THE EFFECT OF USING THE ABC-EOQ-ROP METHOD ON THE FREQUENCY OF DRUG EMPTINESS IN THE HOSPITAL

JAM
17, 3
Received, January 2018
Revised, September 2018
July 2019
August 2019
Accepted, August 2019

M. Burhan
Master of Hospital Management faculty of medicine Universitas Brawijaya
Sri Winarsih
PharmacyDepartment faculty of medicine Universitas Brawijaya
Tatong Harijanto
Master of Hospital Management faculty of medicine Universitas Brawijaya

Abstract: This study aims to determine the effect of the use of inventory control methods of always better control (ABC), economic order quantity (EOQ), and reorder point (ROP) supported by a computer-based daily stock information system of drugs and consumable medical devices on the emptiness of drugsfrequency and vital types of medical devices use at the Bangil Hospital Pharmacy Installation.This type of quantitative research uses a pre-experimental design with one group pre and post-test design. Data analysis using t-test and normality test with the Kolmogorov-Smirnov Test. The sample data used were emptiness drugs and vital consumables, with observations of vacancy data from May 2016 to May 2017, nine months before the intervention and three months after the intervention, the effects were analyzed using the t-test.The results show that there is a significant influence on the use of inventory control methods to reduce the frequency of emptiness of drugs and vital types of consumables. If there are emptiness drugs, make other efforts in fulfilling drug procurement.

Keywords: Frequency of emptiness of drugs, vital types of medical consumables, inventory control, pharmaceutical installations.

Cite this article as: Burhan, M., Sri W., and Tatong H. 2019. *The Effect of Using the ABC-EOQ-ROP Method on the Frequency of Drug Emptiness in the hospital*. Jurnal Aplikasi Manajemen, Volume 17, Number 3, Pages 451–463. Malang: Universitas Brawijaya. http://dx.doi.org/10.21776/ub.jam.2019.017.03.09

Journal of Applied Management (JAM)
Volume 17 Number 3, September 2019
Indexed in Google Scholar

Corresponding Author:
M. Burhan, Master of Hospital Management faculty of medicine Universitas Brawijaya, DOI: http://dx.doi.org/10.21776/ub.jam.2019. 017.03.09

According to Law No. 44 of 2009 concerning Article fifteen paragraph 1 hospitals, it is explained that pharmaceutical requirements must guarantee the availability of quality, useful, safe, and affordable pharmaceutical supplies, medical devices, and consumable medical materials. (Undang-Undang Republik Indonesia, 2009).Management of pharmaceutical supplies in hospitals is carried out by carrying out the functions of logistics management. These functions are processes that include planning, determining needs, budgeting, procurement, receipt, distribution, maintenance, deletion, and control and supervision (Setoet al., 2015).

Inventory control is a core function of supply management to maintain a balance of inventory needs and demand needs. According to Seto, at al.

(2015), to determine inventory control as expected, the three fundamental principles that must be met are the type controlled, the amount ordered and the time of re-ordering. The three principles are fulfilled by using the Always Better Control (ABC) analysis method to fulfill the type of control and determine the priority based on investment and usage, the Economic Order Quantity (EOQ) to determine the number of items ordered, while the Reorder Point (ROP) to determine the time reorder. Inventories consist of various types of goods, and many, each type requires a separate assessment to determine the order size and order point(Rangkuti, 2007).According toAnief (2008), the use of inventory control methods to maintain the balance of inventory needs and demand needs. And help in preventing inventory from experiencing shortages or excesses. Inventory must be balanced with needs, and too little inventory can cause emptiness drugs (Pamungkas, 2014).

One of the influential factors in drug supply in hospitals is controlling the amount of drug stock to meet needs. If the drug stock is too small, then the demand for use often does not meet the service so that the patient is less satisfied, loses profits and requires additional costs to obtain drug material in the shortest time so that the patient is satisfied. If excess inventory causes large storage costs, the drug will likely suffer damage, expire, and potentially risk the price of drug materials decreasing (Setoet al., 2015).One of the main quality indicators of Bangil Hospital is the incidence of emptiness drugs and Health consumables (medical devices). A preliminary study from September to October 2016 found a high frequency of the occurrence of emptiness drugs and medical devices in the pharmaceutical installation of Bangil Hospital from January to August 2016, which was 1299 incidents. One of the factors causing the emptiness of drugs / medical devices is because there is no policy to control drug inventory / medical supplies optimally. Inventory control at Bangil Hospital has been using stock-taking which is carried out every six months. Other inventory control that is controlling the stock of drugs and Health consumables (medical devices) manually by recapitulating and recording the drug that comes in and out every day with a stock card and then entered into a computer.

This study aims to determine the effect of the use of the ABC-EOQ-ROP method for inventory control supported by a computer-based daily stock drug / medical devices information system on the frequency of emptiness drugs and vital type medical devices at the Bangil Hospital Pharmacy Installation. Determination of drugs and vital types of drugs based on the criteria of the Ministry of Health on VEN analysis which is an effort to use budget or limited funds efficiently by grouping drugs according to the benefits of each type of drug on health which are grouped into vital, essential and non-vital groups (Ministry of Health, Republic of Indonesia, 2010). The research hypothesis is that the average frequency of emptiness drugs and vital types of consumables per day after the use of inventory control methods supported by a computer-based daily stock drug information system decreases compared to before the intervention.

METHOD

The research design used was a pre-experimental design with the type of one group pre and post-test design. Researchers observed the frequency of emptiness drugs before the intervention for nine months, then were treated using the ABC-EOQ-ROP method supported by a computer-based daily stock drug information system and then observed the results for three months and analyzed the effect of the intervention on the frequency of emptiness drugs after treatment

The design is as follows:

Pre-test	Independent variable	Post-test
O_1	X	O_2

O_1 is the calculation of the frequency of emptiness drugs and vital types of drugs (critical criteria) before treatment. X is an inventory control model based on the ABC-EOQ-ROP method.O_2 is the calculation of the frequency of emptiness drugs and vital type of drug after treatment.

Data analysis using T-test with test $\alpha = 0,05$. The normality test uses the Kolmogorov-Smirnov test with the significance test guidelines using the following criteria:

1. If p-value $\leq \alpha$, then Ho is rejected meaning that there is an influence on the use of ABC, ROP and EOQ analysis methods for inventory control on the frequency of emptiness drugs/ drugs in the Pharmacy Installation of Bangil Hospital
2. If p-value $> \alpha$, then Ho is accepted meaning that there is no influence on the use of ABC, ROP and EOQ analysis methods for inventory control on the frequency of emptiness drugs/ drugs in the Bangil Hospital Pharmacy Installation

The data used are primary data, obtained from interviews with officers in pharmaceutical installations and the management section related to the management of pharmaceutical supplies. Secondary data, obtained from analysis and analysis of documents including policies, guidelines for pharmaceutical services, standard operating procedures (SOPs), reports and records in pharmaceutical installations. The aim is to find out the management of drug / medical supplies which have been carried out so far. Other secondary data in the form of reports of all types of drugs / medical devices in 2016, reports on drug stock-taking / medical supplies in 2016, reports on the number of drug use/drugs in 2016 and reports on drug / medical devices prices in 2016. The research site was conducted at the Bangil Hospital pharmaceutical installation for four months, starting on 1 February 2017 until 31 May 2017.

The subject of the research was the occurrence of emptiness drugs / medical devices vital type every day which was recapitulated monthly at the Bangil Hospital pharmaceutical installation before and after the application of the ABC-EOQ-ROP method which was formulated in the form of numbers. The research variables used are independent variables, namely inventory control methods, ABC, EOQ, and ROP methods. The dependent variable is the first frequency of emptiness drugs nine before the intervention, the second frequency of emptiness drugs three months after the intervention.

The research instruments used were interview guidelines, observation guidelines, activity sheets for recording all types of drugs/drugs, VEN analysis activity sheets, ABC analysis method activity sheets, Group A, B, and C grouping activity sheets, Vital A (VA grouping activity sheets)), Vital B (VB) and Vital C (VC), safety stock calculation activity sheet, lead time calculation activity sheet, blank drug / medical activity sheet and remaining VA, VB and VC group stock, ROP determination activity sheet, activity sheet EOQ determination, activity sheet calculation of the frequency of emptiness drugs / medical devices before and after treatment from the cooperation pharmacy and pharmaceutical unit.

The research procedure consists of four stages: first, providing training in inventory control methods, secondly the application of ABC, EOQ and ROP methods, third, data processing, comparative analysis and the influence of the use of methods before and after the intervention on the frequency of emptiness drugs / medical supplies, fourthly formulating recommendations to parties' hospital management.

RESULTS

The results of determining the types of drugs and vital drugs are based on VEN criteria

Determination of vital type drugs and medical consumables is done by criteria set by the Ministry of Health.

The results of determination of vital types of drugs / medical devices are 250 drugs / medical devices from a total of 1860 types of drugs and medical devices in the Pharmacy Installation. Criteria for determining drug / medical devicesvital type, namely:

1. The group of drugs / medical devices used in the operating room (surgery)
2. The group of drugs / medical devices used for emergency services
3. Drug / medical devices for diabetes mellitus
4. Drug / medical devices for heart disease and blood vessels.

5. Vaccination preparations group, and most related drug classes cause of death
6. Antiviral HIV drugs

The results of observations made on emptiness drugs samples from the period of May 2016 to January 2017 found as many as 11 (eleven) types of drugs and vital types of consumables (critical criteria) that experienced vacancy (in table 1):

Table 1 List of names of drugs and vital types that have vacancies from May 2016 to January 2017

No	Name of Drug & Medical Devices	Group	Drug or medical devices criteria
1	Clonidine	C	Drugs for heart disease and blood vessels
2	Micardis 40	A	Drugs for heart disease and blood vessels
3	Aminopilin tablet	C	Drug for Respiratory Disease
4	Metformin 500	C	Drug for Diabetes Mellitus
5	Ventolin Nebula	C	Drug for Respiratory Disease
6	Clopidogrel	C	Drugs for heart disease and blood vessels
7	Lisinopril 5	C	Drugs for heart disease and blood vessels
8	ISDN	C	Drugs for heart disease and blood vessels
9	Theobroma	C	Drug for Respiratory Disease
10	Spuit 20 cc	C	Medical Devices for PEB and Eclampsia
11	Spuit 1 cc	C	Medical Devices for Diabetes Mellitus

Control of drug and medical devices inventory using the ABC-EOQ-ROP method

The results of the formulation and calculation of inventory control methods are input into computer-based drug information systems and medical devices.

ABC Analysis Results

ABC analyze drug / medical devices of vital type by grouping drugs and medical devices based on investment and usage values.

ABC analysis based on investment value

The following table presents the results of the ABC drug vital type of analysis.

Group A is the largest investment value group with a percentage of 70.90%, but the number of drugs is slightly around 9.6% of the total vital type of drugs.

Table 2 Results of ABC drug analysis and vital type medical devices according to funding requirements (investment)

Group	Investment (Rp)	%	Σ Drug	Amount of medicine (%)
A	2.174.431.608	70,90	24	9,6
B	614.659.930	20,04	47	18,8
C	277.953.785	9,06	179	71,6
Total	**3.067.045.323**	**100**	**250**	**100**

ABC analysis based on usage

Table 3 ABC Analysis Results according to the number of uses

Group	Investment (Rp)	%	∑ Drug	Amount of medicine (%)
A	446.655	70,83	23	9,2
B	126.336	20,03	33	13,2
C	57.597	9,13	194	77,6
Total	**630.588**	**100**	**250**	**100**

Group A is the largest number of user groups with a percentage of 70.83% but the number of drugs is at least around 9.2% of the total type of vital drugs.

EOQ calculation results

According to Heizer and Render 2015, the use of the EOQ method can determine the number of needs that must be ordered using the formula:

$$EOQ = \sqrt{\frac{2DS}{H}}$$

D = Annual demand in units for supplies
S = Installation or storage fee for each order
H = Cost of storage or carrying inventory per unit per year

Calculation of the EOQ value for each order requires data related to the number of requests each year, order fees and storage fees. Data on the number of requests was obtained from a document review, while the ordering costs and storage costs were obtained from interviews with the procurement department and the pharmaceutical warehouse.

Booking Fee

According to interviews with longtime informants talking to partners when making an order is an average of five minutes. Telephone rates follow the category of direct long-distance connections. The DLD tariff, according to the telecom source (www.telkom.co.id), is Rp. 320-1,100 per minute. The calculation of telephone costs as follows: Telephone costs = length of conversation (minutes) x telephone costs per minute.
Call charges = 5 x Rp. 320 / minute = IDR 1,600. So the telephone fee is Rp. 1,600.

Office stationery costs (ATK)

Order letter every month requires 50 sheets of paper with details of 2 sheets per time and uses quarter ink printer ink for four months.

Table 4 Administration fee for ordering every month at the Bangil Hospital pharmaceutical warehouse.

No	Name of goods	the number of goods	Price	Total
1	Order letter (SP)	50 sheet	100	5.000
2	Printer ink	¼ ink	40.000	10.000
	Total cost			**15.000**

According to the calculation in the table, the total ATK cost required per month is IDR 15,000, while to order for three months (December 2016-February 2017) is 15,000 x 3 = 45,000. The number of bookings made 150 times in 3 months, and the ATK booking fee is Rp. 300.

Table 5 Ordering costs for each order at the Pharmacy WarehouseBangil Hospital

No	Cost Description	Booking Fee (Rp)
1	Telephone Charges	1.600
2	ATK fee	300
	Total cost	**1.900**

So the cost of each order is Rp. 1,900. Then calculate the number of orders each time an order is as follows:
For example, Drug Micardis 80 mg in the following way:

The number of usage periods December 2016-February 2017 = 12,400 tablets. Ordering fee = Rp. 1,900. Storage costs (according to Heizer and Render 26% of the price)

= Rp. 6.500 x 0,26
= Rp.. 1.690

Then the Micardis 80mg drug EOQ value is:

$$Q^2 = \frac{2\,(1900)(12.400)}{1.690} = 557$$

$$Q = \sqrt{\frac{2(1900)(12.400)}{1.690}} = 167$$

So the number of ordering 80 mg drug Micardis in each order is 167 tablets.

Reorder point calculation results (ROP)

The use of ROP is calculated from the period December 2016-February 2017 by determining the average usage per day for three months. While the lead time is set at 14 days. To determine the buffer stock using the formula
Buffer stock = (dxL) xZ
d = average usage of the last 3 months
L = lead time = 14 days
Z = service level = 2
ROP formula = (dxl) + Buffer stock
For example the calculation of 80 mg drug Micardis
Average number of usage = total usage divided by 90 days = 12,400 / 90 = 137
Service level = 2, Lead time = 14 days, then
Buffer stock = z x d x L = 2x137x14 = 3858
So ROP micardis 80mg = BS + (dxL) = 358 + (137x14) = 5787 tablets
So Micardis 80mg drug reorder point is 5787 tablets.

The results of the frequency of Emptiness drugs

The frequency of emptiness drugs before and after the intervention was carried out by observing the frequency distribution data of emptiness drugs and vital type medical devices from May 2016 to May 2017. The results obtained from these observations obtained 11 (eleven) types of items of drugs and medical devices of the vital type that experienced a vacancy (table 1). In the May-2016 period until the end of May-2017, emptiness drugs were reported 124 times and were dominated by three types of drugs only, that are Clonidine 51 times (41.1%), ISDN 33 times (26.6%) and Theobron 17 times (13.7%). The only one post period is metformin. The total frequency of emptiness drugs / medical devices in Table 7 is as follows:

Table 7 Total frequency of emptiness drugs / medical devices

No	Month	Frequency
1	May 2106	226
2	June 2016	282
3	July 2016	85
4	August 2016	138
5	September 2016	364
6	October 2016	504
7	November 2016	397
8	December 2016	167
9	January 2017	130
10	**February 2017**	**372**
11	March 2017	70
12	April 2017	44
13	May 2017	28

The difference in the frequency of total emptiness drugs / medical devices versus the critical criteria in Figure 1.

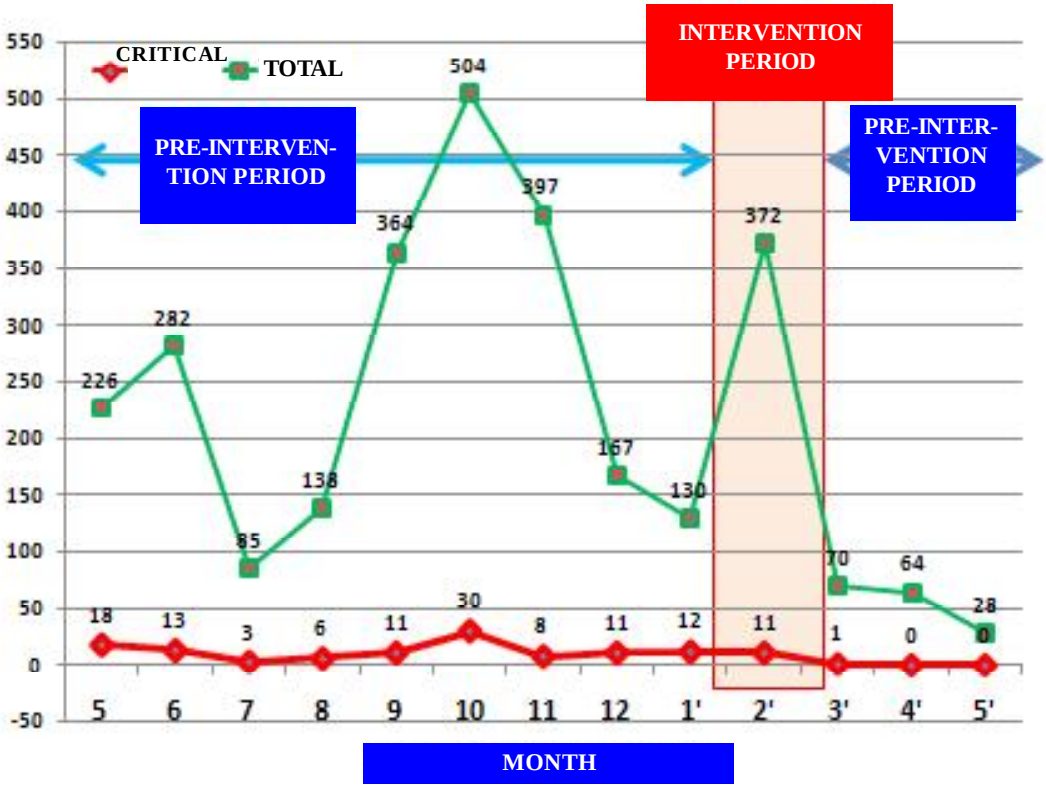

Figure 1 Frequency of vacancies Total drug / medical devices versus critical criteria

Results of Analysis of the Differences in the Frequency of Emptiness drugs, Before and After Intervention Inventory control is supported by a computer-based Drug Information System and Medical devices (SIOA).

Impact of SIOA application on the frequency of emptiness drugs / medical devices

Hypothesis:

1. The average frequency of total drug / medical devices (TOA-2) vacancies in the post-intervention period is lower than the average total drug / medical devices (TOA-1) vacancies in the period before the intervention.
2. The average frequency of criteria-critical emptiness drugs / medical devices (OAKK-2) in the period after the intervention is lower than the average emptiness of drugs / criteria-critical medical devices (OAKK-1) in the period before the intervention.

Hypothesis test method:

Two independent groups t-test.

Independent t-test requirements are:

1. The variables of both groups must be numeric scale (interval or ratio);
2. Variable data distribution both groups must have a normal distribution; and
3. Variable data distribution both groups must have the same data distribution (variance)

Variables tested:

1. Variable measuring scale:
   Variable TOA / OAKK ratio.
2. Data distribution:

Test data distribution of TOA-1, TOA-2, OAKK-1 and OAKK-2 with the Kolmogorov-Smirnov One-sample method, was proven to have a normal distribution (the hypothesis that all four data have a normal distribution, cannot be rejected). Can be seen in Table 8.

Table 8 Distribution of OAKK-1 and TOA-1 data

HYPOTHESIS TEST SUMMARY				
No.	**Null Hypothesis**	**Test**	**Sig.**	**Decision**
1.	The distribution of freq_K is normal with mean 0.33 and a standard deviation of 0.58	One-Sample Kolmogorov-Smirnov Test	0.766	Retain the null hypothesis
2.	The distribution of freq_T is normal with mean 47.33 and standard deviation 21.20	One-Sample Kolmogorov-Smirnov Test	0.997	Retain the null hypothesis
Asymptotic significances are displayed. The significance level is 0.05.				

Table 9 Distribution of OAKK-1 and TOA1 data

HYPOTHESIS TEST SUMMARY				
No.	**Null Hypothesis**	**Test**	**Sig.**	**Decision**
1.	The distribution of freq_K is normal with mean 12.44 and a standard deviation of 7.86	One-Sample Kolmogorov-Smirnov Test	0.629	Retain the null hypothesis
2.	The distribution of freq_T is normal with mean 254.78 and standard deviation 142.12	One-Sample Kolmogorov-Smirnov Test	0.997	Retain the null hypothesis
Asymptotic significances are displayed. The significance level is 0.05.				

The distribution of TOA-1 and OAKK-1 has a normal distribution ($p = 0.629$ or $p > 0.05$) with an average TOA-1 = 12.44 ± 7.86 times / mo, while OAKK-1 has a normal data distribution ($p = 0.943$ or $p > 0.05$) with an average of 254.12 ± 142.12 times / month.

Proof above, then the t-test to prove the hypothesis that the average frequency of emptiness drugs pre and post-intervention period, on the data emptiness of all drugs / medical devices and data on emptiness drugs of critical criteria (vital type), can be continued.

T-Test Results mean the difference in the distribution of emptiness drugs:

Average critical criteria (OAKK) emptiness drugs / medical devices report in the pre and post-intervention period:

Table 10 Average report on the emptiness of drugs / medical devices of critical criteria for OAKK in the pre and post-intervention period

No	Variable	sample (n)	Average ± SD	Lefene test for equal variance	t-test for equality of means	Mean difference OAKK-1 – OAKK-2
1	OAKK -1	9	12,4 ± 7.859/month	F = 2,126 (p = 0.176)	P = 0,027 (Sig., t = 2,58, df = 1)	12,1/month
2	OAKK -2	3	0,33 ± 0,577/month			

That the frequency of reports on emptiness drugs / medical devices-critical-criterion (OAKK) on average decreased from 12.4 ± 7,859 / mo in the pre-intervention period, decreased significantly to 0.33 ± 0.577 / month post-intervention period. This finding shows that intervention by applying SIOA, which allows obtaining information about daily drug stock can reduce the frequency of emptiness drugs up to 99.73% from the frequency of previous vacancies.

Average report on total drug / medical devices (all types of drug / medical devices) or TOA in the pre and post-intervention period.

Table 11 Average report on total drug / medical devices (all types of drug / medical devices) or TOA in the pre and post-intervention period

No	Variable	sample (n)	Average ± SD	Lefene test for equal variance	t-test for equality of means	Mean difference TOA-1 – TOA-2
1	TOA -1	9	254,8 ± 47,33/month	F = 6,195 (p = 0.032, S)	P = 0,002 (Sig., t = 4,240, df = 8,94)	207,4/month
2	TOA -2	3	47,33 ± 21,197/month			

The table above shows that the lefene-test yields p = 0.032 Significant, meaning that the variability of TOA-1 data is different from the TOA-2 data, it is decided to use t-tests for two groups of data with no homogeneous variability. T-test results showed that the average TOA decreased from 254.8 ± 47.33 / month in the pre-intervention period, to 47.33 ± 21.197 / month in the post-intervention period. These findings lead to the conclusion that the application of SIOA can reduce the frequency of emptiness drugs / medical devices (all types) by 81.4% from the previous report on emptiness drugs / medical devices.

Conclusion of T-Test Results

Intervention by implementing the Daily Stock Drug / Medical devices Information System in February-2017, was able to reduce the frequency of drug / medical devices emptiness, both reports of all types of drug / medical devices by 81.4% from an average of 254.8 times / month on period May-2016 to January-2017, to 47.33 times / month during the period March-2017 to 31 May-2017. Meanwhile the frequency of emptiness drugs / medical devices critical criteria (11 types), also decreased by 99.7%, from an average of 12.4 times/month in the May-16 period until the end of January 2017, to

only 0.33 times/month in the period beginning March 2017 until the end of May-2017.

DISCUSSION

The application of inventory control methods at Bangil Hospital is an effort or way to reduce the frequency of emptiness drugs that are still high. According to Seto et al. (2015), to ensure effective inventory control, three basic questions must be answered that is what will be controlled, how many will be ordered, and when to reorder. The application of these basic principles is applied at Bangil Hospital, which is supported by a computer-based daily stock drug information system:

Use of ABC Analysis

The application of the ABC method can avoid the excessive purchase of drugs / medical devices that should not need to be ordered or purchased in large quantities. According toAhyari (2000), in reality, there are raw materials that are used in large numbers of units but a small rupiah value, conversely there are some raw materials in high rupiah values even though the number of physical units is not large.

Investment Value of drugs and medical devices of vital type

ABC investment analysis results in table 2 group A amounted to 9.6% of all types of drug / medical devices requested by pharmacies but absorbed the maximum budget of 70.90% of the total budget. Group C is the most numerous, namely 71.6% but absorbs the least amount of budget, 9.06% of the total budget use.

Group A

Group A is goods with a small or low number of physical units but a high amount of rupiah (Ahyari, 2004). There are 24 types of inventory and budget use of 70.90%. According to Heizer and Render (2015), the drug must have tighter inventory controls, the accuracy of recording is more often verified. Physical supervision can be done more stringently and periodically every month.

Group B

Group B is goods with a physical amount and a moderate amount of rupiah (Ahyari, 2000). There are 47 types of inventory and budget use of 20.04%. Group B requires considerable attention after group A. There is a need for periodic physical supervision. According to Heizer and Render (2015), group B can be calculated every three months.

Group C

Group C, goods with large or high physical quantities but low/small rupiah values (Ahyari, 2000). There are 179 types of group C drugs / medical devices. The use of the budget is 9.06%. Supervision is not like groups A and B enough to follow the supervision that has been carried out so far.That is every six months.

ABC Usage Analysis

Group A

There are 24 types of drugs classified as group A, and pharmaceutical warehouses can meet the availability of drugs as much as 70, 83%. This means that the availability of the drug is very important to be considered and must always be available in pharmaceutical warehouses because it has the highest / most frequent use-value, physical inventory monitoring must be more thorough and strict.

Group B

There are 33 types of group B drugs, and pharmaceutical warehouses can meet the availability of drugs as much as 20.03%. According to Seto et al. (2015), group B is a much larger number, and the proportion of sales is smaller, there is no need to monitor these drugs as tightly as group A.

Group C

One hundred ninety-four types of drug / medical devices are classified as group C can meet the availability of 9.13%. The use/demand for this drug is small, but the most typical is 77.66% of all vital type drugs / medical devices.

According to Seto (2015), group C is a larger amount and a smaller proportion of sales, there is no need to monitor as closely as group A. And managers should monitor periodically to determine whether the drug is removed from inventory.

Economic Order Quantity (EOQ)

Inventory is affected by ordering costs and storage costs. Ordering in large quantities will reduce booking costs because there are fewer order frequencies. But it will increase storage costs because more inventory is stored. Conversely, ordering a small amount will reduce storage costs because there is less inventory stored, but increase ordering costs because the order frequency increases. Therefore the number of orders must minimize the cost of ordering and storage costs. As according to Heizer and Render (2015), that along with the increasing quantity ordered, the number of orders per year will decrease, but storage costs will increase due to the amount of inventory that must be taken care of more. According to Seto et al. (2015), to determine the number of economical bookings, efforts should be made to reduce the cost of ordering and storage costs.

Execution of drug orders at the Pharmacy Installation Bangil Hospital, there is no specific calculation of the number of orders. The order amount depends on the number of requests from the service unit. This condition risks increasing the cost of ordering if the order is a small amount or increasing storage costs if the number of orders is too much.

Determine the exact number of orders in each order, can use the EOQ (Economic Order Quantity) calculation. Sabarguna (2004), Economic Order Quantity (EOQ) is some inventory items that can be ordered in a period to minimize the costs of that inventory. EOQ calculation in this study is used to calculate the optimum number of drug orders and vital medical devices that are classified as group A because this drug is the drug that most influences the costs incurred to meet the needs of drugs in Bangil Hospital.

The application of the EOQ method to calculate the number of orders helps management decide on the number of orders to avoid excessive investment in inventory and not experience inventory shortages which cause disrupted service

Example of Micardis 80 mg tablet EOQ drug calculation, the results of the calculation, the economic number of orders for this drug is 434 tablets per order. If the number of orders is increased, it will increase storage costs because of the large amount of inventory. If the number of orders is lowered, it will increase the booking fee because the order with a smaller number of order frequencies will be further increased, thereby increasing the booking fee.

EOQ must be supported by an information system that can find out the number of drug uses in each year.

Reorder Point (ROP)

Efforts to determine the lead time for each do not use special calculations but are set for 14 days to anticipate the length of the determination of answers to the determination of partners (companies) selected to serve online procurement. According to the Director-General of Pharmaceutical and Appliance Health Ministry of Health of the Republic of Indonesia (2010), the lead time is the waiting time needed from ordering until the drug is received.

Reorder is done when the drug value is equal to the stock in the ROP number in the pharmaceutical module of the daily stock drug information system. If the ROP number carries the stock, then the order is made by Cito to the distributor to avoid emptiness.

The reorder time is set so that the supply can cover the supply needs during the grace period/ waiting for the order to arrive. According to Heizer and Render (2015), efforts to overcome the vacancy need a safety stock that is useful to overcome uncertainty in demand.

Safety stock is protection against two types of uncertainty. First, uncertainty about sales that exceeded the forecast during the refill period. Second, there is uncertainty regarding delays in order receipt, order processing, or transportation delays during refilling (Bowersox, 2001).

The calculation of Micardis 80 drug safety stock is 3858 tablets, and the Reorder Point is 5778. It

means that the ordering of Micardis 80 tab drugs will be done if the drug stock reaches 5778 tablets. The amount is an ideal point/amount to be re-ordered to avoid shortages due to stock out and to avoid shortages due to increased demand.

The frequency of emptiness drugs and medical devices

Observation of the frequency of emptiness drugs before intervening (treatment) for the types of drugs as a whole from May 2016 to January 2017 shows the high frequency of the incidence of emptiness drugs and medical devices in the Pharmacy Installation of Bangil Hospital, one of the causes of the high frequency because it has not yet implemented the inventory control method. According to Seto et al. (2015), the use of inventory control methods can maintain a balance between supply and demand.

The results of observation (observation) of the frequency of emptiness drugs and medical devices vital type (critical criteria) for the period of May 2016 to January 2017 showed that the group of heart disease drugs dominated the most, especially clonidine. The high emptiness of these heart disease drugs from the field search and from interviews with the Head of Pharmacy Installation due to hospitals having difficulty getting the drugs from distributors, distributor vacancies due to factory difficulties in raw materials.

The results of observations (observations) of the frequency of emptiness drugs and medical devices of all types as a whole (total drug / medical devices) in the post-treatment / intervention period still occur due to a delay in delivery of drugs by the distributor, the delay is due to the procurement of an online model when making choices pharmaceutical companies (principle) do not immediately get an answer as to who the distributor is designated for sending drugs to the hospital so that it exceeds the specified lead-time deadline.

Drug procurement at Bangil Hospital has been using an online e-purchasing system through the website of the Government Goods / Services Procurement Policy Agency (LKPP). Drug procurement through e-purchasing is issued by the government through the Minister of Health Circular Letter / 167 / III / 2014 regarding Drug Procurement based on Electronic Catalog (E-catalog).

The circular is intended to guarantee the availability and equal distribution of drugs that are safe, quality, and efficacious to meet the needs of health services. This is necessary to carry out drug procurement in a transparent, effective, efficient manner, and the results can be accounted for. The advantage of the online system is that it makes it easier for pharmaceutical technical officers to order drugs to meet hospital needs. The weakness of this system is that the ordered drug is because the price is relatively low, many items are not guaranteed of its quality and are often complained of by users (officers) in hospitals, and e-catalog servers often have problems in operation. Factors that can affect the occurrence of emptiness drugs / medical devices in procurement activities include delays in making an order letter (SP), vacancy in the distributor, and errors in ordering. Errors in this order are known if there are drugs or goods whose stock is still empty and not coming.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Inventory control by the ABC-EOQ-ROP method aided by a computer-based daily stock drug / medical devices information system can help reduce the frequency of emptiness drugs. There is a significant influence on the use of inventory control methods on the frequency of emptiness drugs.

Recommendations

Suggestions to increase lead-time if there is a delay from the distributor. If there are emptiness drugs on the distributor, an attempt is made to find a solution by procuring other methods, for example to a private pharmacy or another hospital pharmacy or to find another distributor who has goods needed by the hospital.

REFERENCES

Aditama, T. Y. 2007.*Manajemen Logistik*, Manajemen Administrasi Rumah Sakit, Edisi2, Jakarta: Penerbit Universitas Indonesia.

Ahyari, Agus. 2000. *Manajemen Produksi Pengendalian Produksi*. Yogyakarta.

Anief, M. 2008. *Manajemen Farmasi*. Yogyakarta: UGM.

Assauri, S. 2004. *Manajemen Produksi dan Operasi*. Jakarta: Fakultas Ekonomi UI.

Bangil Hospital. 2015. *Laporan Tahunan Bangil Hospital Kabupaten Pasuruan Tahun 2015*.

Bowersox, J. 2001. *Manajemen Logistik Integrasi Sistem-sistem Manajemen Distribusi Fisik dan Manajemen Material Jilid 1*.pp. 13-40.Jakarta: PT Bumi Aksara.

Direktorat Jenderal Bina Kefarmasian dan Appliance Health Kementerian Kesehatan RI. 2010. *Buku Materi Pelatihan Manajemen Kefarmasian di Instalasi Farmasi Kabupaten/Kota*. Jakarta.

Fadhila, R. 2015. *Studi Pengendalian Persediaan Drug Generik melalui Metode Analisis ABC, Economic Order Quantity (EOQ) dan Reorder Point (ROP) di Gudang Farmasi Rumah Sakit Islam Asshobirin Tahun 2013*. Jakarta.

Febriawati, H. 2013. *Manajemen Logistik Farmasi Rumah Sakit*. Yogyakarta: Gosyen Publishing.

Heizer, J. and Render, B. 2015. *Operations Management: Sustainability and Suply Chain Management, Manajemen Operasi: Manajemen Keberlangsungan dan Rantai Pasokan,Kurnia H (penerjemah),* 2016 Edisi11, Jakarta: Salemba Empat.

Menteri Kesehatan Republik Indonesia. 2008. *Kepmenkes Nomor 1121/MENKES/SK/XII/2008 tentang Pedoman Teknis Pengadaan Drug Publik dan Perbekalan Kesehatan untuk Pelayanan Kesehatan Dasar.* Jakarta: Kementerian Kesehatan RI.

Pamungkas G. 2014. *Analisis Penyebab Emptiness drugs Kusta di RS. X Tahun 2014.* Jurnal Ilmu Kesehatan, vol. 10.

Rangkuti, F. 2007. *Manajemen Persediaan Aplikasi di Bidang Bisnis*. Jakarta: PT. Raja Grafindo.

Seto, S., Nita, Y.,and Triana, L. 2015. *Manajemen Farmasi 2: Lingkup Apotek, Farmasi Rumah Sakit, Pedagang Besar Farmasi, IndustriFarmasi*, Edisi 4.Surabaya: Airlangga University Press.

Suciati S, Adisasmito W. B., and Wiku B. 2006. *Analisis Perencanaan Drug Berdasarkan ABC Indeks Kritis di Instalasi Farmasi.* Jurnal Manajemen Pelayanan Kesehatan. vol. 9 no.1 pp.19-26.

Undang-Undang Republik Indonesia. 2009.*Nomor 44 Tahun 2009 tentang Rumah Sakit.*

Winasari A.2016.*Gambaran Penyebab Kekosongan Stok Drug Paten dan Upaya Pengendaliannya di Gudang Medis Instalasi Farmasi RSUD Kota Bekasi pada Triwulan I Tahun 2015*.