, which often leads to product damage or expiration, as well as shortages of essential medicines that should remain available which impact the wastage, financial loss, and compromised service quality (Alfaouri et al., 2025).

The application of Lean Management in healthcare supply chains facilitates the systematic identification of waste such as excess inventory, delays, and inefficiencies, and supports targeted interventions to enhance operational efficiency, reduce costs, and improve service delivery (Talero-Sarmiento et al., 2024) A study conducted at Jombang Regional Hospital (RSUD Jombang) reported that wastage in the procurement process decreased from 96.07% to 45.60%, while wastage in the receiving process declined from 62.59% to 58% following the adoption of Lean Management principles (Widodo, 2022). Similarly, research at Surabaya Islamic Hospital (RS Islam Surabaya) demonstrated improved efficiency in the planning, procurement, storage, preparation, and distribution stages of the pharmacy unit after Lean Management implementation (Setianto et al., 2020).

In 2023, the management of RSU Kaliwates implemented Lean Management through the Just-in-Time (JIT) procurement approach—a method of purchasing medicines from pharmaceutical distributors only when the stock levels begin to decline, thereby reducing inventory values. However, the effectiveness of this initiative has not yet been evaluated. The 2023 year-end management report indicated that improvements in pharmaceutical supplies had not been observed. Evaluating the implementation of Lean Management through the Just-in-Time (JIT) will provide evidence on its effectiveness in reducing inventory costs, minimizing expired medicines, and preventing stock-outs, thereby supporting data-driven decision-making to optimize pharmacy supply management and improve service quality (Balkhi et al., 2022)

Internal evaluation in 2022 at the Pharmacy Department at RSU Kaliwates revealed that, among the nine stages of pharmaceutical supply management, three stages required the most improvement: Drug Procurement (procurement stage), Drug Inventory (storage stage), and Inventory Days (control stage). These stages were prioritized due to their potential to yield significant improvements with minimal cost implications. Consequently, this study focuses on these three critical stages of pharmaceutical supply management.

Based on the above findings, this study aims to assess the effectiveness of Lean Management implementation through the JIT strategy at the Pharmacy Department of RSU Kaliwates Jember. Specifically, the study seeks to evaluate its impact on procurement cost efficiency, inventory management efficiency, and reduction of inventory days.

METHODS:

This study employed using quacy-experimental one-group pretest–posttest design. This design includes a pretest before the treatment is given and a posttest after the treatment is given, thus the results of the treatment can be known more accurately because it can be compared to the condition before the treatment was given. The research was conducted at the Pharmacy Department of RSU Kaliwates Jember, a Type C hospital that has implemented Lean Management through the JIT

methods. The study site was selected because, although Lean Management had been adopted, its efficiency had not yet been formally evaluated.

The study assessed three main parameters related to pharmaceutical supply management:

1. Procurement costs – the total drug purchase cost (before and after discounts).
2. Total inventory value – the total value of drugs stored in the hospital warehouse and pharmacy depot.
3. Inventory days – the average duration (in days) that drugs remained in inventory.

Data for these parameters were obtained from the Hospital Management Information System (SIMRS) and the Inventory Evaluation Data of PT. Rolas Nusantara Medika, covering the period from January 2022 to December 2023. To ensure data validity and reliability, all data were cross-verified with inventory evaluation records.

The steps in implementing the Just-in-time method at Kaliwates Jember General Hospital include:

1. Sorting of Just-in-time medicines to identify medicines can be obtained/purchased from the wholesalers available in Jember Regency.
2. Separating the storage of Just-in-time medicines from non-Just-in-time medicines.
3. Create an MoU with wholesalers in Jember Regency who can implement Just-in-time. The contents of the MoU include several points:
    a. Minimum purchase invoices to avoid shipping costs
    b. Delivery time to allow same-day delivery
4. Create a manual Stock Card for monitoring Just-in-time medicines.
5. Just-in-time medicines that have been purchased and delivered by PBF are distributed directly to inpatient and outpatient depots, so that they are received directly by patients, without any storage in warehouses.
6. Temporary storage of Just-in-time medicines is only available in inpatient and outpatient depots, so that Just-in-time medicine shelves and manual stock cards are only available at the depot.
7. The function of the pharmaceutical warehouse is only as an administration.

The effectiveness of Lean Management implementation was evaluated based on three key outcome variables:

1. Procurement cost efficiency: defined as a reduction in the cost of purchasing drugs of equivalent quality. Secondary data is taken from the Hospital Management Information System (SIMRS). HNA (pharmacy net price) – discount Collection at the end of the month.
2. Medical supply inventory efficiency: defined as a decrease in the total value of stored drugs. Secondary data was taken from the SIMRS. HNA was collected at the end of each month.
3. Inventory day reduction: defined as a reduction in the average number of days drugs remain in storage. Secondary data was taken from the SIMRS.

Efficiency for each variable was calculated using the following general formula:

$$\text{Efficiency } (\%) = \frac{\text{Pretest value} - \text{Posttest value}}{\text{Pretest value}} \times 100$$

One-sample testing in principle is to test whether a certain value (as a comparison) is significantly different or not. The certain value here is generally a parameter value to measure a population. (Nuryadi, 2017). If the interpretation of the p value < 0.05, it is stated to be significantly different. Prior to analysis, the data were tested for normality using the Shapiro–Wilk test. Because the results indicated non-normal data distribution (p > 0.05), a Wilcoxon signed-rank test was applied to compare pre- and post-

intervention data. Statistical significance was determined at a 95% confidence level with $\alpha = 0.05$. A p-value < 0.05 was considered statistically significant, indicating a meaningful effect of JIT implementation.

RESULTS:

Effectiveness of Lean Management at RSU Kaliwates Jember

The implementation of Lean Management aims to enhance modern management capabilities in facing greater challenges following the Covid-19 pandemic. Based on the results of the internal meetings at the RSU Kaliwates Jember pharmacy installation, it was decided to implement Lean Management using the Just-in-Time method. The Just-in-Time method is applied through accurate planning of drug procurement and collaboration with drug distributors, taking into account the numerous Pharmaceutical Wholesalers (PBF) in Jember Regency.

This Just-in-time method is used because it can be implemented without increasing costs and labor and is considered capable of improving efficiency in the pharmaceutical installation at RSU Kaliwates Jember.

Procurement Cost Efficiency

The procurement cost analysis were obtained from the Medicine Purchase Report of RSU Kaliwates Jember, comprising purchases of FOPI medicines (Pertamedica IHC Drug Formulary) and JKN medicines (national drug formulary). As an IHC member facility, RSU Kaliwates sources approximately 60–65% of its medicines from the FOPI formulary and 5–10% from JKN medicines relative to total annual purchases.

Table 1. Total Drug Procurement Costs at RSU Kaliwates Jember, 2022–2023

Month	Procurement Cost (Rp) 2022	Procurement Cost (Rp) 2023	Cost Difference (Rp)	Efficiency (%)
January	1,136,145,123	945,898,481	190,246,642	16.74
February	1,788,844,011	930,299,652	858,544,959	47.99
March	1,095,280,069	927,379,861	167,900,208	15.31
April	832,381,162	1,074,892,815	−242,511,653	−29.13
May	1,249,286,295	1,074,892,815	174,393,480	13.96
June	1,491,073,639	1,118,061,752	373,011,887	25.02
July	1,048,548,801	1,009,911,755	38,637,046	3.68
August	1,702,716,341	1,071,562,461	631,153,880	37.07
September	1,276,081,543	1,153,095,672	122,985,871	9.64
October	1,340,734,680	989,317,147	351,417,533	26.21
November	732,360,932	909,385,882	−177,024,950	−24.17
December	1,059,332,046	1,218,157,373	−158,825,327	−14.99
Total	**14,752,784,642**	**12,422,855,066**	**2,329,929,576**	**15.79**

Source: Secondary Data from the Hospital Information System (SIMRS) (2022 and 2023).

As shown in Table 1, the total drug procurement cost in 2022 (prior to Lean Management implementation) amounted to Rp 14,752,784,642, whereas in 2023 (after implementation) it decreased to Rp 12,422,855,066, reflecting an efficiency improvement of 15.79%.

Total Inventory Value

The total drug inventory value data were obtained from the Inventory Evaluation Records of PT Rolas Nusantara Medica for 2022 and 2023. As shown in Table 2, implementation of JIT strategy at RSU Kaliwates Jember led to a marked reduction in the total inventory value throughout 2023 compared to 2022.

Table 2. Total Drug Inventory Values at RSU Kaliwates Jember, 2022–2023

Month	Inventory Value (Rp) 2022	Inventory Value (Rp) 2023	Difference (Rp)	Efficiency (%)
January	1,603,200,755	1,024,573,180	578,627,575	36.09
February	1,627,011,827	1,182,776,493	444,235,334	27.30
March	1,613,098,329	1,052,616,435	560,481,894	34.74
April	1,606,056,870	1,173,450,568	432,606,302	26.93
May	1,793,668,014	1,095,668,013	698,000,001	38.91
June	1,674,949,141	1,096,135,216	578,813,925	34.56
July	1,765,151,828	943,707,655	821,444,173	46.54
August	1,463,823,135	923,199,596	540,623,539	36.93
September	1,349,731,729	917,964,163	431,767,566	31.99
October	1,114,528,796	1,036,589,252	77,939,544	6.99
November	1,003,798,473	1,053,776,047	−49,977,574	−4.98
December	1,288,612,342	1,417,487,001	−128,874,659	−10.00
Total	**17,903,631,239**	**12,917,943,619**	**4,985,687,620**	**27.85**

Source: Processed secondary data from PT Rolas Nusantara Medica (2022–2023)

As shown in Table 2, the total inventory value prior to Lean Management implementation in 2022 was Rp 17,903,631,239, which decreased to Rp 12,917,943,619 in 2023. This represents a 27.85% improvement in inventory efficiency.

Inventory Days

Data on inventory days were obtained from the Hospital Management Information System (SIMRS) of RSU Kaliwates Jember. Table 4.5 summarizes the comparison of inventory days before (2022) and after (2023) Lean Management implementation. The total number of inventory days decreased from 153.43 days in 2022 to 140.78 days in 2023, indicating an efficiency gain of 8.24%.

Table 3. Inventory Days at RSU Kaliwates Jember, 2022–2023

Month	2022 (days)	2023 (days)	Difference	Efficiency (%)
January	12.73	11.69	1.04	8.17
February	11.83	11.54	0.29	2.45
March	12.87	9.82	3.05	23.70
April	12.02	12.14	−0.12	−0.99
May	12.27	11.47	0.80	6.52
June	13.13	11.90	1.23	9.37
July	12.45	10.56	1.89	15.18
August	11.74	10.47	1.27	10.82
September	12.44	10.48	1.96	15.76
October	18.91	16.53	2.38	12.59
November	11.15	12.19	−1.04	−9.32
December	11.89	11.99	−0.10	−0.84
Total	**153.43**	**140.78**	**12.65**	**8.24**

Source: Processed secondary data from PT Rolas Nusantara Medica (2022–2023)

As shown in Table 3, the average inventory days in 2022 amounted to 153,43 days which decreased to 140,78 in 2023. This represents a 8,24% improvement in inventory efficiency.

Table 4. Statistical Analysis of JIT Effects on Pharmaceutical Supply

Parameter	Statistic	p-value (2-tailed)
Procurement Cost Efficiency	Z = -	0.041
Total inventory value	Z = −2.746	0.006
Inventory Days	Z = -2.394	0.017

Statistical analysis using the Wilcoxon signed-rank test produced a negative Z-value (Table 4), indicating that post-implementation costs were lower than pre-implementation values. The p-value = 0.041 (< 0.05) confirms a statistically significant difference in drug procurement costs before and after the implementation of Lean Management. The difference in drug procurement costs between 2022 and 2023 is Rp. 2,329,929,576,- or there is an efficiency of 15.79% from 2022 to 2023. The Wilcoxon signed-rank test yielded a Z value = −2.746 and a p-value = 0.006 (< 0.05), indicating a statistically significant difference between pre- and post-implementation inventory values. The negative Z value confirms that the post-implementation data were consistently lower than the pre-implementation values, reflecting the positive effect of the strategy on reducing inventory accumulation. The Wilcoxon signed-rank test produced a Z value = −2.394 and a p-value = 0.017 (< 0.05), a statistically significant reduction in the number of inventory days after Lean Management implementation. This result indicates that the application of the JIT methods effectively reduced the average drug storage duration at the hospital.

DISCUSSION:

The Effect of Lean Management on Drug Procurement Costs

The results demonstrate a significant difference in drug procurement costs before and after the implementation of the JIT strategy at the Pharmacy Department of RSU Kaliwates Jember. The total reduction in procurement costs between 2022 and 2023 was IDR 2,329,929,576, representing an efficiency improvement of 15.79%. This improvement is attributed to the transition from a consumption-based procurement system to a JIT planning approach. The results of this study are in accordance with the research of Mohammad Sallam (2024), which states that with the implementation of Lean Management, costs can be reduced by 8%. The JIT system minimizes unnecessary stockpiling by synchronizing procurement with real-time demand, thereby reducing overstocking and holding costs. Consequently, the application of Lean Management principles—particularly through JIT tools—enabled the pharmacy to decrease procurement expenditures by up to 15.79% compared to pre-implementation levels. A study reported that JIT adoption in hospitals can generate cost savings ranging from approximately 10% to 17%, mainly through reduced inventory holding costs and elimination of waste (Balkhi, 2024). Similarly, more recent evidence (2025) indicates that JIT systems effectively align inventory with real-time demand, thereby reducing excess stock and minimizing wastage (Pramod Kumar Muppala, 2025)

The adoption of JIT procurement at RSU Kaliwates Jember is feasible due to the region's robust pharmaceutical distribution network. Based on the 2010 Pharmaceutical Wholesalers Facility List, Jember Regency has 32 licensed pharmaceutical wholesalers (PBFs), far more than neighboring regencies such as Banyuwangi (2 PBFs), Bondowoso (4 PBFs), and Situbondo (2 PBFs), while Lumajang has none. This extensive supply chain infrastructure supports flexible,

need-based purchasing. Additionally, price stabilization policies by IHC during 2022–2023 prevented fluctuations in drug prices, further enhancing procurement efficiency.

Prior to Lean Management implementation, procurement followed a consumption-based model, with purchases made to maintain stock levels in both the medicine depot and warehouse. After adopting Lean Management, procurement became more targeted: medicines were purchased only to replenish the medicine depot based on actual consumption, while the warehouse assumed a primarily administrative role in managing inventory records.

The Effect of Lean Management on the Total Value of Drug Inventory

JIT also had a substantial impact on reducing the total drug inventory value. The total inventory value decreased from IDR 17,903,631,239 in 2022 to IDR 12,917,943,619 in 2023, corresponding to a 27.85% increase in efficiency. This decline in inventory value reflects the transition from a consumption-based inventory system to one guided by Lean principles. The integration of continuous stock evaluation reduced unnecessary accumulation of pharmaceuticals in both warehouse and clinical units. Regular and systematic stock monitoring ensured that purchases aligned closely with consumption patterns, minimizing stagnant inventory and reducing the risk of drug expiration or damage. Continuous stock evaluation and systematic monitoring shown to reduce overstock and stock-outs, align procurement with actual consumption, and minimize pharmaceutical waste and expiration in hospital settings (Damput & Sulistiadi, 2025)

Furthermore, improved data accuracy and transparency through real-time monitoring in the Hospital Management Information System (SIMRS) enhanced decision-making regarding procurement timing and quantity. The application of JIT methodologies optimized the balance between supply and demand, ensuring that inventory levels were both cost-efficient and operationally adequate.

The Effect of Lean Management on Inventory Days

Result indicates a significant reduction in average inventory days following JIT implementation. In 2022, total inventory days amounted to 153.43 days per year (an average of 12.8 days per month), which declined to 140.78 days (11.7 days per month) in 2023. This reduction corresponds to an 8.24% improvement in efficiency. The reduction in inventory days suggests faster drug turnover and improved synchronization between supply and demand. As procurement now focuses on real consumption needs, excess stockholding is minimized, leading to more efficient inventory utilization.

Nevertheless, slight increases in inventory days were observed in April, November, and December 2023. These temporary fluctuations are explained by proactive measures taken to anticipate supply disruptions and increased patient loads during specific periods. For example, higher procurement volumes were observed before the Eid al-Fitr holidays (April) and the Christmas–New Year season (November–December), when major pharmaceutical wholesalers temporarily suspend operations. Such adjustments reflect adaptive planning within the Lean framework, aimed at maintaining service continuity while preventing stockouts.

According to Kua Walker (2010), hospitals see many immediate benefits from using the JIT method, such as increased employee productivity and cash flow from purchasing to inventory. Over time, as hospitals began to understand the procurement costs better from the benefits of the JIT system, they learned to design contracts that encourage mutual profit and savings between hospitals and distributors/suppliers.

The results of this study are also consistent with the research conducted by Doso et al. (2020) titled Analysis of Inventory Control Using EOQ,

JIT, and MMSL Methods at the Pharmacy Installation of XXX Hospital in Mojokerto City during 2016-2018, which showed that the control of drug and medical device inventory at the Pharmacy Installation of XXX Hospital in Mojokerto City has been efficient, with an average ITOR value of around 28 times compared to the existing standard of 8–12 times.

Research Limitations

This study faced several limitations, including time constraints, limited human resources, and challenges in data collection and processing accuracy. Moreover, the analysis was restricted to three efficiency variables: procurement cost, total inventory value, and inventory days. Future research should expand the scope by evaluating additional Lean Management indicators such as dead stock levels, procurement lead time, stock-out occurrences, and distributor service performance. Incorporating these variables will provide a more comprehensive understanding of Lean Management's impact—not only on procurement and inventory efficiency—but also on distribution reliability and the reduction of expired drug losses.

CONCLUSIONS:

The implementation of Lean Management through the JIT (JIT) procurement method demonstrated a significant positive impact on drug procurement costs, total inventory value, and inventory days at the Pharmacy Department of RSU Kaliwates Jember. The application of Lean principles resulted in a more effective and efficient procurement process by reducing stagnant stock, minimizing the risk of drug damage and expiration, and optimizing the overall drug supply chain.

To enhance procurement cost efficiency, optimize inventory value, and reduce inventory days in other healthcare facilities—particularly those located in districts or cities with active pharmaceutical distributors (PBFs)—it is recommended that Lean Management be adopted using the JIT approach. This method enables better synchronization between procurement and demand, promoting sustainable efficiency in hospital pharmaceutical management.

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