A Periodic Review Inventory Control of Medicine at Hospital

Devi Ajeng[1*], Manasya Khulafa Alief Rahman[2], Devia[3]
[1,2,3] Department of Computer Science, Faculty of Mathematics and Natural Sciences, Universitas Negeri Semarang, Semarang, Indonesia
*Corresponding Author:

ABSTRACT
One of the important problems in inventory control is the problem of managing stock in the system. In the case of medicine product storage management, over inventory will lead to high storage costs and increase the risk of spoilage or expiration. While the shortage of inventory causes demand that cannot be fulfill. In addition, optimal storage management in the case of medicinal products is also an effort to create a socially responsible supply chain. Lack of product management causes products to experience stockout, resulting in low service levels at the hospital. This study aims to create a storage management model using periodic reviews so that the medicines in the hospital do not experience stockout or overstock and the hospital does not experience losses due to this. The periodic review method was chosen because it is considered capable of being a model of the problems faced by hospitals in storage. The calculation of the periodic review method requires data obtained from hospitals, such as demand data, lead time data, drug data, cost data, so the data used is primary data. After obtaining the required data, a periodic review is calculated which will become a benchmark for hospitals to place orders for medicines that have run out based on the demand for medicines and the time period from the sender of these medicines and so on

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1. INTRODUCTION

Storage management is one of the very important tasks for any company that manufactures or manufactures products. Accuracy in meeting supply to demand will impact the company's efficiency in meeting customer needs. The most undesirable thing is the occurrence of overstock or stockout. These two things are the most common problems storage management faces [1]. Overstock occurs when there are too many goods in storage so it is not efficient because the costs are very large and can harm the company with goods piling up in the storage warehouse [2], while stockouts can be caused at any time by various factors, such as fluctuating stock

demand, variability in lead times and unforeseen problems in the supply chain [3]. The same thing happened in the hospital. Hospitals must have good storage management so that medicines stored in storage warehouses have optimal stock of goods, so that these medicines will not be excess or lack when experiencing high drug demand. Medicines are considered to be one of the most frequently used medical facilities in hospitals. About 10-15% of the total revenue is spent on the cost of supplying medicines [4]. Thus, storage control is one of the most important things to reduce excessive spending due to the problem of excess drugs. In addition, an excess of drugs can also cause the drug to expire, and if the drug has entered the expiration date, then the drug cannot be traded, in fact it will make a big loss to the hospital.

In the case of inventory control of medicinal products with perishable product types, it is necessary to pay attention to the time of ordering inventory so that no product is damaged it cannot be sold. Perishable products refer to products that have a certain maximum lifetime to be used [5]. Replacement of perishable product inventory must be carried out periodically according to the needs and age of the product. In addition, the lack of drug supply risks endangering patient safety and increasing the vulnerability of health services. Optimal inventory control is also an effort to create a socially responsible supply chain [6]. One of the things that can help structure good inventory control is technology. Currently, the development of science and technology can help improve the quality, efficiency, and effectiveness of the required information [7].

Assisted by using the ABC (Always Better Control) Classification method. The ABC Classification method is used to classify the data into 3 classes: class A, with a percentage value of 0%-80%, class B with a percentage value of 80%-90%, and class C with a percentage value 90%-100% [8]. With sample data taken from the types of drugs, namely tablets and the number of drug packaging units totaling 100. Thus, 15 samples of drugs were obtained which were used for the calculation of the ABC Classification and periodic review. To reduce the presence of excess drugs that can cause expiration and hospital losses, proper storage control is needed. So the purpose of this study is to establish proper storage control using periodic reviews so that hospitals can order or make medicines according to patient requests and ensure if these medicines are optimal so that they can meet hospital demands.

2. METHODS

This study uses primary data taken in 2019 from a hospital in Semarang, Indonesia. Data collection uses observation and interviews with officers responsible for taking care of drugs in the hospital warehouse. One of the ideal techniques for research related to behavior, actions, or natural events is observation [9], while the interviews is a meeting between two or more parties to communicate face-to-face or through

intermediaries with a specific purpose, such as obtaining information as data [10]. The data collected is warehouse data for each month from January 2019 to October 2019. After obtaining the required data, then the data will be sampled based on the type of drugs, namely tablets and the number of drug packaging units totaling 100, and the results shown in Table 1.

Table 1. Drug Data

Item	Number of Item	Price (IDR)
ANALTRAM TABLET	600	4,455,000.00
CEFADROKSIL 500 MG	6000	4,200,000.00
ATORVASTATIN 20 MG	900	1,559,976.00
BISOPROLOL 5 MG	4800	1,209,644.00
CIPROFLOKSASIN 500 MG	3000	1,200,000.00
FUROSEMIDE TAB	5000	1,150,000.00
AMINOPHYLLIN 200 MG	5000	975,000.00
DOMPERIDON 10 MG TAB	5000	875,000.00
ALPRAZOLAM 0,5 MG	8200	770,759.00
SIMVASTATIN 20 MG	3000	660,132.00
TRIFADIUM 2 MG	3000	613,050.00
FUROSEMIDE 40 MG	1700	391,000.00
BISACODIL TAB	1200	382,800.00
PRONICY	1000	275,000.00
Total	50200	18,886,552.00

Next, each item was classified using ABC analysis using two attributes, price and number of items. ABC (Always Better Control) analysis is a technique that is often used in inventory control [11]. ABC analysis is based on Pareto's Law and is used to classify items based on their value to the company [12]. This research uses price and number of items as attributes and class as label. Items will be classified into three classes: class A, which gives 70% of the total score, class B, which gives 15% of the total score, and class C, which gives 15% of the total score. The ABC analysis steps are as follows.

1) Determine the number of units of each item and the total number of items.

2) Determine the total price of each item and the total price.

3) Sort items from large to small.

4) Calculate the cumulative percentage of the number of goods and the price of goods on each item.

5) Form a class based on the cumulative percentage.

In addition, the approach used is a quantitative approach which will be calculated using the periodic review method. Use of periodic reviews to manage complex and unique medicines [13]. Thus, this study is suitable for using the periodic review method. In the periodic review, data is needed that will later support the calculations carried out, such as demand, lead time, drug, and cost data. First, calculate the initial calculation using Equation (3) to calculate the periodic review.

$$\overline{x}_{(R+L)} = D(R + L) \quad (1)$$

Then calculate the order-up-to-level using Equation (4).

$$S = \overline{x}_{(R+L)} + k\sigma_{R+L} \quad (2)$$

Which mean:

D = Demand / demand

R = Review Interval

L = Lead Time

k = probability value of 1 normal unit

S = Up to Level

3. RESULTS AND DISCUSSION

3.1 ABC Classification

The results of the ABC analysis classify items into three classes in Table 2. Five items were classified as class A which accounted for 70% of the total overall score. Three items were classified as class B which accounted for 15% of the total overall score. Six items were classified as class C which accounted for 15% of the total overall score. From these results, an optimal control policy can be made, namely by optimizing the control of the five items in class A. In other words, items in class A need to be prioritized because they contribute the most value so that it greatly affects the total score obtained by the hospital. ABC curve can be seen in Figure 1.

Table 2. Research Flowchart

Item	Number of item	Price (IDR)	% Sum	% Cumulative amount	% Price	% Cumulative price	Class
ANALTRAM TABLET	600	4,455,000.00	1.24	1.24	23.80	23.80	A
CEFADROKSIL 500 MG	6000	4,200,000.00	12.40	13.64	22.44	46.24	A

ATORVASTATIN 20 MG	900	1,559,976.00	1.86	15.50	8.33	54.57	A
BISOPROLOL 5 MG	4800	1,209,644.00	9.92	25.41	6.46	61.04	A
CIPROFLOKSASIN 500 MG	3000	1,200,000.00	6.20	31.61	6.41	67.45	A
FUROSEMIDE TAB	5000	1,150,000.00	10.33	41.94	6.14	73.59	B
AMINOPHYLLIN 200 MG	5000	975,000.00	10.33	52.27	5.21	78.80	B
DOMPERIDON 10 MG TAB	5000	875,000.00	10.33	62.60	4.67	83.48	B
ALPRAZOLAM 0,5 MG	8200	770,759.00	16.94	79.55	4.12	87.59	C
SIMVASTATIN 20 MG	3000	660,132.00	6.20	85.74	3.53	91.12	C
TRIFADIUM 2 MG	3000	613,050.00	6.20	91.94	3.28	94.40	C
FUROSEMIDE 40 MG	1700	391,000.00	3.51	95.45	2.09	96.49	C
BISACODIL TAB	1200	382,800.00	2.48	97.93	2.05	98.53	C
PRONICY	1000	275,000.00	2.07	100.00	1.47	100	C

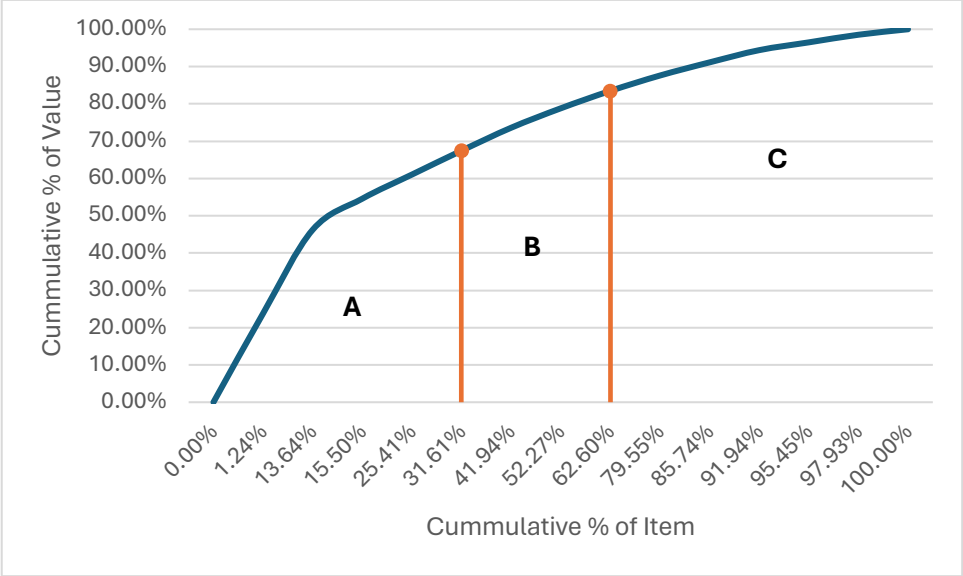

Figure 1. Research Flowchart

3.2 Periodic Review

The review interval for all cases is 4 days and the lead time for all cases is 3 days so that we used $R = \frac{4}{30} = 0.13$ and $L = \frac{3}{30} = 0.1$ for all periodic review calculations. To calculate the periodic review of Analtram Tablet from class A with $D = 600$, we calculate the initial

calculation $\overline{x}_{(R+L)} = D(R+L) = 600(0.13+0.1) = 138$ then calculate the order-up-to-level as follows:

$$\begin{aligned} S &= \overline{x}_{(R+L)} + k\sigma_{R+L} \\ &= 138 + 1(0.13+0.1) \\ &= 138.23 \sim 139 \end{aligned}$$

From the calculation above, it was found that the order-up-to-level of Analtram Tablet items was 139, so the hospital must reorder up to 139 pieces every four days. Another example, to calculate the periodic review of Furosemide Tab from class B with $D = 5000$, we calculate the initial calculation $\overline{x}_{(R+L)} = D(R+L) = 5000(0.13+0.1) = 1150$ then calculate the order-up-to-level as follows:

$$\begin{aligned} S &= \overline{x}_{(R+L)} + k\sigma_{R+L} \\ &= 1150 + 1(0.13+0.1) \\ &= 1150.23 \sim 1151 \end{aligned}$$

From the calculation above, it was found that the order-up-to-level of Furosemide Tab items was 1151, so the hospital must reorder up to 1151 pieces every four days. To calculate the periodic review of Simvastatin 20 mg from class C with $D = 3000$, we calculate the initial calculation $\overline{x}_{(R+L)} = D(R+L) = 3000(0.13+0.1) = 690$ then calculate the order-up-to-level as follows:

$$\begin{aligned} S &= \overline{x}_{(R+L)} + k\sigma_{R+L} \\ &= 690 + 1(0.13+0.1) \\ &= 690.23 \sim 691 \end{aligned}$$

From the calculation above, it was found that the order-up-to-level of Simvastatin 20 mg items was 691, so the hospital must reorder up to 691 pieces every four days. Table 3 shows the results of periodic review calculations for each item. From the results of these calculations, an order-up-to-level inventory control policy can be made so that inventory control can be more optimal. These results can also be combined with the results of ABC analysis to find out which items need to be prioritized, namely items classified as class A. Thus, hospitals can focus on controlling inventory from class A by considering periodic reviews of each item to avoid stockouts or overstocks so that the level of hospital service can increase.

Table 3. Periodic Review

Class	Item	Number of item	Periodic Review
A	ANALTRAM TABLET	600	139
A	CEFADROKSIL 500 MG	6000	1381

A	ATORVASTATIN 20 MG	900	208
A	BISOPROLOL 5 MG	4800	1105
A	CIPROFLOKSASIN 500 MG	3000	691
B	FUROSEMIDE TAB	5000	1151
B	AMINOPHYLLIN 200 MG	5000	1151
B	DOMPERIDON 10 MG TAB	5000	1151
C	ALPRAZOLAM 0,5 MG	8200	1887
C	SIMVASTATIN 20 MG	3000	691
C	TRIFADIUM 2 MG	3000	691
C	FUROSEMIDE 40 MG	1700	392
C	BISACODIL TAB	1200	277
C	PRONICY	1000	231

Storage management is an ongoing and planned process to manage the stock that the company needs, ensure sufficient supply, balance supply, demand, and avoid overstock or stockout [14]. So that the results of the number of items that must be reordered using order-up-to-level can be a benchmark for hospitals and avoid overstock or stockouts, also ensure inventory based on existing demand. In addition, this method also determines the time period for conducting inventory checks, which is 3 days every 1 month. This is to prevent vacancies in storage caused by reordering only based on supplies that have run out [15].

4. CONCLUSION

The aim of this research is to establish proper storage control. In order to achieve the objectives of this study, the researchers conducted an analysis of the data obtained from the medicine storage area. Analyzing the number of medicines that must be ordered by the hospital, so that there is no overstock or stockout. Medicines are a type of perishable product, which means they have an expiration date. If there is an overstock, then the drugs cannot be sold because they have entered their expiration period and even result in losses for the hospital. On the other hand, if there is a stockout, then the drugs cannot meet the patient's needs, this can also add to the loss to the hospital. By implementing periodic reviews, you can suppress stockouts and overstocks. So that the number of medicines that must be ordered by the hospital can be more accurate, and effective and based on factors in the field, such as the number of requests from the previous month, the time of order, and so on. This can also increase the profit of the hospital because it can ensure that all patients get the medicines they want. For further research, it is

possible to use more sample data and a longer time interval, so that the desired results become more accurate, and can cover all medicines that are in hospital storage.

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