

Analysis of Drug Management Compliance Based on WHO Indicators at a Type C Public Hospital

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ABSTRACT

Background: Drug management plays a fundamental role in ensuring medicine availability, patient safety, and efficient use of healthcare resources in hospital. Assessing compliance with standardized drug management indicators is essential for identifying gaps in pharmaceutical services and supporting continuous quality improvement. **Objective:** This study aimed to analyze drug management compliance based on the World Health Organization indicators at a Type C public hospital. **Methods:** A descriptive retrospective study was conducted using drug management record from January to December 2024, complemented by direct observation and interviews with pharmacy personnel. The assessment covered four domains, including drug selection, procurement, distribution, and drug use. **Result:** The findings showed that formulary compliance reached 84%, available procurement funding was 113% of the estimated requirement, procurement accuracy was 101%, stock card accuracy was 100%, medicine availability was maintained for 14 months, expired medicines accounted for 0.5%, and dead stock represented 6% of total inventory. The average number of medicines per prescription was 2.7 items, generic prescribing accounted for 59% of prescriptions, and average dispensing times were 50 minutes for compounded prescriptions and 23 minutes for non-compounded prescriptions. Although several indicators met recommended standards, formulary compliance, generic prescribing, inventory turnover, and dead stock management require further improvement. **Conclusion:** Strengthening evidence-based pharmaceutical management is necessary to enhance service quality and optimize medicine utilization in public hospitals.

Keywords : Drug Utilization; Hospitals; Public; Inventory Control; Pharmaceutical Services.

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INTRODUCTION

Drug management is a fundamental component of hospital pharmaceutical services because it directly influences medicine availability, patient safety, treatment continuity, and healthcare efficiency. Hospitals allocate a substantial proportion of their operational expenditure to medicines and pharmaceutical supplies, making effective drug management essential for both financial sustainability and quality of care. Ineffective management may lead to medicine shortages, excessive inventory, expired medicines, dead stock, procurement inefficiencies, and irrational medicine use, all of which can compromise patient outcomes and increase healthcare costs (1,2).

Drug management is a continuous cycle consisting of medicine selection, procurement, storage, distribution, and rational medicine use. Each stage is interconnected, and weaknesses in one component may negatively affect the overall pharmaceutical supply chain. Appropriate medicine selection ensures that hospitals procure medicines consistent with therapeutic guidelines, while effective procurement secures continuous medicine availability. Efficient inventory management minimizes wastage resulting from expiration and overstocking, whereas rational medicine use promotes safe, effective, and economical treatment. To facilitate systematic evaluation, the World Health Organization has developed standardized indicators for assessing hospital drug management performance (3,4).

In many low and middle income countries, maintaining an efficient pharmaceutical supply system remains challenging due to increasing medicine demand, budget limitations,

procurement delays, and inventory management issues. Previous studies have reported that poor inventory control contributes to medicine shortages, high levels of expired medicines, and financial losses in hospital pharmacy services (5,6). These findings demonstrate that routine evaluation using standardized performance indicators is essential for improving pharmaceutical management and supporting evidence-based decision making.

Several studies have evaluated hospital drug management using World Health Organization indicators. Nugroho et al. reported that procurement activities generally met recommended standards; however, delayed payments and prolonged dispensing times remained important operational challenges (7). Arfianingsih et al. identified expired medicines exceeding recommended thresholds together with persistent dead stock, indicating weaknesses in inventory control (8). Rumangkang et al. found that formulary compliance was below the expected standard, suggesting that medicine selection had not been fully aligned with national recommendations (9). In contrast, Kusumaningrum et al. demonstrated that pharmaceutical management indicators in a teaching hospital largely complied with established standards, reflecting the influence of institutional management capacity and organizational support (10). These findings indicate that hospital drug management performance varies considerably across healthcare settings.

Although previous studies have described individual drug management indicators, most focused on reporting indicator values without comprehensively evaluating compliance across the entire pharmaceutical management cycle. Furthermore, limited attention has been given to integrating findings from drug selection, procurement, distribution, and medicine use into a single assessment framework capable of identifying priority areas for managerial improvement. This limitation reduces the practical value of previous evaluations for hospital policy development and continuous quality improvement.

The novelty of this study lies in its comprehensive assessment of hospital drug management compliance using the complete set of World Health Organization indicators across four major domains: drug selection, procurement, distribution, and drug use. Rather than merely presenting descriptive indicator values, this study identifies areas of compliance and non-compliance, enabling a more comprehensive understanding of pharmaceutical management performance and providing evidence-based recommendations for improving medicine availability, inventory efficiency, and rational medicine use in hospital settings.

Therefore, this study aimed to analyze drug management compliance based on World Health Organization indicators at a Type C public hospital. The findings are expected to provide practical evidence for strengthening pharmaceutical management systems and supporting quality improvement initiatives in hospital pharmacy services.

METHODS

This study employed a descriptive observational design with a retrospective approach to evaluate drug management performance at the Pharmacy Installation of a Type C public hospital in Indonesia. The study was conducted using hospital drug management records from January to December 2024. Ethical approval was obtained from the Institutional Ethics Committee prior to data collection.

The study population comprised all documents related to hospital drug management during the study period, including medicine procurement reports, stock cards, inventory records, medicine distribution reports, prescription records, and hospital formulary documents. Total sampling was applied, whereby all eligible drug management records from the study period were included in the analysis.

Drug management performance was evaluated based on the World Health Organization (WHO) drug management indicators and the Indonesian Ministry of Health Regulation No. 72 of 2016 concerning Standards of Pharmaceutical Services in Hospitals. The evaluated variables included

medicine selection (National Formulary compliance), procurement (procurement funding, procurement accuracy, and procurement frequency), inventory management (stock card accuracy, Turn Over Ratio, medicine availability, expired medicines, and dead stock), and medicine use (generic prescribing and dispensing time).

Data were collected through document review, direct observation of pharmacy practices, and semi-structured interviews with pharmacy personnel to verify the implementation of drug management procedures. The primary research instruments consisted of standardized data extraction forms developed according to WHO drug management indicators, observation checklists, interview guides, and a computer equipped with Microsoft Excel for data entry and calculation.

Data processing included data verification, coding, tabulation, calculation of each indicator according to WHO formulas, and validation for completeness and consistency. Descriptive statistical analysis was performed by calculating frequencies, percentages, ratios, and averages. The observed indicator values were then compared with WHO benchmarks and Indonesian Ministry of Health standards to determine the level of compliance. The findings were presented in the form of tables and narrative descriptions to facilitate interpretation of hospital drug management performance.

The research procedure consisted of six sequential stages: (1) obtaining ethical approval and research permission; (2) collecting drug management documents; (3) conducting document review, observations, and interviews; (4) calculating WHO drug management indicators; (5) comparing the results with WHO and national standards; and (6) interpreting and presenting the findings.

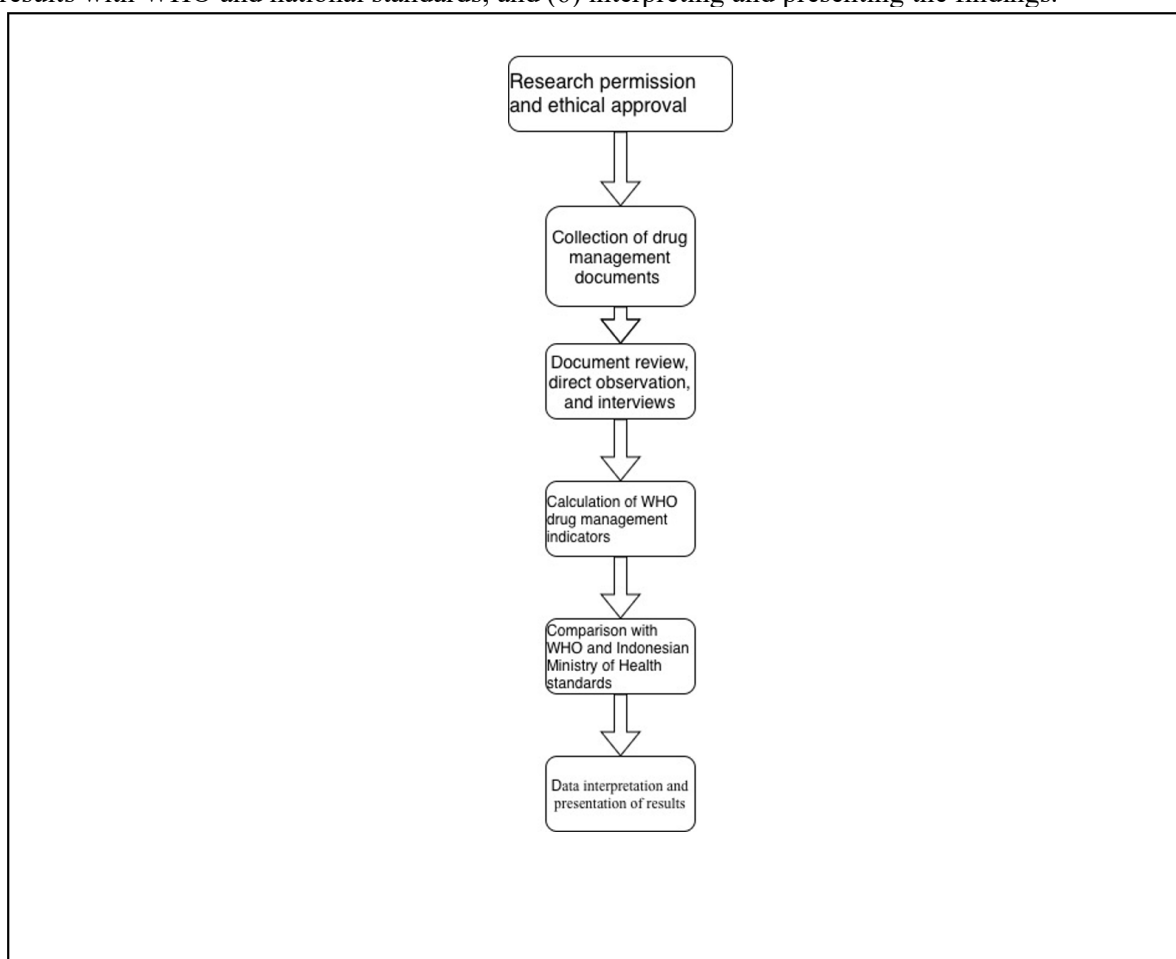


Figure 1. Research Stages Flowchart

RESULTS

A total of all eligible drug management records from January to December 2024 were included in the analysis. The evaluation covered four domains of drug management: medicine selection, procurement, inventory management and distribution, and medicine use.

National Formulary Compliance

The analysis of medicine selection showed that 84% of medicines prescribed in the hospital were listed in the Indonesian National Formulary (FORNAS), while 16% were non-formulary medicines.

Table 1. National Formulary Compliance

Num.	Indicator	Percentage (%)
1	FORNAS-compliant medicines	84
2	Non-FORNAS medicines	16
Amount		100

Table 2. Procurement Performance Indicators

Num.	Indicator	Percentage (%)
1	Procurement funding	113
2	Procurement accuracy	101
3	Procurement frequency	24 times/year

Table 3. Inventory Management Indicators

Num.	Indicator	Percentage (%)
1	Stock card accuracy	100
2	Turn Over Ratio (TOR)	6.5 times/year
3	Medicine availability	14 months
4	Expired medicines	0.5%
5	Dead stock	6%

Table 4. Medicine Use Indicators

Num.	Indicator	Percentage (%)
1	Generic prescribing	59
2	Dispensing time (coumpounded)	50 minutes
3	Dispensing time	23 minutes

Table 5. Overall Drug Management Indicators

Num.	Indicator	Indicators	Percentage (%)
1	Medicine selection	FORNAS	84
2	Procurement	Procurment funding	113
3	Procurement	Procurement accuracy	101
4	Procurement	Procurement frequency	24 times/year
5	Inventory management	Stock card accuary	100%
6	Inventory management	TOR	6.5 times/year
7	Inventory management	Medicine avaibility	14 months
8	Inventory management	Expired medicines	0.5 %
9	Inventory management	Dead stock	6%
10	Medicines use	Generic prescribing	59%
11	Medicine use	Dispensing time (compounded)	50 minutes
12	Medicine use	Dispensing time (non-compounded)	23 minutes

DISCUSSION

The findings of this study demonstrate that drug management at the hospital showed varying levels of performance across medicine selection, procurement, inventory management, and medicine use. While several indicators reflected effective management practices, others revealed areas requiring further improvement. These findings emphasize the importance of evaluating the entire drug management cycle because deficiencies at one stage may influence medicine availability, operational efficiency, and the quality of pharmaceutical services.

Compliance with the National Formulary had not yet reached the expected level, indicating that non-formulary medicines were still prescribed. Formulary adherence is essential for promoting rational medicine selection, standardizing prescribing practices, and improving procurement efficiency. The World Health Organization (WHO) emphasizes that selecting a limited number of essential medicines based on clinical needs, efficacy, safety, and cost-effectiveness can streamline procurement and distribution, improve medicine availability, support rational prescribing, and reduce healthcare costs. Therefore, strengthening coordination between the Pharmacy and Therapeutics Committee, prescribers, and the pharmacy installation is necessary to improve formulary compliance. Regular prescription audits and periodic formulary evaluations may also help identify the reasons for non-formulary prescribing and support appropriate corrective measures.

Procurement performance showed relatively favorable results, although funding and procurement accuracy slightly exceeded the estimated requirements. Adequate financing is essential to maintain medicine availability; however, procurement exceeding planned requirements may indicate discrepancies between forecasting and actual consumption. Previous research in Indonesian hospitals has also demonstrated that procurement performance does not always fully comply with established standards, with discrepancies reported between planning, allocation of funds, procurement quantities, and actual medicine use. These findings highlight the importance of accurate demand forecasting based on historical consumption, morbidity patterns, stock levels, lead time, and available budgets. Improving coordination between pharmacy, procurement, and financial units may further enhance procurement efficiency and reduce the risk of both shortages and excessive inventory.

Inventory management demonstrated strong performance in terms of stock card accuracy, indicating consistency between inventory records and physical stock. Accurate inventory records are essential for effective monitoring, procurement planning, and prevention of stock discrepancies. Nevertheless, the presence of expired medicines and dead stock indicates that further optimization of inventory control is required. Dead stock may result from changes in prescribing patterns, inaccurate forecasting, low medicine utilization, or excessive procurement. Moreover, accumulation of slow-moving and dead-stock medicines increases the risk of expiration and financial losses. Previous evidence from Indonesian hospitals suggests that inventory control approaches such as Minimum-Maximum Stock Level (MMSL) can improve inventory efficiency by reducing stock value, stock-outs, and dead stock. Similarly, ABC-VEN analysis, Economic Order Quantity (EOQ), Reorder Point (ROP), and safety stock calculations may support prioritization and more efficient purchasing decisions.

The observed Turn Over Ratio indicates that inventory circulated several times during the study period. TOR is an important measure of inventory efficiency because a low turnover may reflect excessive stock, whereas excessively high turnover may increase the risk of medicine shortages if procurement and replenishment are not well controlled. The medicine availability period observed in this study suggests that the hospital maintained

sufficient stock to support service continuity. However, maintaining large quantities of inventory for extended periods may increase holding costs and the risk of expiration. Therefore, inventory levels should be continuously adjusted according to consumption patterns, procurement lead times, and safety stock requirements. WHO emphasizes that essential medicines should be continuously available in sufficient quantities to meet patient needs, making a balance between availability and inventory efficiency particularly important. Regarding medicine use, generic prescribing remained below the optimal WHO/INRUD value. WHO/INRUD considers 100% generic prescribing an optimal target because prescribing medicines by generic name can support rational medicine use, facilitate procurement, and improve affordability. The lower proportion observed in this study may be influenced by prescriber preferences, clinical considerations, availability of specific products, or established prescribing practices. Strategies such as regular prescription audits, prescriber feedback, clinical pharmacy interventions, and strengthening hospital policies on generic prescribing may contribute to improving this indicator.

The dispensing service results should be interpreted according to Indonesian national pharmaceutical service standards rather than directly as WHO/INRUD dispensing-time indicators, as the definitions and measurement approaches may differ. Efficient prescription services are important because prolonged waiting times can affect patient satisfaction and the overall quality of hospital services. Workflow complexity, prescription volume, staffing levels, medicine preparation procedures, and information system performance may influence service time. Workflow optimization, electronic prescribing, improved coordination between service units, and appropriate allocation of pharmacy personnel may therefore contribute to more efficient prescription services.

Overall, the findings indicate that effective hospital drug management requires an integrated approach across the entire pharmaceutical management cycle rather than improvement of individual indicators in isolation. The relatively strong performance in procurement and stock-record accuracy provides a foundation for further improvement, while gaps in formulary compliance, dead stock management, generic prescribing, and service efficiency remain important priorities. Integrating routine performance monitoring with evidence-based inventory management strategies and multidisciplinary collaboration may help hospitals improve medicine availability, minimize pharmaceutical waste, promote rational medicine use, and strengthen operational efficiency. Continuous evaluation using WHO indicators alongside relevant Indonesian national standards is therefore recommended as part of hospital pharmaceutical quality improvement programs.

CONCLUSION

The findings of this study demonstrate that drug management at the hospital showed varying levels of performance across medicine selection, procurement, inventory management, and medicine use. While several indicators reflected effective management practices, others revealed areas requiring further improvement. These findings emphasize the importance of evaluating the entire drug management cycle because deficiencies at one stage may influence medicine availability, operational efficiency, and the quality of pharmaceutical services.

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REFERENCES

1. World Health Organization. *The selection and use of essential medicines, 2025: WHO Model List of Essential Medicines, 24th list*. Geneva: World Health Organization; 2025.
2. World Health Organization. *How to investigate drug use in health facilities: selected drug use indicators*. Geneva: World Health Organization; 1993.
3. World Health Organization. *Promoting rational use of medicines*. Geneva: World Health Organization.
4. World Health Organization. *Management of drugs at health centre level: training manual*. Brazzaville: WHO Regional Office for Africa; 2004.
5. Ministry of Health of the Republic of Indonesia. *Regulation of the Minister of Health of the Republic of Indonesia Number 72 of 2016 concerning Standards of Pharmaceutical Services in Hospitals*. Jakarta: Ministry of Health of the Republic of Indonesia; 2016.
6. Ministry of Health of the Republic of Indonesia. *Technical Guidelines for Pharmaceutical Service Standards in Hospitals*. Jakarta: Ministry of Health of the Republic of Indonesia.
7. Management Sciences for Health. *MDS-3: Managing Access to Medicines and Health Technologies*. Arlington, VA: Management Sciences for Health; 2012.
8. Quick JD, Rankin JR, Laing RO, O'Connor RW, Hogerzeil HV, Dukes MNG, et al. *Managing Drug Supply: The Selection, Procurement, Distribution, and Use of Pharmaceuticals*. 2nd ed. West Hartford, CT: Kumarian Press; 1997.
9. Satibi. *Manajemen Obat di Rumah Sakit*. Yogyakarta: Gadjah Mada University Press; 2014.
10. Pudjaningsih D. Pengembangan indikator efisiensi pengelolaan obat di farmasi rumah sakit. Yogyakarta: Universitas Gadjah Mada; 1996.
11. Putra et al. Efficiency of drug inventory control in hospitals in Indonesia using the Minimum-Maximum Stock Level: a systematic review. *Jurnal Manajemen dan Pelayanan Farmasi (Journal of Management and Pharmacy Practice)*.
12. Suhailah et al. Analysis of BPJS drug inventory control using ABC-VEN methods at Dr. Moewardi Surakarta Hospital in 2023. *Jurnal Manajemen dan Pelayanan Farmasi (Journal of Management and Pharmacy Practice)*.

13. World Health Organization. *Essential medicines*. Geneva: World Health Organization; 2026.
14. World Health Organization. *The rational use of drugs: report of the conference of experts, Nairobi, 25–29 November 1985*. Geneva: World Health Organization; 1987.