Formosa Journal of Multidisciplinary Research (FJMR)
Vol. 4, No. 6, 2025: 2561-2570

Analysis of Chemotherapy Drug Inventory Control Using the ABC Method at the Pharmacy Installation of Cancer Hospital in 2023

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A R T I C L E I N F O
Keywords: ABC Method, Chemotherapy Drug, Inventory Value, ITOR

Received : 16, May
Revised : 30, May
Accepted: 23, June

A B S T R A C T
Chemotherapy Drug inventory control in Cancer Hospitals has a high investment value. This becomes a crucial issue related to hospital income and drug availability. So it is necessary to analyze the inventory control of chemotherapy drugs to find out whether it is in the efficient category or not. Inventory control efficiency is assessed by Inventory Value and Inventory Turn Over Ratio (ITOR). The study used a descriptive method, with a sample of chemotherapy drugs from January to December 2023. Drugs are grouped based on the ABC method of investment value, analyzed for final inventory value and ITOR. The results showed that there were 16 drugs in category "A", 13 drugs in category "B", and 62 drugs in category "C". The inventory value decreased by Rp 243,249,119, - and ITOR increased by 29,914. It was concluded that chemotherapy drug inventory control at the Cancer Hospital Pharmacy Installation was efficient.

DOI: https://doi.org/10.55927/fjmr.v4i6.264
ISSN-E: 2829-8896
https://npaformosapublisher.org/index.php/fjmr

INTRODUCTION

Healthcare expenditure is increasing every year. This increase will affect the quality of health service delivery, including the quality of drugs to be provided. This presents new challenges for hospitals in providing financial resources to deliver quality-assured health services and medicines (Satibi, 2015). The management of medication has the task of providing safe, effective, and economical health services. The management of medication begins with the processes of selection, planning, procurement, storage, distribution, and usage (Kharazmi et al., 2016). The role of medication in healthcare services has significant consequences, as the budget allocated for purchasing drugs accounts for 40-50% of the operational budget for healthcare services.

Each hospital has a different drug inventory control system depending on the hospital's management policy. Therefore, the analysis method used in the study must be adapted to the existing management policy. There are two planning methods commonly used by hospital pharmacy departments: the epidemiological method and the consumption method. The epidemiological method is a planning approach based on disease patterns and projected increases in patient visits (Depkes, 2008). The consumption method, on the other hand, is used to plan the quantity of medication needed, based on an analysis of medication requirements from previous periods, with adjustments and corrections made for usage pattern. Similarly, there are differences in drug inventory control between general hospitals and specialized hospitals (Bodagenta, 2012).

Previous research on drug inventory control analysis has been conducted in general hospitals with different drug criteria, and there has been no similar research using cancer drugs or cancer hospitals as samples in the study. As in the study (Rofiq et al., 2020) using the ABC VEN and EOQ calculating methods in general hospital with sample of all BPJS drugs that fall into the AE criteria from ABC VEN analysis. In this study, also calculating of ROP value aand the services level value (CSL).

The ABC method is the simplest method that can be used in inventory control. This analysis relates to the value of drug use within 1 year by classifying drugs into three categories, namely A, B, and C, based on the total investment value used in 1 year or period. The principle of this analysis is to identify the types of drugs that require the most cost or budget due to usage or expensive prices by grouping. These groups are:

Table 1. Properties of Group A, B, C Chategory

A Category	B Category	C Category
• Very strict control • Small number of drug item • No safety stock / very low • High price • High frequent order	• Moderate stock control • Not many drug item • Medium price • Substitued with cheaper / more expensive drug	• Moderate stock control • Many drug items with same active ingredients • Low price

• Small quantities order • Weekly control stock • Careful inventory planning is required to avoid financial losses • Accurate record keeping and stock availability • Purchasing by one trusted department • Have a fast lead time	• Ordering adjusted according needs and planning • Purchases can be longer intervals • Combinations purchasing • Purchasing by one trusted department • Have a medium lead time	• stock inventory tends to be large and excessive • Stock control is required for storage efficiency • Ordering is adjusted to the needs and predicted usage based on consumption or epidemiology methods • Longer interval purchases • Purchasing by one trusted department

Some things that must be considered in the classification of drugs with the ABC method are drugs with the same active ingredient content are considered 1 drug name, drug classification uses the total consumption value not the unit price, the consumption period can be adjusted according to needs.

The efficiency and inefficiency of the control carried out can be seen from the indicators, namely the value of drug inventory at the beginning and end of the period and the value of the inventory turn over ratio (ITOR). This indicator is considered important because it will directly affect the income statement and statement of financial position of the hospital. The data required in calculating the inventory value is drug price data, data on the amount of drugs at the beginning of the period and the remaining at the end of the period. Inventory value can be calculated monthly or within a certain period of time (Rofiq et al., 2020).

The drug inventory value will be influenced by the stock of drug availability and changes in treatment pattern during the year. If the available stock at the end of the period is higher than at the beginning, the inventory value will be higher, and vice versa. If the drug has increased in price, the inventory value will increase. The lower of inventory value, the more effective inventory control is said to be. Inventory Turn Over Ratio (ITOR) is a method used to determine how many times funds rotate in a certain period. The higher ITOR value is better for inventory management, this is because there is not much inventory value settling in the warehouse (Supriyati, 2023). The purpose of the ITOR indicator is to assess and compare with the ideal ITOR standart value for hospitals is 8-12 times a year (Indarti et al., 2019).

LITERATURE REVIEW

Chemotherapy drugs are a running asset as well as the largest revenue for Cancer Hospital. This class of drugs has a considerable unit investment value, so in its operational activity, inventory control is needed to avoid losses. Drug inventory control is one of the important aspects of pharmaceutical management operations in hospitals. Inventory control aims to ensure the availability of sufficient drugs to meet the needs in service to patients, but also serves to avoid the accumulation of excess drug supplies and results in damage to drug preparations and financial ineffectiveness. But no much research has been done on the effectiveness of drug inventory control carried out in hospitals and health facilities.

The number of drugs available in the pharmacy installation must be in an optimal state to prevent the problem of drug vacancies. The unavailability of drugs needed in the implementation of chemotherapy will cause discomfort to patients, especially in emergencies that require drugs immediately. Drug vacancies also result in a decrease in the image of hospital service, which results in a decrease in the number of patient visits and patient dissatisfaction in conducting treatment (Ceylan & Bulkan, 2017).

The selection of inventory control methods must be adjusted to several factors, including the location of the hospital, the type of hospital, the financial position, the vision and mission of the hospital, and the business management patterns applied in the hospital (Yilmaz, 2019). There are several methods used to analyze and control inventory such as the ABC (Always Better Control) method, the MMSL (Minimum Maximum Stock Level), and the EOQ (Economic Order Quantity) (Sofia, 2023).

METHODOLOGY

This research has obtained permission from the Health Research Ethics Committee of the Islamic Hospital of Malang with No. 20/KEPK/RSI-U/III/2024 and was declared ethically feasible according to 7 WHO standards. This research uses a descriptive analytical method by describing the data obtained. The data used in this research is related to the use of chemotherapy drugs from January 2023 to December 2023 at a private cancer hospital in Indonesia. The required data includes the drug usage over one year, the remaining drug inventory in January 2023, the remaining drug inventory in December 2023, and the unit prices from each supplier.

Data analysis is conducted using the ABC method based on investment value. The total annual expenditure is calculated based on the total drug usage over the year obtained from the hospital management information system, along with the unit price of each medication. Then, these medications are sorted from the highest to the lowest total annual expenditure. Medications that are rated from 0–75% are classified as category A, the next 76–90% are classified as category B, and the remainder is category C.

The sample will be calculated of the ending inventory value. This calculation was carried out to determine the efficiency of controlling the inventory of chemotherapy drugs. This calculation requires the remaining drug data from January 2023 and December 2023. Inventory value of drug is calculated

by multiplying the amount of drug stock by the unit price of the drug at the beginning of the period and the end of the period, provided that the price of the drug is considered the same. The total of both is then compared to determine in which period the investment value is more efficient in managing the inventory of chemotherapy drugs during the year 2023. The calculation of the ITOR value is done by dividing the cost of goods sold by the average inventory value.

RESEARCH RESULT AND DISCUSSION

The chemotherapy drug management procedure carried out in this cancer hospital is different from the management of drugs in general, this is because chemotherapy drugs have relatively expensive prices and can cause more severe side effects than drugs in general. The first stage of drug management is selection by the pharmaceutical installation together with the medical committee and doctors. This stage will discuss the plan for drug use in the coming year, the standard of treatment to be used, drug effectiveness, drug availability and drug prices. Selection is also carried out on credible pharmaceutical wholesaler vendors to ensure drug quality.

Drug inventory control plays an important role in drug availability and hospital revenue. This management must be done in a coordinated manner, involving multidisciplinary with selective quality control and cost control. Chemotherapy drugs with a high investment value require good pharmaceutical management to avoid large losses. Pharmacy management requires an analysis method that can categorize chemotherapy drugs based on their investment value and usage. This can be done by using ABC analysis.

ABC Analysis

The results of the ABC analysis can be used as a reference in conducting drug planning in the next period, useful in carrying out inventory control and can be used to determine the types of drugs that should be prioritized from a financial point of view in order to improve the efficiency and effectiveness of purchasing and storage costs. ABC analysis based on investment value was chosen because this analysis will determine the type and classification of drugs based on the highest budget absorption in 2023. The results of this analysis are very common to change. This is because the use and needs of drugs in the implementation of chemotherapy will always changes in treatment patterns in accordance with the prevalence of patients receiving treatment.

Based on the ABC analysis that has been carried out, the following results are obtained:

Table 2. ABC Investment Analysis Results

Category	No of Drug	% of Drug	Annual Expenditure	% Annual Expenditure
A	16	15,38	IDR 13.376.803.842	74.74
B	13	12,50	IDR 2.658.947.307	14.86
C	75	72,12	IDR 1.861.075.370	10.40
Total	104	100	IDR 17.896.826.519	100

Based on Table 2, 16 types of drugs (15,38%) of chemotherapy drugs are in category A, 13 types of drugs (12,50%) in category B, and 75 types of drugs (72,12%) in category C, for a total of 104 drug items. According to the percentage and total investment required, category A accounted for 74.74% of the expenditure budget with a value IDR 13.376.803842, category B accounted for 14.86% of the expenditure budget with a value IDR 2.658.947.307, and category C accounted for 10.40% of the expenditure budget with a value IDR 1.861.075.370, so that the total budget required for the use of chemotherapy drugs in 2023 amounted to IDR 17.896.826.519. These results are consistent with (Sofia, 2023) findings, which state that category A drugs account for 74% of investment funds. Category A is given for drug items that are most often served so that maintenance for group A is the smallest because the storage costs of this type of inventory are not too long and the frequency of use is frequent. Category B is for the type of drug inventory that is used with moderate frequency. For group C, the type of inventory is low frequency; infrequent use causes maintenance costs to be higher due to the long storage process (Doso et al., 2020).

Category A chemotherapy drugs have a relatively high unit price but are used in small quantities, so in planning, it is attempted to be appropriate for use, and purchases are made in small quantities according to the therapy plan. The majority of category A chemotherapy drugs are parenteral injection preparations that require assistance from medical personnel.

Category B chemotherapy drugs are more likely to have similar active ingredient content and dosage with other category drugs. Category B drugs are dominated by parenteral injection preparations, and there are several medium-priced oral preparations.

Category C chemotherapy drugs have a relatively small price but a high number of uses. The majority of drugs in this category are oral preparations or tablets that can be consumed independently by patients. So that the inventory becomes more. To control drug inventory, at the planning stage, the minimum stock and maximum stock must be calculated so that there is no excess stock. It can also be done by shortening the storage time in the warehouse and optimizing the preparations that are already available. Without ABC analysis in inventory control, it will require greater effort to organize all drugs without knowing their priorities so that the inventory becomes ineffective as a whole (Darmawan et al., 2021).

The results of this ABC analysis are fluctuating it can be change at any time and can be different from one hospital to another.This is because the use and needs of drugs used in each hospital will be different and always change according to the preference of patients who take treatment and also the type of hospital. With this ABC analysis method, it is hoped that it can help managerial parties to carry out better drug management and planning.

Inventory Value Analysis

The inventory value is the value obtained from multiplying the number of drug items by the price of the drug. The data needed in calculating the inventory value are drug price data, data on the amount of drugs at the beginning of the

period, the amount of drug usage during 1 period and the amount of remaining. Based on the calculation of the inventory value carried out in January 2023 and December 2023, the following data were obtained:

Table 3. Inventory Value Result

Category	Inventory Value of January	Inventory Value of Decembers	Difference
A	IDR 389.008.095	IDR 111.395.155	IDR 277.612.940
B	IDR 48.109.587	IDR 28.854.087	IDR 19.255.500
C	IDR 128,060,867	IDR 102,999,877	IDR 25,060,990
Total	IDR 565.178.549	IDR 243.249.119	IDR 321.929.430

In January 2023, category A drugs have a January inventory value of IDR 389.008.095 and in December of IDR 111.395.155 with a difference in value of IDR 277.612.940. Category B drugs have a January inventory value of IDR 48.109.587 and in December of IDR 28.854.087 with a difference in value of IDR 19.255.500. Category C drugs have a January inventory value of IDR 128.060.867 and in December of IDR 10.999.877 with a difference in value of IDR 25.060.990. So that the total inventory value in January was IDR 565.178.549 and in December it was IDR 243.249.119 with the difference between the two being IDR 321.929.430. It can be said that the value of inventory from January - December 2023 has decreased by 57%.

Tabel 4. ABC Investment Statistical Results

	January 2023	December 2023	Statistic Test Result	Testing Method
Inventory Value	IDR 565.178.549	IDR 243.249.119	P Value 0,001	Wilcoxon Signed Ranks Test

After further analysis using the Wilcoxon Signed Ranks Test statistical test, there is a significant difference between the January inventory value data and the December 2023 data with a significance value <0.05. So it can be concluded that a low inventory value is more significant in controlling the supply of chemotherapy drugs.

The decrease in drug inventory value at the end of the 2023 period is because there are not many remaining drugs either in the pharmaceutical installation or in the Pharmacy Warehouse. Drugs that have been ordered have been maximized for use in chemotherapy services until December 2023. The remaining drugs at the end of 2023 are chemotherapy drugs that will be used in early 2024 because vendors and hospitals are still monitoring and evaluating stocks.

A low ending inventory value is more efficient than a high ending inventory value, because it means that there is not much drug stock sitting in the warehouse at the end of the period. The ratio of inventory value to total current

assets is 20-30%, which means that the greater the sales, the more inventory is needed. Vice versa, the smaller the sales, the lower the stock required.

Inventory Turn Over Ratio Analysis

Inventory turn over ratio is a parameter used to determine how much funs rotate in one period. In this study, it is calculated for 2023 period. ITOR also can be used such as indicator of the efficiency of drug management.

Tabel 5. ITOR Value Analysis Result

January ITOR	**December ITOR**
12,875	29,914

Based on table 5, it is known that the ITOR value in January was 12.875 and in December it was 29.914. These results indicate that in the 2023 period the funds rotated 29.914 times, it can be interpreted that the ITOR value of Hospital X is in the ideal category.

Based on the above indicators, it can be explained that the inventory value in December 2023 is higher than January 2023, so this will also affect the ITOR value. The higher the ITOR value, the more effective the turnover of drug inventory in the hospital, there are not many drugs left at the end of the period, there are no drugs that are damaged, there is no dead stock and over stock.

The way to carry out efficient inventory control is to evaluate drug inventory that is included in the slow moving category, evaluate inventory that is not used within 3 consecutive months, and conduct stock-taking which is carried out periodically and periodically to determine the suitability between real stock and that in the hospital management information system or online drug recording system (Kemenkes, 2016).

Several factors must be considered in carrying out inventory control;

1. Selection of generic products. Generic products have the lowest cost acquisition so that with a low nominal investment, a larger quantity of goods can be obtained.
2. Reduction in the amount of inventory. To minimize it, it can be done by reducing drugs with the same type, content and dosage to avoid duplication.
3. Selection of drugs in accordance with those listed in the national formulary or hospital formulary
4. Approval of returns to distributors to minimize losses.

CONCLUSIONS AND RECOMMENDATIONS

Chemotherapy is a therapy with a long treatment time and with great risk, both the risk of failure, recovery, financial and mental from the patient, the patient's family and the hospital. So to provide comfort, openness between the patient, the patient's family, the doctor and the pharmacy is also a determinant in making treatment decisions.

Based on the research that has been done, it can be concluded that the inventory control carried out at the Hospital is in a good category. This is

evidenced by the ITOR value which increased. At the beginning of the 2023 period of 12.87 and at the end of the 2023 period increased to 29.91. Inventory control, especially for chemotherapy drug preparations, is relatively safe and can be fulfilled properly.

Problems that still occur in controlling the supply of chemotherapy drugs are stockouts, expired drugs and damaged drugs. Stockout is a situation of unavailability of the desired drug so that it can be replaced by making substitutions with other drugs that have the same active ingredient content. Expired drugs are still found but in a very minimal amount, usually a class of drinking drugs. Damaged drugs were found in the storage process or inappropriate delivery process. This problem can be solved by checking when the goods arrive and applying the principles of first in first out (FIFO) and fisrt expired first out (FEFO).

This analysis can be used as a recommendation for routine analysis that can be used to determine the performance of pharmaceutical installations of Cancer Hospital in planning and controlling the supply of chemotherapy drugs within a specified period of time. This will ensure that the effectiveness of drug ordering, distribution, and use can be maximized.

Due to the fluctuating nature of medication use, which can change according to the condition of the patient, hospital management must adapt quickly to the situation. Rather than ordering large quantities of medication at one time, management should order medication gradually in relatively small quantities. This will reduce the risk of damage and storage costs.

ADVANCED RESEARCH

The results of the analysis that has been carried out cannot be fully implemented due to many considerations from the hospital regarding the suitability of the analysis method with hospital management conditions. the results of this research evaluation come from the user's perspective which is conveyed descriptively based on existing data and interviews with sources. this research can be used as an additional reference if the hospital will conduct a managerial audit, especially on drug inventory control.

ACKNOWLEDGMENTS

Praise and gratitude to Allah SWT for all His favors and blessings and to all those who helped so that the writing of this article could be completed.

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