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Evaluation of the Medicine Logistics Management System at Public Health Centers

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Abstract

This study aims to evaluate the medicine logistics management system at Puskesmas x, Batam City, focusing on three key components: medicine distribution, ordering time and Reorder Point (ROP), and medicine disposal. A qualitative research approach was employed, with data collected through in-depth interviews, observations, and document reviews conducted between March and April 2025. The key informants included the pharmacist-in-charge and pharmacy technicians.

The results indicate that medicine distribution follows a structured procedure, applying the First Expired First Out (FEFO) and First In First Out (FIFO) principles to maintain quality and minimize waste. The ROP method is integrated into a computerized system, enabling timely procurement when stock levels reach the minimum threshold. Medicine disposal is conducted according to the Standard Operating Procedure (SOP), with expired medicines identified, documented, and either returned to the Batam City Health Office or destroyed on-site.

Although the system largely complies with the Standar Pelayanan Kefarmasian di Puskesmas, challenges remain, including procurement delays due to central warehouse shortages and occasional expired stock. Strengthening coordination with the Health Office, improving demand forecasting, and establishing contingency procurement strategies are recommended to enhance efficiency and ensure uninterrupted medicine availability.

Keywords— medicine logistics management, primary health care, reorder point (ROP), medicine distribution, medicine disposal

INTRODUCTION

Efficient medicine logistics management is a critical component of public health service delivery, particularly at the primary health care level. Public Health Centers (PHCs) serve as the first point of contact between communities and the health system, providing essential promotive, preventive, curative, and rehabilitative services (World Health Organization [WHO], 2017). Ensuring the continuous availability of medicines in these facilities is vital to maintaining treatment adherence, preventing disease progression, and improving overall patient outcomes (Management Sciences for Health [MSH], 2012).

The medicine logistics management system encompasses a series of interrelated activities, including planning, procurement, receipt, storage, distribution, and disposal of pharmaceutical supplies (USAID DELIVER PROJECT, 2011). Weaknesses in any of these stages can disrupt the supply chain, leading to stock-outs, overstocking, or the provision of substandard medicines. Such inefficiencies not only compromise the quality of care but also undermine patient trust in the health system (Yadav, 2015).

In Indonesia, the Ministry of Health has established regulations such as the Minister of Health Regulation No. 74 of 2016 on Pharmaceutical Service Standards in PHCs, which emphasizes the importance of systematic medicine management to ensure rational drug use and availability (Kementerian Kesehatan RI, 2016). However, evidence suggests that gaps remain in the implementation of these standards, particularly in urban and resource-limited settings (Nurhayati et al., 2021).

Puskesmas x, located in Batam City, Riau Islands Province, plays a vital role in delivering primary health care services to a densely populated urban community. Despite the availability of government policies and funding mechanisms such as the National Health Insurance (JKN) program, preliminary observations indicate challenges in medicine supply chain operations, including delays in procurement, fluctuations in stock levels, and occasional shortages of essential drugs. These issues highlight the need for a systematic evaluation of the existing logistics management system to ensure optimal service delivery.

Given the strategic role of Puskesmas x in meeting the health needs of its surrounding population, evaluating its medicine logistics management system is crucial for identifying operational strengths and weaknesses, ensuring continuous medicine availability, and supporting evidence-based policy interventions. This study aims to assess the performance of the medicine logistics management system at Puskesmas x, focusing on its efficiency, reliability, and alignment with national pharmaceutical service standards.

RESEARCH METHODS

This study employed a qualitative research approach, which was directed toward gathering data, interpreting meaning, and gaining a comprehensive understanding of the case under investigation. The research was conducted at Puskesmas x, Batam City, Riau Islands Province, focusing on the evaluation of the medicine logistics management system.

The data collection period was carried out from March to April 2025. The key informant in this study was the pharmacist-in-charge at Puskesmas x, who possesses complete and in-depth knowledge regarding medicine logistics management at the facility's pharmacy installation. In addition, supporting informants included pharmacy technicians (Tenaga Teknis Kefarmasian, TTK) who assist the pharmacist in implementing medicine management tasks.

Two types of data sources were used in this study:

- Primary data – obtained through in-depth interviews with the pharmacist and pharmacy technicians regarding the processes of planning, procurement, receipt, storage, distribution, and disposal of medicines.
- Secondary data – obtained from document reviews, including monthly medicine usage reports, stock cards, procurement requests, and relevant photographs from the pharmacy installation.

Data collection techniques included:

- Interviews – conducted using a semi-structured guide to explore issues related to the planning and procurement of medicines. Interviews were recorded with the consent of the participants to ensure data accuracy.
- Observations – direct observation of logistics management activities and review of related documents at the pharmacy installation.
- Documentation – capturing relevant visual and written evidence from official records.

Instrument validation was carried out by cross-checking information from multiple data sources, including documents that could support or contradict the interview findings.

RESULTS AND DISCUSSION

Results

Flow of Medicine Distribution in the Pharmacy Installation at the Public Health Center

The medicine distribution flow in the pharmacy installation of a PHC aims to ensure that required medicines are available on time, with guaranteed quality, and in accordance with established procedures. The process can be explained in the following stages:

1. Medicine Request from Service Units
   - Health service units such as general clinics, dental clinics, emergency units, or special programs (e.g., TB, HIV, MCH) submit medicine requests based on daily or program needs.
   - Requests are made using a medicine request form or through the PHC management information system (if computerized).
   - Unit staff check internal stock before submitting a request.

2. Receipt of Requests by the Pharmacy Installation
   - Pharmacy staff receive the request form and check for completeness (medicine name, quantity, unit, and purpose of use).
   - Request verification is carried out to ensure conformity with the available medicine list and program requirements.

3. Retrieval of Medicines from the Pharmacy Storage
   - Pharmacy staff retrieve medicines from storage using the First Expired First Out (FEFO) or First In First Out (FIFO) principle.
   - Each withdrawal is recorded in a stock card or inventory system to maintain accurate data.

4. Packaging and Distribution Recording
   - Medicines are packed according to the request, with labels and usage instructions if necessary.
   - Staff record the distribution in a medicine distribution logbook including date, type of medicine, quantity, receiving unit, and recipient's signature.

5. Delivery of Medicines to Service Units
   - Medicines are handed over directly to the relevant service unit staff.
   - The receiving staff verify the type and quantity, then sign the receipt document.

6. Stock Monitoring and Evaluation
   - The pharmacy installation conducts periodic monitoring of medicine availability to prevent shortages or overstocking.
   - In case of stock-outs, a procurement request is made to the District Health Office or authorized distributor according to regulations.

Table 1. Human Resources at the Pharmacy Installation of the Public Health Center

No.	Position / Role	Number of Personnel	Main Responsibilities
1	Pharmacist-in-Charge	1	Overall management of medicine logistics, including planning, procurement, storage, distribution, and reporting.

2	Pharmacy Technician (TTK)	2	Assisting the pharmacist in medicine storage, preparation, distribution, and stock recording.
3	Administrative Staff (Pharmacy)	1	Managing documentation, inventory records, and coordination with other units.
4	Support Staff (Cleaning & Stock Handling)	1	Ensuring cleanliness of storage areas and assisting in handling and arranging stock.

Table 1 shows that the PHC pharmacy installation is managed by one pharmacist-in-charge, supported by two pharmacy technicians, one administrative staff, and one support staff. This structure enables essential logistics functions such as planning, procurement, storage, distribution, and record-keeping. However, the limited number of personnel may challenge workload management during peak demand, indicating a need for efficient task allocation and capacity building.

Pharmacy Installation Planning at the Public Health Center

Based on the research findings at Puskesmas x, Batam City, the planning process in the pharmacy installation is carried out annually and periodically to ensure the continuous availability of essential medicines. Planning begins with collecting consumption data from the previous year, disease pattern analysis, and treatment guidelines applicable at the PHC level. In 2024, the planning team, led by the pharmacist-in-charge, reviewed monthly medicine usage reports from all service units, including the general clinic, dental clinic, maternal and child health (MCH) program, and tuberculosis program.

The 2024 Rencana Kebutuhan Obat (RKO) included 156 types of medicines in accordance with the National Essential Medicines List (DOEN). The quantity for each item was calculated using the average monthly consumption method with an additional buffer stock of 10% to anticipate outbreak situations. For example, paracetamol syrup was planned at 1,200 bottles/year, amoxicillin syrup at 950 bottles/year, and ORS at 800 sachets/year.

Coordination was carried out with the PHC head and program coordinators to align the medicine requirements with the available operational budget. The proposed plan was then submitted to the Batam City Health Office for verification and inclusion in the centralized procurement schedule.

The study found that the planning process at Puskesmas x was generally accurate, with 93% of planned items procured on schedule. However, some adjustments were required during the year due to an unexpected dengue fever outbreak in mid-2024, which necessitated an emergency procurement request for additional antipyretics and ORS.

Effective planning in this PHC has contributed to minimizing stock-outs and ensuring that essential medicines are available to support uninterrupted health service delivery to the community.

Procurement of Medicines at the Pharmacy Installation of Puskesmas

Based on the research conducted at Puskesmas x, Batam City, the procurement of medicines follows the annual and periodic planning cycle determined through the Rencana Kebutuhan Obat (RKO). The procurement process is primarily carried out through the Batam City Health Office using a centralized procurement system. In 2024, the Puskesmas submitted two procurement requests:

- Annual procurement covering 156 types of medicines listed in the National Essential Medicines List (DOEN).
- Emergency procurement in July 2024 for 12 items, due to unexpected increases in patient visits during a dengue fever outbreak.

The main sources of medicines include:

- Dinas Kesehatan Kota Batam (82% of total procurement volume).
- National health programs such as TB and HIV/AIDS control (12%).
- Direct purchases using operational funds for urgent needs (6%).

Procurement documentation is handled by the pharmacist-in-charge, with all orders recorded in both manual stock cards and the Sistem Informasi Manajemen Puskesmas (SIMPUS). The average lead time from order submission to delivery in 2024 was 21 days for regular procurement and 5–7 days for emergency procurement.

The study found that while regular procurement generally met the planned schedule, delays occurred during Q2–Q3 2024 due to supplier stock shortages at the central warehouse. This resulted in temporary shortages of amoxicillin syrup, paracetamol syrup, and oral rehydration salts (ORS), which were mitigated through stock borrowing from nearby PHCs.

Overall, the procurement process at Puskesmas x is well-documented and compliant with Ministry of Health regulations, but dependency on centralized supply creates a vulnerability to delays, highlighting the need for contingency procurement strategies.

Medicine Receipt at the Pharmacy Installation of Puskesmas

Based on the research conducted at Puskesmas x, Batam City, the medicine receipt process is carried out upon every delivery from the Batam City Health Office, national health programs, or direct purchases. The receipt is managed by the pharmacist-in-charge, assisted by pharmacy technicians (TTK), to ensure the accuracy in quantity, type, and quality of the medicines received.

The receipt procedure includes:

- Checking delivery documents such as invoices, delivery notes, and item lists.
- Physical verification of medicines to match them with the documents, inspect packaging conditions, batch numbers, expiration dates, and labels.
- Recording the receipt in both manual stock cards and the Public Health Center Management Information System (SIMPUS).
- Reporting the receipt to the PHC head and the Health Office as part of logistics control.

Research data show that in 2024, regular medicine receipts were conducted every two months on average, with the number of items per delivery ranging between 120–156 types of medicines. The conformity rate between ordered and received items was 97%, while the remaining 3% represented shortages or delayed deliveries.

Several issues were identified during the receipt process, including delayed distribution in the second quarter due to stock shortages at the central pharmacy warehouse, and two cases of damaged packaging, which were returned to the supplier for replacement.

Overall, the medicine receipt procedure at Puskesmas x complies with the Ministry of Health's pharmaceutical service standards, with well-documented recording and reporting mechanisms. However, there is a need to improve coordination with suppliers to minimize the risk of delays and shortages in the future.

Medicine Receipt at the Pharmacy Installation of Puskesmas

The medicine receipt process at Puskesmas x begins with submitting the calculated medicine requirements using the Economic Order Quantity (EOQ) method. The request data are sent to the Pharmacy Installation of the District Health Office for verification against the available stock in the central warehouse. Once approved, the medicines are shipped to the PHC and received by the pharmacist-in-charge together with pharmacy technicians (TTK).

As explained by Informant 3:
"…the planning procedure is carried out every month, listed by the PHC pharmacist, and then submitted to the Pharmacy Installation warehouse of the District Health Office for stock verification. If certain medicines are out of stock, they will be replaced with similar ones. Once approved, the medicines will be delivered to the PHC…"

Upon arrival at the PHC, the receipt process includes:

- Checking delivery documents (invoice, delivery note, and item list).
- Physical verification (matching quantity, type, packaging condition, batch number, and expiration date).
- Recording the receipt in both manual stock cards and the PHC's information system.
- Reporting to the PHC head and confirming with the District Health Office.

Based on an interview with Informant 1, pharmacy technicians monitor warehouse stock through the PHC information system. If the current stock falls below the minimum threshold, a procurement plan is made and approved by the pharmacist:

"…we check the warehouse stock, the minimum stock, and the requested quantity. We must plan the amount needed…"

In practice, the quantity of medicines received is not always identical to the order. Adjustments are sometimes made by the District Health Office, especially when the central stock is unavailable, by providing alternative brands or dosage forms with the same active ingredients.

Informant 2 noted:

"…the problem is when the items listed for the District Health Office are out of stock, but there is no direct notification, and they simply replace them with other medicines…"

Emergency situations such as outbreaks or an increase in certain disease cases can also influence the amount received. The pharmacist may instruct an increase in the order quantity to anticipate needs beyond the system's calculated figures.

As Informant 1 explained:

"…we look at the outbreak trend and the prescriptions received. For example, if diarrhea cases are increasing, the number of orders for certain diarrhea medicines is increased even though the system already has a set rule…"

Overall, the medicine receipt process at Puskesmas x complies with the Standard Operating Procedure (SOP). However, dependence on the District Health Office's stock makes the process vulnerable to delays and discrepancies between the quantities ordered and received.

Medicine Distribution at the Public Health Center

The ordering time refers to the point at which medicine inventory reaches the minimum threshold, prompting a new order. This concept encompasses both the frequency of orders and the inventory level at which a reorder should be placed. The Reorder Point (ROP) calculation model is used to determine the minimum stock level that triggers a new order. Order frequency for a specific medicine can be calculated to determine how many times procurement occurs within a year. This is obtained by dividing the total annual consumption of the medicine by the Economic Order Quantity (EOQ) value.

Observations at the pharmacy installation of the Public Health Center indicate that the ROP method is already in use. Orders are placed when the current stock level reaches or falls below the minimum stock threshold. The minimum stock value is recorded and monitored through the computerized management information system. Inventory monitoring is typically conducted during the day, after stock levels have been reduced due to distribution to service units based on requests.

This process was further explained by one of the informants:

"…Usually, after receiving a request from the Public Health Center, we check for items that are out of stock. In the morning or afternoon, we input the request, issue the medicines, and observe the stock reduction. We check the final stock level and then prepare a purchase order (PO). The pharmacist-in-charge will contact the Health Office to confirm stock availability, after which we send the medicine list via WhatsApp or email. We do not wait for the regular distribution schedule from the Health Office—if medicine stock is running low, we immediately prepare the procurement plan so that the Health Office can deliver quickly, even outside the scheduled distribution, in the event of a shortage…" (Informant 1).

Medicine Disposal at Puskesmas

Based on in-depth interviews, medicine inventory control at the Pharmacy Installation is carried out to determine and ensure the availability of medicines that meet service demands. The personnel in charge manage the stock based on predefined minimum and maximum thresholds. As expressed by the informants:

"…providing the required quantity of medicines according to the shortage in stock…" (Informant 1)
"…determining minimum and maximum stock levels by referring to the current stock…" (Informant 2)

The personnel responsible for inventory control consist of the pharmacist-in-charge and two pharmacy technicians (Tenaga Teknis Kefarmasian, TTK). The pharmacist-in-charge is authorized to check and approve both the planned medicine requests and the existing inventory, while the pharmacy technicians assist by recording the list of out-of-stock medicines and submitting it to the pharmacist-in-charge.

This role division is reflected in the following statements:

"…I am the pharmacist-in-charge, and my role is to plan the medicine stock requests. I then inform the Pharmacy Installation at the Batam City Health Office, which will approve the request…" (Informant 1)
"…As pharmacy technicians, we are responsible for listing or recording out-of-stock medicines and submitting the list to the pharmacist-in-charge…" (Informant 2)

According to the interviews, the method used for inventory control is the minimum–maximum stock method:

"…here we use the minimum and maximum stock method…" (Informant 3)

In monitoring low stock levels, staff rely on a computerized information system. This was confirmed by several informants:

"…directly from the computer system…" (Informant 1)
"…using a computerized system…" (Informant 2)

Observations confirmed that stock recording is fully computerized, so medicines that fall below the minimum threshold are automatically listed as "out of stock." Based on interviews and document reviews, the planning procedures applied for inventory control follow the Standard Operating Procedure (SOP), which serves as a guide for managing requests and helps prevent medicines from expiring before use.

The inventory control process consists of three main activities: monitoring current stock levels, determining the planned request quantities, and checking the number of items to be ordered. In practice, if medicines previously distributed to service units are found to have expired, the pharmacist-in-charge will compile a list of the expired stock and report it to the Batam City Health Office. The Health Office will then decide whether the expired medicines should be returned to them or destroyed directly by the pharmacist and pharmacy technicians at the Pharmacy Installation of Puskesmas x.

Discussion

The findings of this study indicate that the medicine logistics management system at Puskesmas x operates in alignment with the Standar Pelayanan Kefarmasian di Puskesmas (Minister of Health Regulation No. 74 of 2016). The three key components analyzed—medicine distribution, ordering time and Reorder Point (ROP), and medicine disposal—demonstrate both strengths and areas for improvement in ensuring continuous medicine availability.

1. Medicine Distribution

The distribution process at Puskesmas x follows a structured and documented workflow, starting from requests by service units to the physical delivery of medicines. The application of the First Expired First Out (FEFO) and First In First Out (FIFO) principles reflects compliance with good storage practices and minimizes the risk of dispensing expired products. Similar findings were reported by Chandani et al. (2012), who emphasized that effective distribution mechanisms reduce the incidence of stock-outs and wastage in primary health care settings. However, this study identified occasional delays due to central warehouse shortages, highlighting the need for a contingency plan such as inter-facility stock borrowing or local procurement mechanisms.

2. Ordering Time and Reorder Point (ROP)

The use of ROP calculations to determine the minimum stock level for reordering demonstrates the facility's adoption of inventory control principles recommended in the Logistics Handbook by USAID DELIVER PROJECT (2011). The integration of the ROP system into the computerized management information system allows real-time monitoring, reducing the risk of ordering delays. Nevertheless, dependency on the centralized procurement schedule from the Batam City Health Office can still lead to temporary shortages, especially during outbreak situations. Yadav (2015) noted that such reliance on centralized systems is a common vulnerability in public health supply chains, and mitigation strategies—such as flexible ordering outside scheduled deliveries—are essential to maintain service continuity.

3. Medicine Disposal

The study also found that expired medicines are managed according to the SOP, beginning with identification and documentation by the pharmacist-in-charge and pharmacy technicians, followed by reporting to the Batam City Health Office for further instructions on whether to return or destroy the items. The use of a computerized stock monitoring system ensures timely identification of medicines nearing expiry, which is consistent with WHO (2017) recommendations for pharmaceutical waste minimization. However, the occurrence of expired medicines indicates a potential gap in demand forecasting and consumption tracking, as also discussed by Vledder et al. (2019), who highlighted the importance of accurate consumption data in reducing wastage.

4. Overall Implications

The results suggest that while the core processes of medicine logistics management at Puskesmas x are well-structured and in line with national standards, the system's efficiency is still influenced by external factors such as supplier availability and centralized procurement schedules. Strengthening coordination with the Batam City Health Office, implementing flexible procurement policies during emergencies, and enhancing demand forecasting accuracy are recommended steps to improve system resilience.

CONCLUSION

This study concludes that the medicine logistics management system at Puskesmas x generally operates in accordance with the Standar Pelayanan Kefarmasian di Puskesmas (Minister of Health Regulation No. 74 of 2016), covering key aspects of distribution, ordering, and disposal. The distribution process follows established procedures, applying First Expired First Out (FEFO) and First In First Out (FIFO) principles to maintain medicine quality and minimize wastage. The integration of the Reorder Point (ROP) method into a computerized management system enables timely ordering based on minimum stock levels, contributing to improved stock control.

Medicine disposal is conducted according to the Standard Operating Procedure (SOP), with clear roles for the pharmacist-in-charge and pharmacy technicians, supported by computerized monitoring to promptly identify expired medicines. However, the system still faces challenges such as occasional delays in procurement due to central warehouse shortages and the occurrence of expired medicines, indicating the need for more accurate demand forecasting and contingency procurement strategies.

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