

The Use of Fishbone Diagram as Root Cause Analysis in Drug Management at Community Health Center, Boyolali Regency, 2024

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ARTICLE HISTORY:

Submitted : 2025-08-31

Accepted : 2026-06-25

Published : 2026-06-30

KEYWORDS:

Boyolali; Drug management;
Evaluation; Fishbone diagram;
Puskesmas

Citation:

Arifah, R.H., Iswandi, paranginangis, J.M. (2026). The Use of Fishbone Diagram as Root Cause Analysis in Drug Management at Community Health Center, Boyolali Regency, 2024. Pharmacon: Jurnal Farmasi Indonesia, 23(1), 42-52. <https://doi.org/10.23917/pharmacon.v23i1.12653>

ABSTRACT

Drug management at community health centers plays an important role in ensuring the quality of health services. This study aims to evaluate drug management in inpatient community health centers in Boyolali Regency using the Hanlon method to determine problem priorities and the Fishbone diagram to trace root causes. The research was conducted descriptively through document review, observation, and interviews based on national drug management indicators. The results revealed inaccuracies in planning that led to both stock shortages and surpluses, distribution delays, as well as storage practices that did not fully comply with standards, including the application of FIFO/FEFO. The Hanlon analysis identified planning and distribution as priority issues, while the Fishbone analysis revealed that the main factors stemmed from limited human resources and suboptimal work methods. Enhancing the capacity of pharmacy staff, implementing information technology-based recording systems, and strengthening coordination with the Health Office are needed to ensure the effective and quality availability of medicines. Accordingly, enhancing pharmacists' capacity, utilizing digital technologies in medicine management, and fostering stronger coordination with the Health Office are recommended to promote accuracy, effectiveness, and sustainability in pharmaceutical service delivery.

INTRODUCTION

In Indonesia, community health centers (*puskesmas*) function as the main providers of primary healthcare and play a crucial role in ensuring the accessibility, availability, and rational use of medicines. Numerous studies have indicated that issues in pharmaceutical management at *puskesmas* remain prevalent, encompassing stages such as planning, procurement, storage, distribution, and documentation. A national review by the (Ministry of Health of the Republic of Indonesia, 2023) revealed that only 68% of community health centers complied with national standards for drug management, with the most common deficiencies occurring in planning accuracy and stock regulation. Likewise, research conducted by (Kurnilia et al., 2024) showed that the accuracy of drug planning at Sukoharjo CHC was below 75%, which led to discrepancies between

supply and actual demand. Ineffective planning often results in mismatches between drug needs and stock availability, while weaknesses in data recording hinder proper monitoring and evaluation. Furthermore, inappropriate storage conditions can increase the likelihood of medicine degradation and quality reduction (Ministry of Health of the Republic of Indonesia, 2021).

Previous investigations also confirmed that many *puskesmas* continue to face difficulties in harmonizing drug planning with real consumption, maintaining proper storage conditions, and ensuring the punctual delivery of supplies. Reported that approximately 20% of medicines stored at Sumberpitu CHC failed to comply with the FEFO system, which contributed to an increase in expired stock. Similarly, (Almahera, 2024) found that the timeliness of drug procurement in several CHCs in West Lombok was only around 70%, leading to

repeated shortages of essential drugs. Poor forecasting and inadequate reporting mechanisms limit effective supervision and evaluation, while neglecting the *First-Expired, First-Out (FEFO)* principle exposes health centers to financial losses and reduced drug efficacy (Almahera, 2024).

Considering these persistent challenges, it becomes imperative to systematically assess pharmaceutical management performance at *puskesmas*. Such evaluations are vital not only to identify inefficiencies but also to generate evidence-based strategies for improvement. Emphasized that enhancing staff competence and integrating digital data systems could significantly strengthen pharmaceutical management in primary healthcare. In addition, (Sholehah et al., 2024) reported that implementing a Management Information System (MIS) at Mijen CHC reduced stock imbalances by up to 30% when compared with manual processes. Consequently, empowering human resources, adopting digital-based management systems, and reinforcing coordination with relevant authorities are essential to ensure that drug management contributes to safe, effective, and high-quality pharmaceutical services (Sholehah et al., 2024).

Boyolali Regency, located in Central Java, hosts several inpatient community health centers that play a strategic role in delivering both primary and inpatient care. The area's geographical characteristics and dense population necessitate an efficient and well-coordinated pharmaceutical management system. A recent study by (Listiana et al., 2024; Wijianto et al., 2023) reported that the average accuracy of drug planning at Boyolali I CHC was only 72%, suggesting that pharmaceutical management issues continue to persist in this region. Therefore, a comprehensive assessment of drug management practices is required, utilizing the Hanlon method to establish problem priorities and the Fishbone diagram to explore root causes. The outcomes of this study are expected to provide valuable insights for system improvement and contribute to enhancing healthcare quality within Boyolali Regency (Fidihamah et al., 2020)

METHODS

This study employed a descriptive-evaluative design to assess drug management practices at

Community Health Center (CHC), Boyolali Regency, during the year 2024. This CHC was chosen purposively as the research site because it is one of the inpatient community health centers in Boyolali that provides both outpatient and basic inpatient services. Its strategic role in serving a large population and the geographical challenges of the region make it a representative case for evaluating the effectiveness of pharmaceutical management at the primary healthcare level (Menteri Kesehatan RI, 2019).

This study employed a descriptive-evaluative design to examine drug management processes comprehensively at Community Health Center (CHC). The selection of this design was based on its capacity to identify existing problems while simultaneously assessing performance against established national standards. A descriptive-evaluative approach enables both quantitative and qualitative interpretation of findings, providing a balanced perspective between numerical data (e.g., accuracy rates, compliance percentages) and contextual insights from staff interviews and observations. This design was also consistent with the national Ministry of Health (MoH) guidelines on performance evaluation at the primary care level (Ministry of Health of Republic, 2021).

Inclusion Criteria

Community health center staff directly involved in drug management activities (planning, procurement, storage, distribution, or reporting) and official records related to medicine logistics during January–December 2024 were included in the study. Exclusion Criteria: Records or respondents not directly related to drug management (such as administrative or non-pharmacy personnel) and incomplete data that could not be verified through triangulation were excluded. This CHC was purposively chosen as the study site because of its dual role in providing outpatient and inpatient services, representing a typical yet complex operational model for rural Puskesmas in Central Java. The data sources included both primary data (interviews and direct observations) and secondary data (administrative records, procurement documents, and monthly reports). To ensure data representativeness, the researchers reviewed drug management activities across different departments pharmacy, inpatient, outpatient, and program based units covering a

12-month reporting period (January–December 2024) (Cholilah et al., 2021).

The descriptive-evaluative research design was conducted at this Community Health Center, Boyolali Regency, in 2024 with data sources included:

Secondary data review

Planning, procurement, distribution, and drug usage records. Relevant administrative records were examined, including drug planning proposals, procurement documents, distribution reports, and drug utilization logs. These documents were analyzed to assess conformity with national guidelines, particularly the National Essential Medicines List (DOEN) and the National Formulary (FORNAS) (Menteri Kesehatan RI, 2019) (Ministry of Health of the Republic of Indonesia, 2019).

Direct observation

Storage facilities, temperature monitoring, and inventory practices. On-site observations were conducted to evaluate storage conditions, stock arrangement, temperature and humidity monitoring, as well as compliance with the First-Expired First-Out (FEFO) principle. Special attention was given to the handling of narcotics and psychotropic medicines, which require stricter regulatory adherence (Azizah, 2020).

Structured interviews

Conducted with pharmacy staff and drug management officers. Semi-structured interviews were carried out with pharmacy staff and drug management officers to capture insights on challenges, decision-making processes, and perceptions of system efficiency. These interviews also explored barriers to timely procurement and stock control (Almahera, 2024).

Data analysis

Combined both quantitative evaluation and qualitative interpretation. Quantitative indicators such as planning accuracy, procurement timeliness, and storage compliance were analyzed using percentage-based performance metrics compared with national standards (Satibi, 2021). Meanwhile, qualitative data from interviews and observations were analyzed thematically to identify recurring patterns, bottlenecks, and underlying causes of inefficiency. The integration of both datasets

allowed triangulation, thereby enhancing the validity and depth of findings (Sholehah et al., 2024).

Evaluation indicators

Based on national guidelines, the indicators included planning and procurement (drug proposal, conformity of available drug items with DOEN, planning accuracy, conformity with FORNAS, conformity of request quantity, and conformity of received quantity), storage and distribution (storage according to dosage form, temperature, narcotics regulation, and arrangement considering FEFO), availability and utilization (average stockout duration, Report on Drug Usage and Request From accuracy, conformity of program drugs with needs, and Inventory Turn Over Ratio/ITOR), and control and evaluation (percentage of expired drugs, percentage of damaged drugs, conformity of physical stock, and periodic evaluation) (Fanda et al., 2024).

Problem prioritization

The Hanlon method was used to assess problems based on size, seriousness, intervention effectiveness, and PEARL factors (propriety, economics, acceptability, resources, legality) (Fidihamah et al., 2020). Root cause analysis: The Fishbone diagram (Ishikawa analysis) was applied by grouping causes into six factors: man, method, machine, material, measurement, and environment (Ishikawa, 1990).

While the descriptive evaluative approach enabled an in-depth assessment of operational performance, it also presented certain limitations. The reliance on self-reported data from CHC staff may introduce reporting bias, and findings from a single site may not be fully generalizable to all Indonesian Puskesmas. However, the inclusion of multiple data sources and triangulation of methods helped to minimize potential bias and enhance the reliability of conclusions (Azis et al., 2026).

RESULT

The assessment results indicated that the Community Health Center (CHC) is still encountering notable difficulties in synchronizing its medicine planning process with the actual stock levels available on-site. Such discrepancies often disrupt service delivery and may result in temporary shortages of

essential drugs, thereby affecting patient treatment continuity. Furthermore, the timeliness of the procurement process remains hampered by inconsistencies in supplier delivery schedules. While the recording and

reporting mechanisms are generally functional, the existing stock monitoring procedures are yet to achieve the level of accuracy and responsiveness needed for precise drug forecasting.

Table 1. Recapitulation Results of Community Health Center in Boyolali Evaluation

Indicator	Achievement Notes	
Planning vs. Realization Accuracy	<70%	Significant discrepancies remain between needs and actual usage
Procurement Timeliness	<70%	Supplier distribution often delayed
Stock Sufficiency	95%	Most drugs available, but some items frequently out of stock
Storage	80%	In line with SOP, FEFO system needs improvement
Recording & Reporting	85%	Good, but consistency needs to be improved

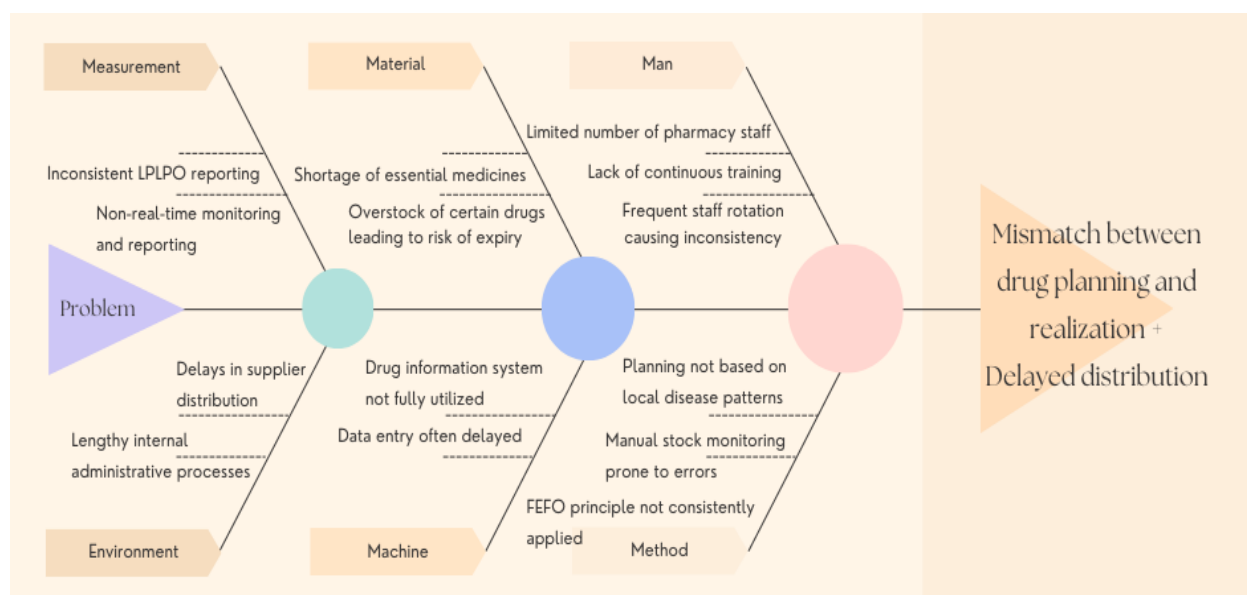


Figure 1. Fishbone Diagram

According to Table 1, the accuracy of medicine planning at this CHC was found to be under 70%, which is substantially below the national benchmark of 90%. Similarly, procurement timeliness only reached 70%, a reflection of repeated delays caused primarily by supplier-related issues. In contrast, the availability of medicine stocks appeared more stable, achieving a 95% sufficiency rate. However, occasional shortages of essential categories particularly antibiotics and antihypertensive drugs were still reported. Compliance with storage protocols obtained a score of 80%, signifying that environmental conditions such as temperature and humidity were properly maintained. Despite this, the application of the First-Expired, First-Out

(FEFO) procedure was inconsistent. The accuracy of recording and reporting stood at 85%, yet periodic delays in uploading data into the electronic system hindered timely supervision and analysis. Among all indicators, stock control represented the most problematic aspect, with a 70% performance rate and recurring cases of both excess inventory (e.g., vitamins, analgesics) and shortfalls (e.g., antihypertensive medications). These issues collectively demonstrate that, despite operational progress, significant refinements are still required for this CHC to reach optimal pharmaceutical management standards (Novianti & Kusumastuti, 2025).

The planning accuracy rate of less than 70% demonstrates that the current forecasting process still lacks analytical rigor. As shown in Table 2, the average planned volume (5,885 units) was significantly lower than the actual usage (9,507 units), resulting in only 61.9% accuracy. This discrepancy suggests that planning practices are not yet based on comprehensive data, such as epidemiological trends or service utilization figures 1 gap similarly noted by (Satibi, 2021). Underestimating medicine needs often leads to shortages of essential drugs, thereby compromising continuity of care. (Menteri Kesehatan RI, 2019) emphasizes that rational drug forecasting should integrate multiple data sources, including disease patterns and consumption histories, to ensure accurate projections and prevent both shortages and oversupply (Pinasthika & Nugraheni, 2024).

Table 2. Planning and Procurement Results of Community Health Center in Boyolali

Average Plan (A)	Average Use (B)	Percentage = (A/B)x100%
5.885	9.507	61,90

The 70% performance level in procurement timeliness (Table 2) indicates persistent delays stemming from administrative inefficiencies and irregular supplier schedules. Lengthy internal approval processes and inconsistent distribution patterns mirror challenges previously reported in West Lombok, where delayed procurement disrupted drug availability (Almahera, 2024). Implementing electronic procurement systems and enforcing performance-based contracts for suppliers are recommended to streamline timelines and enhance accountability (World Health Organization, 2024).

A stock sufficiency rate of 95% (Table 3) implies that overall availability is relatively stable; however, irregular shortages of key medicines such as antibiotics and antihypertensives continue to occur. Simultaneously, certain non essential items including vitamins and analgesics are overstocked, revealing inconsistencies in safety stock management. This imbalance suggests that stock regulation policies are not uniformly applied. As emphasized by (Sholehah et al., 2024), real-time digital inventory systems, such as Management Information Systems (MIS), can improve the equilibrium of stock levels and prevent both shortages and surpluses across health programs.

Table 3. Stock Sufficiency Results of Community Health Center in Boyolali

Obat Program X			Obat Program Y		
Tersedia (A)	Kebutuhan (B)	% = (A/B)x100%	Tersedia (A)	Kebutuhan (B)	% = (A/B)x100%
950	1.000	95,00%	600	600	100,00%

Based on Table 4, this Community Health Center (CHC) demonstrated an 80% compliance rate, showing strong adherence to established storage standards, particularly in maintaining optimal temperature and humidity conditions. However, inconsistent enforcement of the First-Expired, First-Out (FEFO) principle remains a notable shortcoming. Adherence to this principle is crucial for minimizing drug wastage and preventing financial losses resulting from expired pharmaceutical products, as highlighted by (Azizah, 2020). Strengthening internal quality assurance mechanisms through regular supervision, scheduled audits, and the integration of automated temperature and humidity monitoring systems would significantly improve the reliability and

efficiency of storage management practices. The overall evaluation indicates that this CHC continues to encounter persistent obstacles in harmonizing drug requirement planning with actual stock availability.

Table 4. Storage Results of Community Health Center in Boyolali

Number of Storage Places	According to FEFO	Not According to FEFO	Percentage (%)
15	12	3	80,00%

The disparity between projected needs and existing supplies disrupts service delivery and

creates recurring shortages of essential medicines, which can compromise patient safety and treatment continuity. Furthermore, procurement timeliness remains constrained by inconsistent supplier schedules and administrative delays. Although the documentation and reporting systems function adequately, the existing monitoring framework lacks the analytical precision and flexibility needed to facilitate accurate, data-driven drug forecasting (Table 5).

Table 5. Recording and Reporting Results of Community Health Center in Boyolali

Name of CHC	Recording and Reporting	
	Yes	No
Nogosari	✓	

The overall evaluation indicates that this CHC continues to encounter persistent obstacles in harmonizing drug requirement planning with actual stock availability. The disparity between projected needs and existing supplies disrupts service delivery and creates recurring shortages of essential medicines, which can compromise patient safety and treatment continuity. Furthermore, procurement timeliness remains constrained by inconsistent supplier schedules and administrative delays. Although the documentation and reporting systems function adequately, the existing monitoring framework lacks the analytical precision and flexibility needed to facilitate accurate, data-driven drug forecasting (Table 5).

As shown in Table 1, the drug planning accuracy rate was recorded at less than 70%, significantly below the national benchmark of 90%. Likewise, procurement timeliness achieved only 70%, reflecting ongoing supply delays largely influenced by external distribution challenges. Conversely, stock sufficiency reached 95%, indicating relative stability in overall availability, though occasional shortages were observed for essential therapeutic groups such as antibiotics and antihypertensives. The facility's compliance with storage procedures scored 80%, confirming proper temperature and humidity maintenance; however, inconsistent FEFO application continues to pose an operational risk. The accuracy of reporting and documentation

reached 85%, though delays in electronic data entry still hinder prompt analysis and decision-making.

Of all assessed indicators, inventory management proved to be the most vulnerable area, with a 70% performance score and recurring evidence of overstocking (notably vitamins and analgesics) alongside understocking (primarily antihypertensive drugs). These patterns reflect an imbalance in inventory control that can lead to inefficiencies, waste, and service interruptions. Collectively, these findings emphasize that, while this CHC has made tangible progress in several operational areas, further structural and procedural improvements remain essential to achieving a sustainable, responsive, and high-performing pharmaceutical management system aligned with national health service standards.

The evaluation of drug management at this Community Health Center revealed several critical issues that significantly influenced the quality of health services. The findings showed discrepancies between planned drug requirements and actual usage, resulting in both shortages and surpluses. Essential medicines were not always available, while some non-essential drugs accumulated in excessive quantities. This imbalance had the potential to disrupt patient care, particularly when stockouts occurred for life-saving medications.

Drug management evaluation showed that the system was generally running, but several weaknesses required attention. Quality indicator analysis revealed:

- Drug need planning was not fully aligned with actual usage. Some drugs were understocked while others were overstocked.
- Drug procurement experienced delays, mainly due to supplier distribution problems and administrative processes.
- Drug storage met standards (temperature, humidity, recording), but FEFO application remained inconsistent.
- Recording and reporting were relatively good, though delays in data entry into reporting applications still occurred.
- Stock control was not yet optimal. Some essential drugs experienced stockouts during certain periods.

A Fishbone diagram analysis demonstrated that the root causes of these problems were primarily related to human resources, methods, and environmental factors. Pharmacy staff numbers were limited, resulting in high workloads, while training opportunities were insufficient. The planning process did not fully utilize local epidemiological data, and stock monitoring was still performed manually, making it prone to errors and delays. Externally, suppliers' late distribution schedules also contributed to procurement inefficiencies.

The fishbone diagram observations specific to this CHC revealed root causes of the main problems: discrepancies between planning and realization, and distribution delays.

The Fishbone are:

Man (Human Resources)

- Limited pharmacy staff, resulting in heavy workloads.
- Minimal training, leading to uneven knowledge of drug management.
- Frequent staff rotation, causing inconsistencies in management.

Method

- Drug need planning not fully based on local epidemiological data.
- Manual stock monitoring, prone to delays and errors.
- FEFO principle not applied consistently.

Material

- Essential drug stockouts still occurred.
- Overstock of certain drugs, risking damage/expiry.

Machine (System/Tools)

- Drug management information system not optimal.
- Data entry often delayed, disrupting planning.

Measurement

- LPLPO not fully accurate and consistent.
- Reporting not real-time, delaying decision-making.

Environment

- Supplier distribution often delayed.
- Lengthy internal administration, slowing procurement.

The key contributing factors identified were related to human resources, operational methods, and the external supply environment. Therefore, improvement efforts should prioritize enhancing the competency of pharmacy personnel, expanding the use of digital reporting and inventory systems, and strengthening coordination with suppliers to ensure timely and reliable drug distribution.

While this Community Health Center (CHC) has shown significant progress in meeting storage and handling standards, persistent weaknesses in the consistent application of the First-Expired, First-Out (FEFO) principle and the management of controlled substances continue to pose potential patient safety concerns. Overcoming these challenges requires not only technical corrective actions but also a stronger institutional commitment to accountability, transparency, and good governance within the pharmaceutical management framework. This CHC has also demonstrated commendable alignment between pharmaceutical supply and programmatic needs, indicating sufficient institutional capacity to match drug availability with the local disease burden and public health priorities. This consistency reflects the facility's ability to translate national program targets into practical operational outcomes at the community level.

Overall, the findings suggest that drug management at this CHC is operational but remains vulnerable, influenced by workforce capacity, administrative efficiency, and external supply chain dynamics. Achieving a sustainable and high-quality pharmaceutical system will require a comprehensive reform strategy that focuses on developing human resources, advancing digitalization of pharmaceutical information systems, and promoting collaborative partnerships across institutional and regional levels. Such integrated efforts are vital to ensuring continuous, safe, and effective medication services for the community.

DISCUSSION

The evaluation revealed that several drug management indicators at this Community Health Center (CHC) were still below the expected standards, particularly concerning the accuracy of drug types and quantities in relation to planned requirements. This discrepancy was influenced by multiple factors, including delays

in supplier distribution, inconsistencies between drug planning and local disease patterns, as well as inadequate monitoring of inventory levels.

The assessment of pharmaceutical management performance in this research utilized several primary indicators derived from national standards and supporting literature. Planning accuracy refers to the level of agreement between projected drug requirements and the quantities actually obtained through procurement, reflecting the precision of forecasting in meeting real service needs (Satibi, 2021). Procurement timeliness evaluates whether the procurement process occurs according to the planned schedule, indicating the effectiveness of coordination and the overall efficiency of the supply system (Almahera, 2024). Storage compliance examines the extent to which storage practices conform to established standards, including proper regulation of temperature and humidity as well as the consistent application of the *First-Expired, First-Out (FEFO)* principle to safeguard medicine quality (Azizah, 2020).

In addition, stock sufficiency reflects the percentage of essential medicines available compared to the facility's actual requirements, serving as an indicator of supply reliability. LPLPO accuracy and Inventory Turn Over Ratio (ITOR) are used to evaluate the efficiency of stock utilization and reporting, ensuring that inventory management is both accurate and timely (Sholehah et al., 2024). Finally, the percentage of expired or damaged drugs denotes the portion of pharmaceuticals rendered unusable due to expiration or improper handling, acting as a key measure of quality assurance and the effectiveness of warehouse supervision (Tumiwa et al., 2024). The indicators used in this study align with those employed by (Kurnilia et al., 2024) as well as (Listiana et al., 2024), who similarly highlighted planning accuracy and procurement timeliness as key factors influencing the effectiveness of drug management.

As indicated in Table 2, the 61.9% realization rate highlights a clear mismatch between projected and actual drug needs. This fundamental issue stems from the limited use of historical consumption data, disease prevalence, and seasonal trends in the forecasting process. According to Fidihamah et al. (2020), applying structured prioritization methods such as the

Hanlon approach is essential for accurately identifying real healthcare demands. Therefore, transitioning to a more analytical and evidence-based planning model is necessary to improve the alignment between estimated requirements and actual drug utilization.

This CHC also demonstrated commendable consistency in conducting regular evaluations, reflecting a systematic process of reviewing critical indicators of pharmaceutical performance. These assessments extended beyond administrative routines to include comprehensive performance analyses, the identification of areas for enhancement, and the formulation of actionable improvement plans. The steady achievement of key indicators suggests that a culture of continuous evaluation and improvement has become embedded across the health facilities, indicating effective leadership and strong organizational commitment toward improving pharmaceutical service quality. Another persistent challenge is the limited number of qualified pharmacy professionals. Excessive workloads and frequent staff rotation contribute to inconsistencies in stock management and hinder the consistent application of Good Pharmaceutical Practices (GPP). Expanding the number of pharmacists and implementing ongoing professional development programs are crucial measures to strengthen pharmaceutical management capacity at the community level.

From a logistical perspective, the persistent delays in the procurement process highlight the urgent necessity for stronger coordination with suppliers and the streamlining of internal administrative procedures. Implementing digital, real-time reporting systems would not only improve data precision but also enhance transparency and enable faster managerial responses to emerging stock challenges. Although this CHC has demonstrated a firm commitment to continuous quality enhancement particularly in upholding proper storage practices the inconsistent enforcement of the *First-Expired, First-Out (FEFO)* system and limited oversight of high-alert and controlled substances continue to present serious operational and safety concerns that demand immediate corrective action.

Efficient pharmaceutical management is central to achieving Indonesia's Universal Health Coverage (UHC) vision. Frequent shortages of

essential drugs compromise equitable healthcare access, often compelling patients to turn to private facilities and incur higher out-of-pocket expenses. Conversely, excessive procurement and avoidable wastage strain public health budgets, diverting funds from other critical services. Therefore, optimizing the drug management system extends far beyond logistical efficiency it constitutes a cornerstone of both health equity and financial sustainability.

The recent achievement of 95% stock sufficiency at this CHC represents a meaningful advancement toward national performance targets. Nevertheless, ensuring stable availability across all essential medicine groups remains crucial to maintaining the consistency of service quality and reinforcing public confidence in primary healthcare delivery. Continuous monitoring, evidence-based forecasting, and transparent supplier partnerships will be instrumental in transforming these short-term gains into a resilient, sustainable pharmaceutical management system.

A major strength of this CHC lies in its commitment to transparency and regular self-evaluation. The ongoing use of internal performance indicators has fostered a feedback mechanism that promotes institutional learning and adaptive management. This proactive culture differentiates high-performing facilities from those that focus solely on compliance. To build upon this strength, this CHC could establish pharmaceutical quality circles collaborative meetings where staff analyze operational data, identify systemic issues, and design corrective actions collectively. Research has shown that such participatory practices enhance employee engagement, accountability, and adherence to standard procedures.

Although the CHC has begun implementing digital tools such as the e-LPLPO platform, the existing system still functions primarily for record-keeping rather than analytical decision support. Future advancements should focus on integrating pharmacy data with broader health information systems to enable predictive forecasting based on disease incidence and patient utilization trends. This integration would transform pharmaceutical management from a reactive model into a proactive, data-driven process.

In modern healthcare, pharmaceutical management must also account for its ethical

and environmental implications. Improper disposal of expired or damaged drugs contributes to environmental pollution and poses public health risks. The CHC's success in reducing the number of expired medicines through improved FEFO implementation is commendable; however, more comprehensive strategies for pharmaceutical waste management are necessary. Incorporating green pharmacy principles such as prioritizing the procurement of longer shelf life medicines and enforcing environmentally safe disposal practices would align this CHC with global sustainability standards and strengthen its role as a model for environmentally responsible healthcare institutions.

The scope of this study was restricted to one community health center, potentially limiting the transferability of its conclusions to broader settings. Additionally, the dependence on self-reported measures and manually compiled records poses the risk of bias in data accuracy. Future investigations should expand to multiple facilities and employ longitudinal designs to ensure greater validity and temporal consistency in findings (Azis et al., 2026).

CONCLUSIONS

Overall, drug management at this CHC was fairly good but still had weaknesses, especially in planning-realization conformity and procurement timeliness. Strengthening stock monitoring, optimizing planning based on disease patterns, and improving coordination with suppliers are needed to improve drug management quality. The analysis of both tables reveals that this CHC demonstrates satisfactory performance in procedural compliance, particularly in storage and documentation, but continues to experience inefficiencies in planning and procurement.

ACKNOWLEDGMENT

No.

AUTHOR CONTRIBUTION

All authors contributed equally to this research.

CONFLICT OF INTEREST

There is no conflict of interest in conducting this research.

ETHICAL CONSIDERATIONS

No.

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