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Application of ABC and EOQ Methods to Improve Control of Patented Medicine Inventory at Pharmacy A

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Abstract

The aim of this research is to analyze drug supply control at Pharmacy A using the Always Better Control (ABC) method to determine drug procurement priorities based on usage and cost guidelines, making it easier to share data regarding relevant matters and budgets for decision-making and separate items that are small in quantity but have great value. Economic order quantity (EOQ) was used to estimate the inventory that will be used, the existence of safety stock, and the time to reorder inventory. Data on drug supplies, drug unit prices, and drug use from January to December 2021 were collected and analyzed using Microsoft Excel. Medicines are classified into three groups based on their investment value. The results showed that group A had the highest investment value (80%) with 41 types of drugs, group B had a medium investment value (15%) with 24 types of drugs, and group C had the lowest investment value (5%) with 19 types of drugs. Group A's EOQ value varies from 9 item to 3170 items. This research recommends that Pharmacy A use the ABC and EOQ methods in managing drug supplies to make it more efficient, effective, and economical.

Keywords: Pharmacy; inventory control; ABC method; EOQ method

1. Introduction

In today's business world, especially in the health sector, public services have become increasingly widespread, as demonstrated by the large number of pharmacies as a means of providing medicines. To maintain the availability of these drugs, planning and procurement for diapharmacies must be managed well. In general, pharmacies plan and control inventory based on previous experience, so sometimes pharmacies experience shortages or excess supplies. This is because the number of needs always changes depending on demand [1].

Law Number 36 of 2009 concerning health states that pharmaceutical practice includes the control and distribution of drugs, drug services based on doctors' prescriptions, drug information services, and drug development must be carried out by health workers who have the expertise and authority in accordance with the provisions of legal requirements [2].

In pharmacy management, one way to support services to satisfy consumers is by providing drug supplies in pharmacies. Inventory is an important element in the operations of a business entity, including pharmacies. Effective procurement requires planning analysis in drug procurement. Good planning analysis can prevent drug shortages and the frequency of unplanned drug procurement [3]. Planning and procurement of medicines is the main key and an important initial stage in the success of the next stage, because the planning stage is very helpful in matching needs with available funds [4].

Pharmacy A is one of the pharmacies that many local people go to. The medicines at Pharmacy A consist of patent medicines and generic medicines. Patent drugs are drugs discovered by a pharmaceutical company through the research and marketing process of drugs. Meanwhile, generic drugs are drugs with names according to the active substance content determined by the Indonesian pharmacopoeia and the International Nonproprietary Names Modified (INN) from the WHO.

Based on the results of interviews with the management of Pharmacy A, the main problem that often occurs is excess and shortage of drug supplies, where excess drugs occur because drugs are rarely purchased by consumers, so the pharmacy holds too much stock of these drugs. Meanwhile, shortages of drug supplies often occur, especially for patented drugs, due to shortages of drugs at suppliers. With the high demand for patented medicines, this is not balanced by sufficient supplies, so there are often stockouts of medicines, which result in patient delays. This is based on the results of interviews with

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pharmacy owners, who said that several patients who came to the pharmacy wanting to buy the same medicine at different times were hampered by the lack of medicine in the pharmacy.

Several cases show that Pharmacy A experienced problems with late orders, which resulted in inadequate customer service and could be detrimental to the company. Based on interviews, this late order occurred because the ordered medicine did not arrive at the time promised with the company's waiting time policy of 2 days, but the order arrived later than the specified time. The following are several examples of delays in drug delivery that occurred at Pharmacy A and resulted in a shortage of available drugs.

The order for patent medicines was made on February 15, 2021, and was promised to arrive on February 17, 2021. However, the medicines experienced delays caused by some medicines from suppliers still being processed or goods that had not been sent from the distributor, so some of these patent medicines arrived late. with a range of 4–7 days to the warehouse, namely on 19, 20, 22, and 24 February 2021.

In addition, Pharmacy A experienced excess stock or overstock, which resulted in increased drug storage costs and risks such as loss, expiration, and damage to drugs. So far, Pharmacy A has controlled drug supplies by keeping stock of each drug, and orders are made if the stock of a particular drug runs out. Other problems arise due to a lack of inventory control, such as no grouping of drugs and no special calculations to determine how much to order back. As already mentioned, the control system is one of the keys to a company's production efficiency. Inventory control also functions to ensure the availability of goods and so that the company always has inventory in the right quantity, at the right time, and in predetermined specifications or quality so that business continuity can be guaranteed and costs incurred to hold inventory are minimal [5].

To carry out good drug management, it is important to plan to control drug supplies and guarantee sufficient quantities and types so that they can meet demand and are obtained quickly and on time. Effective drug supply control begins with grouping which drugs will be a priority for control using the ABC (Always Better Control) analysis method and determining how many drugs must be ordered using the EOQ (Economic Order Quantity) method.

The ABC (Always Better Control) analysis method is a classification method based on value ranking from highest to lowest and is divided into three large groups: group A with a high investment value, group B with a medium investment value, and group C with a low investment value. This method is very useful in focusing management's attention on determining the types of goods that are most important and need to be prioritized in inventory. The EOQ (Economic Order Quantity) method is an inventory method that determines the most economical order quantity, namely the amount of goods purchased that can minimize the total cost of storing goods from the warehouse and ordering costs each year [6].

One of the studies regarding inventory control using the ABC (Always Better Control) and EOQ (Economic Order Quantity) methods has the title "Medicine Planning Based on Analysis of Always Better Control (ABC) and Economic Order Quantity (EOQ) in the Pharmacy Installation of Melawi Hospital, Melawi Regency, West Kalimantan" [7]. The ABC method used can provide an overview of drug groups with various investment values from highest to lowest. Based on research results, in group A, there are 58 types of drugs with an investment value of 70.0% of the total investment value; in group B, there are 90 types of drugs with an investment value of 20.0% of the total investment value; and group C contains 374 types of medicines with an investment value of 10.0% of the total investment value. And then, as a basis for planning and procuring medicines for the next period, an analysis of the EOQ method calculation was carried out with the results for group A. The highest EOQ value was obtained with 991 items for Rifamficin 450 mg capsules, and the lowest EOQ value was 1 item for one example, namely the drug Thidim using this EOQ method. Hospitals can order drugs in optimal quantities and at economical costs. The aim of drug management at the Melawi Regional Hospital is to ensure the availability of drugs and provide more effective, efficient, and affordable drug services to patients, as well as to determine the priority of pharmaceutical preparations that must be provided by the Melawi Regional Hospital.

Research by [8] and [9] was conducted to reduce losses for hospitals due to weak planning and control. From the results of research conducted using the ABC Critical Index analysis method, seven antibiotic drugs were found that needed to be prioritized. Research conducted by [10] used the Analysis Method (ABC) and Economic Order Quantity (EOQ) Approach. The case study for this research is PT Herlinah Cipta Pratama, a company operating in the food industry that produces dodol with the trademark "PICNIC." The research conducted by [11] shows that inventory control, which causes stockouts, involves stock-taking activities. Inventory control with ABC, EOQ, and ROP analysis can avoid stockouts. ABC analysis shows that there are 36 types (12%) of generic drugs belonging to group A, namely, with a budget usage of 69.60% of the total budget usage for generic drugs. In group B, there are 52 types (17.33%), namely with a use of 20.39% of the total budget use of generic drugs, and 212 types (70.67%) of generic drugs belonging to group C, namely with a budget use of 10.01% of total generic drug budget usage. The optimum order quantity for generic drugs belonging to group A starts at 2-5265 items, group B starts at 6-6879 items, and group C starts at 1-5503 items. Reorder times for generic drugs belonging to group A start from 1-2,315 items, group B starts from 2-1,663 items, and group C starts from 1-916. The amount of safety stock that must be stored in the warehouse to avoid stockouts includes group A, starting from 3–1,442 items, group B, starting from 1–1,036 items, and group C, starting from 1–570 items.

Based on the description of the problems that occurred at Pharmacy A, it is necessary to have good inventory control so that the amount of inventory issued is appropriate and not excessive or insufficient. So the researcher wants to conduct research on drug inventory control at Pharmacy A using the ABC and EOQ (Economic Order Quantity) methods. The ABC method was chosen because it can determine drug procurement priorities based

on guidelines for the amount used and the amount of costs incurred and makes it easier to share data regarding relevant budgets for decision-making. This model can also separate items that are small in number but have great value. The EOQ method was chosen because it is one of the calculations used in determining the quantity of a company's raw material orders. In theory, EOQ only applies when demand for a product, ordering costs, and unit purchasing costs are constant values. The advantage of EOQ is that it is able to estimate the inventory that will be used, the safety stock, and the time to reorder inventory. These two methods are also often used in hospitals and pharmaceutical service facilities, especially in drug supplies. The results of this research are in the form of an implementation plan to improve inventory control at Pharmacy A. This control is expected to help maintain drug stocks and reduce conditions of excess or empty drug stock.

2. Literature Review

2.1. Patent medicine

Medicine plays an important role in protecting and restoring health and helping to maintain and improve the quality of life. Apart from that, drugs are the main component that greatly influences health services, especially in the pharmaceutical sector. In general, there are two types of drugs: patented drugs and generic drugs [12].

A patented medicine is a finished medicine with a trade name registered in the name of the manufacturer or authorized by him and sold in the original packaging from the factory that produces it [13]. This means that a patented drug is a drug that still has a patent and can only be produced by the manufacturer who holds the patent. According to Law No. 13 of 2016, Article 22, the patent protection period is granted for a period of 20 (twenty) years from the date of receipt. During these 20 years, pharmaceutical companies have had exclusive rights to produce these drugs in Indonesia. Meanwhile, generic drugs are drugs with official International Non-proprietary Names (INN) specified in the Indonesian Pharmacopoeia or other standard books for the efficacious substances they contain [14].

2.2. Inventory control

Inventory is a colloquial term that describes all the things or resources an organization keeps to meet demand [15]. Inventory control is a very important managerial function to control costs and ensure the availability of goods when needed in the queue, always ensuring that inventory does not experience stock out or overstock [5]. Inventory control is a very important managerial function because drug supplies and stocks will be costly and involve large investments in current assets; therefore, they need to be controlled effectively and efficiently. Effective inventory control involves optimizing two objectives, namely minimizing the investment value in drug inventory and selling the right variety of products to meet consumer demand [16]. Apart from that, inventory control is also carried out to maintain inventory levels at optimal levels so that savings can be obtained on these inventories, namely to show inventory levels that are in accordance with needs and can maintain production continuity at economical costs [17].

2.3. ABC (Always Better Control) method

ABC classification, often also called ABC analysis, is a classification of a group of items in descending order based on the cost of using the item per time period (price per unit of item multiplied by the volume of use of the item during a certain period) or cost, or total activity [18]. This method describes Pareto analysis, which emphasizes that a small portion of the types of materials contained in inventory have a fairly large use value, which covers more than 60% of all materials contained in inventory [19].

ABC analysis, or 80-20 rule analysis, is an inventory management method with a method of grouping inventory based on usage value into 3 categories, namely: category A, category B, and category C. The ABC inventory analysis method is a simple system or method that can be used to separate several items that require special attention in terms of inventory control [20].

The main principle of ABC analysis is to place the types of drugs in order, starting with the type of drug that uses the largest budget [21]. According to [22], the ABC analysis method is the creation of groups or classifications based on the ranking of values from the highest to the lowest and divided into three large groups called group A, group B, and group C. The following is the ABC classification [19]:

1. Group A

   This is a group of goods that are critical to the function and operations of a company. The inventory levels of this group should be monitored carefully. This group of goods has a high financial volume, where the number of goods is only 10% of all inventory but covers more than 70% of finance.
2. Group B

   This is a group of items that are important but not critical. So there is no need for constant control over all types of goods. This group represents about 20% of finance and accounts for about 20% of all inventory.
3. Group C

   This is a group of goods that are not very important to a company. This group of goods may only represent 10% of the company's finances, but the number of items is 70% of all inventory [20].

According to [23] class A goods are goods with a high annual dollar value, namely 70%–80% of the overall use of money, but only represent 15% of the total inventory. Class B goods are goods with moderate annual dollar volume, namely 15%–25% of total cash use and 30% of total inventory use. Items with a small annual dollar volume are in class C, which represents only 5% of annual volume but represents 55% of total inventory items.

This method of controlling drug supplies can be carried out using the Always Better Control (ABC) method, namely a grouping method based on a range of scores from highest to lowest, which are divided into 3 groups known as group A (high investment value), group B (medium investment value), and group C (low investment value). The use of ABC analysis is very useful in focusing a drug

management system that generates order frequency and prioritizes based on the value or price of drugs because it is unrealistic to monitor inexpensive items as intensively as very expensive items [4].

2.4. EOQ (Economic Order Quantity) method

Economic order quantity (EOQ) is the amount of inventory of goods ordered in a period with the aim of minimizing the cost of inventory of an item. Two types of costs are considered in the EOQ method, namely storage costs and ordering costs [24]. The EOQ model is one of the oldest and best-known inventory control techniques. This technique is relatively easy to use but is based on assumptions [23], namely:

1. The number of requests is known, constant, and independent.
2. The inventory receipt is instant and completely complete. In other words, the inventory from an order comes in one batch at a time.
3. No quantity discounts are available.
4. Variable costs are only costs for setting up or ordering and the cost of holding inventory for a certain time.
5. Stockouts can be completely avoided if orders are placed at the right time.

Inventory models generally minimize total costs. The EOQ model is divided into two categories, namely, deterministic EOQ and probabilistic EOQ. The deterministic EOQ model takes into account the two most basic types of inventory costs, namely, ordering costs and holding costs. If we minimize ordering costs and holding costs, we will also minimize total costs. Meanwhile, the probabilistic EOQ model takes into account demand behavior and lead times that are uncertain or cannot be determined in advance with certainty. With the assumptions given above, the most significant costs are ordering costs and storage costs. The purpose of calculating EOQ is to find out how much logistics stock is economical so that logistics stock is maintained in a safe but cheap condition and can reduce inventory costs [4].

By using economical calculations, a company can, of course, regularly determine how many orders to make. Because in this case there are no costs of running out of inventory and scheduling irregularities, it will have an impact on inventory costs due to inventory piling up, so the formula for determining the optimum order quantity, according [23], is:

$$Q = \sqrt{\frac{2DS}{H}} \quad (1)$$

where,

Q = the optimal number of unity units
D = number of uses or requests for one period
S = ordering cost
H = storage costs per unit for one year

The EOQ model is used to determine the inventory order quantity that minimizes storage costs and inventory ordering costs. By setting an EOQ policy, more orders can be determined each year within a certain period of time, thus reducing the risk of running out of stock [25].

2.5. Safety stock and ROP method

a. Safety stock

Safety stock is additional inventory held to protect or maintain the possibility of inventory shortages caused by demand that is greater than originally estimated or due to delays in ordered goods arriving at the storage warehouse by determining the size of the safety stock, which is then followed by a fixed order quantity, or EOQ [26].

The factors that determine the amount of safety stock are using average raw materials; the time and cost factors used are calculated using the service level. Message delivery time (lead time), namely the time the order is made and the time the order is received, Lead time is known and is constant or fixed every time an order is made [27]. The company has established a policy that the lead time for ordering medicines until the goods arrive is 2 days.

The performance achievement standard (service level) used is 95%, which means group A has 95% availability and a 5% shortage of inventory. According to [19], if the safety stock with service level (95%) is 1.65 and the standard lead time is known to be constant, then the calculation is:

$$SS = Z \times d \times l \quad (2)$$

where,

SS = safety stock
Z = service level
d = average usage
l = lead time

Safety stock functions to protect the company against a condition where the company experiences a shortage of raw materials, delays in the supply of raw materials ordered, which hinder production activities, or unpredictable spikes in demand, so the company must increase production to meet market needs [28].

b. ROP method

According to [19], the reorder point (ROP), or what is called the reorder point, is a point or limit of the amount of inventory in an inventory where an order must be placed again. In other words, ROP is the period during which an order must be regenerated. ROP is also related to lead time and safety stock [29]. By considering safety stock, the calculation of the reorder point according to [23] is:

$$ROP = (d \times l) + SS \quad (3)$$

where,

ROP = reorder point
d = daily demand
l = lead time
SS = safety stock

3. Research Methods

The research was conducted using a quantitative approach. According to [30], quantitative research is research based on quantitative or numerical measures obtained from the results of quantitative measurements of

variables, such as through questionnaires, tests, and observations. The object of this research is the drug supply process by Pharmacy A, which is carried out using the ABC method and the EOQ method. Data collection techniques use observation and interview methods.

In making observations, by directly observing existing activities from data recording drug supplies, drug orders, and the price of each drug in Pharmacy A,. This observation was carried out to determine the condition of inventory control in the pharmacy. Furthermore, interviews were carried out to obtain data and information directly from the management of Pharmacy A. This interview activity was carried out to find out how the pharmacy controls existing drug supplies. According to [31], an interview is the process of collecting information for research purposes through the use of a question-and-answer session that takes place face-to-face between the questioner and the person being asked.

The steps in this research can be seen in detail as follows:

1. Start Identifying Problems. As a first step in this research, it is important to clearly identify the problems that occur with a particular object.
2. Preliminary Study. After the existing problem has been identified, the next step is to conduct a preliminary study using relevant sources or documents to address the problem properly. Journals, books, historical data, articles, and materials on existing topics can be used as sources and references.
3. Data Collection. The next step is to collect primary and secondary data. The primary data used is direct observation and interviews conducted with pharmacy managers to find out more about drug supplies. Secondary data is obtained from existing sources or certain references, such as books or journals and previous research.
4. Data Processing. Next, process the data in a way that is in accordance with the research objectives to be achieved. Data processing was carried out using the ABC and EOQ methods with Microsoft Excel tools.
5. Analysis and Discussion. After processing the data using the ABC and EOQ methods, analysis and discussion are then carried out as a basis for identifying proposals for improving Pharmacy A's inventory control.
6. Conclusions and Suggestions. After the analysis and discussion stages have been carried out, conclusions can be drawn that are in accordance with the researcher's problems and the research objectives that were determined at the beginning. Furthermore, suggestions are given in the form of recommendations, company expectations, and other research related to the topics discussed in the research.

4. Results and Discussion

4.1. Analysis using the ABC method

The ABC method analysis was carried out in three stages for the types of drugs with the highest sales. The data used in this method are patent medicines for the 2021 sales period and are sorted from highest to lowest revenue, then grouped into 3 groups, namely:

1. Group A with a cumulative percentage of 0-80%
2. Group B with a cumulative percentage of 15-20%
3. Group C with a cumulative percentage of 5–15%

In the ABC calculation, namely the calculation of sales of patented medicines based on income value by sorting from the highest income value to the lowest income value, it is shown in Table 1.

Table 1. Calculation of patented medicine sales based on revenue in the 2021 period

No	Name	Total Usage	Drug Price (Rp)	Income (Rp)	% Revenue	% Cumulative	Class
1	ZONAL 50MG	6498	2822	18337356	6.69%	6.69%	A
2	HELIATECH LOTION SPF 45	136	78850	10723600	3.91%	10.61%	A
3	VOMINA TAB	10587	950	10057650	3.67%	14.28%	A
4	ZELONA TAB	20693	475	9829175	3.59%	17.87%	A
5	ZULTROP KAPLET	23405	380	8893900	3.25%	21.12%	A
6	WIBROM TAB	30477	285	8685945	3.17%	24.29%	A
7	VALISANBE 2 MG	19682	333	6554106	2.39%	26.68%	A
8	WICOLD TABLET	16794	380	6381720	2.33%	29.01%	A
9	VALANSIM 10MG	9391	665	6245015	2.28%	31.29%	A
10	OA FORTE CAPLET 60S BTL	14	444600	6224400	2.27%	33.56%	A
11	MEXON TABLET	15544	380	5906720	2.16%	35.72%	A
12	METISOL 4MG 5X10	9310	570	5306700	1.94%	37.65%	A
13	SELES B6 10MG/ 1000TAB	55786	95	5299670	1.93%	39.59%	A
14	YEKANEURON TAB	9192	570	5239440	1.91%	41.50%	A
15	VALISANBE 5 MG	5240	950	4978000	1.82%	43.32%	A
16	PACETIK TAB POT ISI 1000	26180	190	4974200	1.82%	45.14%	A
17	TAB	3436	1425	4896300	1.79%	46.92%	A
18	HEMORID	7109	665	4727485	1.73%	48.65%	A
19	SELVIM 20 (5X10)	8286	570	4723020	1.72%	50.37%	A
20	YUSIMOX TAB	3698	1188	4393224	1.60%	51.98%	A
21	ZOREL 400 MG	42	102600	4309200	1.57%	53.55%	A
22	KUTOIN INJ 100MG/2ML	6540	570	3727800	1.36%	54.91%	A
23	GRESERIC 150	2032	1663	3379216	1.23%	56.14%	A
24	KUTOIN	3476	950	3302200	1.21%	57.35%	A
25	RIAMICYN TAB 10X10	434	7600	3298400	1.20%	58.55%	A
26	FLUTOP C SYRUP	979	3336	3265944	1.19%	59.75%	A
27	INTIDROL TAB 16MG	22	140600	3093200	1.13%	60.88%	A
28	FLUTIAS 125 INHALER	3169	950	3010550	1.10%	61.97%	A
29	TB VIT 6 TABLET	3127	950	2970650	1.08%	63.06%	A
30	NUFACOBAL	136	20900	2842400	1.04%	64.10%	A

No	Name	Total Usage	Drug Price (Rp)	Income (Rp)	% Revenue	% Cumulative	Class
31	KUTILOS	109	25650	2795850	1.02%	65.12%	A
32	HALMEZIN SYRUP	7323	380	2782740	1.02%	66.13%	A
33	CORONET CROWN	7215	380	2741700	1.00%	67.13%	A
34	TROPIDENE 20MG KAPSUL	2105	1283	2700715	0.99%	68.12%	A
35	METOLON TAB	2262	1188	2687256	0.98%	69.10%	A
36	GRICIN 500	2152	1235	2657720	0.97%	70.07%	A
37	YASMIN 21TAB	13	204250	2655250	0.97%	71.04%	A
38	QUANTIDEX	3328	760	2529280	0.92%	71.96%	A
39	NUVOPECT TAB	6581	380	2500780	0.91%	72.88%	A
40	SINTROL KAPLET 3X10	3630	665	2413950	0.88%	73.76%	A
41	CEDROX 500MG TABLET	1896	1235	2341560	0.85%	74.61%	A
42	POLAMEC TAB	6041	380	2295580	0.84%	75.45%	A
43	EKACETOL SYRUP	389	5700	2217300	0.81%	76.26%	A
44	INTRIZIN SYRUP 60ML	37	59850	2214450	0.81%	77.07%	A
45	FLUTAMOL SYRUP	257	8550	2197350	0.80%	77.87%	A
46	ABILIFY 10 MG	1134	1900	2154600	0.79%	78.66%	A
47	BIMADEX 0,5	6675	285	1902375	0.69%	79.35%	A
48	NUDEP	126	15048	1896048	0.69%	80.04%	A
49	JF SULFUR ACNE CARE PUTIH	177	10450	1849650	0.68%	80.72%	B
50	BIMACYL TAB	3825	475	1816875	0.66%	81.38%	B
51	CEDROX 125MG SYRUP	156	11400	1778400	0.65%	82.03%	B
52	60ML	33	53200	1755600	0.64%	82.67%	B
53	XELODA 500MG	65	26600	1729000	0.63%	83.30%	B
54	LYSIN KU	4423	380	1680740	0.61%	83.92%	B
55	NUFADEX M 0,75 MG	174	9500	1653000	0.60%	84.52%	B
56	KAPLET	4116	380	1564080	0.57%	85.09%	B
57	ULSIKUR INJ KALBE	8176	191	1561616	0.57%	85.66%	B
58	GRAXINE	136	11400	1550400	0.57%	86.23%	B
59	ZONIFAR BOX	3223	475	1530925	0.56%	86.79%	B
60	XARELTO 10mg	3196	475	1518100	0.55%	87.34%	B
61	GRATHEOS 50 (5x10)	3063	475	1454925	0.53%	87.87%	B
62	GRICIN 125	351	4085	1433835	0.52%	88.40%	B
63	FLUTAMOL CAPLET	1874	760	1424240	0.52%	88.92%	B
64	TANTUM TAB 2X6	3707	380	1408660	0.51%	89.43%	B
65	QUAMIPROX F	4874	285	1389090	0.51%	89.94%	B
66	INTIBION	2887	475	1371325	0.50%	90.44%	B
67	POLARIST TAB	2880	475	1368000	0.50%	90.94%	B
68	SIOBION KAPSUL	179	7600	1360400	0.50%	91.43%	B
69	BIMACTRIM TAB	3552	380	1349760	0.49%	91.93%	B
70	QUANTIDEX SYRUP	109	12350	1346150	0.49%	92.42%	B
71	INTIBROX TAB	2355	570	1342350	0.49%	92.91%	B
72	LYTACUR SYRUP	535	2375	1270625	0.46%	93.37%	B
73	ACEPRESS 25MG	2005	570	1142850	0.42%	93.79%	B
74	EFLAGEN 50MG	2383	475	1131925	0.41%	94.20%	B
75	EFLIN TABLET	826	1330	1098580	0.40%	94.60%	B
76	OBIVIT	750	1425	1068750	0.39%	94.99%	B
77	ULTRAVITA KAPL	763	1378	1051414	0.38%	95.38%	B
78	LYVIT SYRUP	67	15200	1018400	0.37%	95.75%	C
79	OA PLUS 60KAPLET	109	9025	983725	0.36%	96.11%	C
80	HAEMOGAL CAPLET	119	7600	904400	0.33%	96.44%	C
81	OBIMIN AF	447	1900	849300	0.31%	96.75%	C
82	LYTAMIN SYRUP	122	6650	811300	0.30%	97.04%	C
83	UTROGESTON 200MG	36	20900	752400	0.27%	97.32%	C
84	RHODIUM (30TAB)	95	6650	631750	0.23%	97.55%	C
85	SINRAL 5 MG	110	5700	627000	0.23%	97.78%	C
86	JF SULFUR FAMILY	64	9500	608000	0.22%	98.00%	C
87	ORANGE BARSOAP	19	31350	595650	0.22%	98.22%	C
88	XARELTO 15mg	364	1568	570752	0.21%	98.43%	C
89	DACIN TAB 300MG	197	2660	524020	0.19%	98.62%	C
90	METHYLON TAB 4MG 10X10	79	6270	495330	0.18%	98.80%	C
91	OXAN KAPLET	294	1520	446880	0.16%	98.96%	C
92	TB ZET TABLET 10X10	427	1045	446215	0.16%	99.12%	C
93	POLYSILANE TAB	54	7600	410400	0.15%	99.27%	C
94	SINRAL 10 MG	168	2138	359184	0.13%	99.40%	C
95	NUCRAL 60 TABLET	63	5643	355509	0.13%	99.53%	C
96	RHINOS SR TAB	188	1520	285760	0.10%	99.64%	C
97	MEVITON TAB	134	1425	190950	0.07%	99.71%	C
98	LYCALVIT TAB	362	475	171950	0.06%	99.77%	C
99	SELVIPLEX KAPSUL	112	1425	159600	0.06%	99.83%	C
100	TROVILON TAB	317	475	150575	0.05%	99.88%	C
101	SELEDRYL TAB	46	2090	96140	0.04%	99.92%	C
102	RHINOFED TAB (50)	48	1900	91200	0.03%	99.95%	C
103	ULCUMAAG KAPLET	48	1425	68400	0.02%	99.98%	C
104	ODANOSTIN	42	1425	59850	0.02%	100.00%	C
Total	417612		273927595				

Table 2. Drug groupings based on ABC analysis of investment value

Drug Group	Number of Types Drugs	Usage Value	Number of Types Drugs	Nilai Investasi (Rp)
A	41	352298	84.57%	188145542
B	24	56099	13.47%	36062044
C	19	8192	1.97%	11832280
Total	84	416589	100%	236039866

Based on Table 2, it can be seen that there are 41 patented medicine items included in Group A, or 84.57% of the total medicine supply, with a total investment value of Rp.88145542. There are 24 patented medicines included in Group B, or 13.47% of the total medicine inventory, with a total investment of Rp.36062044. Meanwhile, there are 19 patented medicines included in Group C, or 1.97% of the total medicine supply, with a total investment of Rp.11832280.

Based on Fig. 1, it can be seen that the drugs included in group A account for 79.709% of the total investment in drugs. Medicines included in Group B make up 15.278% of the total investment in medicines. Meanwhile, Group C made up 5.013% of the total investment in medicines.

4.2. Calculation analysis of the EOQ method

After the data is grouped using the ABC method, the next step is to determine the EOQ for products that fall into group A, inventory that has a percentage of 0%–80%. Inventory management in this group necessitates a great deal of attention. In administering medicines at the Pharmacy A, no special calculations are made regarding the number of medicines ordered. To find out the optimum order quantity every time you order patent medicines at the Pharmacy A, the EOQ (Economic Order Quantity) method can be applied. EOQ calculations are carried out based on the following formula [23]

To determine EOQ, calculations are needed regarding

demand for one period, ordering costs, and storage costs. The number of requests has been calculated using ABC analysis.

a. Ordering Costs

Based on data from pharmacy A, it is known that the cost per order for patent medicines in terms of telephone costs and administration costs is IDR 2225. This data is used in the EOQ calculation in Table 3.

b. Storage Fees

Carrying costs include costs associated with holding inventory for a certain time. The provision for storage fees from Pharmacy A is 26% of the price of the goods. After knowing the amount of medication used, ordering costs, and storage costs, a calculation is made regarding the optimum order quantity for each order.

Based on table 4, the maximum optimum order quantity for the SELES B6 1000Tab drug is 3170 items per order,

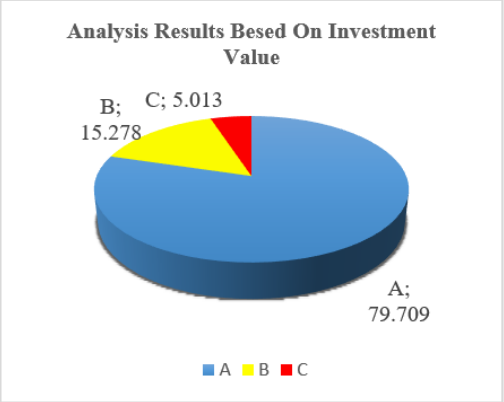

Figure 1. Analysis results based on investment value

Table 3. Total costs per order at pharmacy A

No	Order Fees	Order Fee (Rp)
1	Telephone Fee	625
2	Administration Fees (ATK)	1600
	Total Cost per Order	2225

and the minimum optimum order quantity for the KUTILOS drug is 9 items per order. For example, the EOQ calculation is for Zonal 50 mg as follows:

Number of uses = 6498 pcs
Storage costs = Rp. 73372
Ordering fee = Rp. 2225

So the Economic Order Quantity (EOQ) is:

$$Q = \sqrt{\frac{2.D.S}{H}} = \sqrt{\frac{2\ x\ 6498\ x\ 2225}{733.72}} = \sqrt{39410.72} = 199$$

and the frequency of purchasing Zonal 50Mg medication in a year = $\frac{6498}{199} = 33$.

Based on calculations using the Economic Order Quantity (EOQ) method above, the most economical order quantity for Pharmacy A to order 50 mg of Zonal medicine per year is 199 pieces for one order. Meanwhile, the frequency of orders for Zonal 50 mg was 33.

4.3. Analysis of safety stock and ROP calculations

After grouping the data using the ABC and EOQ methods, it is necessary to determine the safety stock of group A products, namely the percentage from 0% to 80%. Stock in this group requires high attention to inventory control because products in Group A need to be kept in safety stock. The service standard used is 95%, which means group A has 95% availability and a 5% shortage of inventory. The percentage used is 95%, so the Excel service factor used is 1.65. The results of the safety stock calculation can be seen in Table 5.

Table 4. Calculation of EOQ for Group A patented medicines

NO	Name	Total Usage	Order Fees (Rp)	Storage Fees (Rp)	EOQ	F(x) Purchases
1	ZONAL 50MG	6498	2.225	733.72	199	33
2	VOMINA TAB	10587	2.225	247	437	24
3	ZELONA TAB	20693	2.225	123.50	863	24
4	ZULTROP KAPLET	23405	2.225	98.80	1027	23
5	WIBROM TAB	30477	2.225	74.10	1353	23
6	VALISANBE 2 MG	19682	2.225	86.58	1006	20
7	WICOLD TABLET	16794	2.225	98.80	870	19
8	VALANSIM 10MG	9391	2.225	172.90	492	19
9	MEXON TABLET	15544	2.225	98.80	837	19
10	METISOL 4MG 5X10	9310	2.225	148.20	529	18
11	SELES B6 10MG/ 1000TAB	55786	2.225	24.70	3170	18
12	YEKANEURON TAB	9192	2.225	148.20	525	17
13	VALISANBE 5 MG	5240	2.225	247	307	17
14	PACETIK TAB POT ISI 1000	26180	2.225	49.40	1536	17
15	TAB	3436	2.225	370.50	203	17
16	HEMORID	7109	2.225	172.90	428	17
17	SELVIM 20 (5X10)	8286	2.225	148.20	499	17
18	YUSIMOX TAB	3698	2.225	308.88	231	16
19	KUTOIN INJ 100MG/2ML	6540	2.225	148.20	443	15
20	GRESERIC 150	2032	2.225	432.38	145	14
21	KUTOIN	3476	2.225	247	250	14
22	RIAMICYN TAB 10X10	434	2.225	1.976	31	14
23	FLUTOP C SYRUP	979	2.225	867.36	71	14
24	FLUTIAS 125 INHALER	3169	2.225	247	239	13
25	TB VIT 6 TABLET	3127	2.225	247	237	13
26	NUFACOBAL	136	2.225	5.434	11	13
27	KUTILOS	109	2.225	6.669	9	13
28	HALMEZIN SYRUP	7323	2.225	98.80	574	13
29	CORONET CROWN	7215	2.225	98.80	570	13
30	TROPIDENE 20MG KAPSUL	2105	2.225	333.58	168	13
31	METOLON TAB	2262	2.225	308.88	181	13
32	GRICIN 500	2152	2.225	321.10	173	12
33	QUANTIDEX	3328	2.225	197.60	274	12
34	NUVOPECT TAB	6581	2.225	98.80	544	12
35	SINTROL KAPLET 3X10	3630	2.225	172.90	306	12
36	CEDROX 500MG TABLET	1896	2.225	321.10	162	12
37	POLAMEC TAB	6041	2.225	98.80	522	12
38	EKACETOL SYRUP	389	2.225	1.482	34	11
39	FLUTAMOL SYRUP	257	2.225	2.223	23	11
40	ABILIFY 10 MG	1134	2.225	494	101	11
41	BIMADEX 0,5	6675	2.225	74.10	633	11

The following is an example of calculating Safety Stock (SS) and Zonal ROP 50 mg:

Number of drug uses (d) = 6498 pcs
Lead time (l) = 2 days
Service level = 95%
Z (95%) = 1.65

The number of days in a year is 365 days, so the average number of uses per day (d)

= 6498 pcs / 365
= 18 pcs

Safety stock calculations are carried out using the following formula [32]:

$SS = Z \times d \times l$
= 1.65 × 18 × 2
= 58.75 or 58 pcs

And for the ROP calculation, it is known:

D = 18 pcs
l = 2 days
SS = 58 pcs

$ROP = (d \times l) + SS$
= (18 × 2) + 58
= 94 pcs

From the safety stock calculation that has been carried out with the example of the Zonal 50 mg drug with the time between ordering until the goods arrive 2 days with an average demand per day of 18 items, the results of the safety stock calculation for the Zonal 50 mg drug are 59 items per product inventory, with 95 items remaining. Use the safety stock above. If the order ordered from the supplier, when the product quantity reaches the reorder point, experiences delivery problems so that the product arrives from the supplier at the wrong time and demand is high at that time, the company will use this safety stock product to overcome the shortage. stock. The purpose of the reorder point above is that if the company places an order before the number of products stored is 95, it will experience a buildup of excess products or overstock, which can be detrimental to the company.

Table 5. Calculation of safety stock and ROP

No	Name	Total Usage	Average Usage / Day	Lead Time	Service Level (95%)	Savety Stock	ROP
1	ZONAL 50MG	6498	18	2	1.65	59	94
2	VOMINA TAB	10587	29	2	1.65	96	154
3	ZELONA TAB	20693	57	2	1.65	187	300
4	ZULTROP KAPLET	23405	64	2	1.65	212	340
5	WIBROM TAB	30477	83	2	1.65	276	443
6	VALISANBE 2 MG	19682	54	2	1.65	178	286
7	WICOLD TABLET	16794	46	2	1.65	152	244
8	VALANSIM 10MG	9391	26	2	1.65	85	136
9	MEXON TABLET	15544	43	2	1.65	141	226
10	METISOL 4MG 5X10	9310	26	2	1.65	84	135
11	SELES B6 10MG/ 1000TAB	55786	153	2	1.65	504	810
12	YEKANEURON TAB	9192	25	2	1.65	83	133
13	VALISANBE 5 MG	5240	14	2	1.65	47	76
14	PACETIK TAB POT ISI 1000	26180	72	2	1.65	237	380
15	TAB	3436	9	2	1.65	31	50
16	HEMORID	7109	19	2	1.65	64	103
17	SELVIM 20 (5X10)	8286	23	2	1.65	75	120
18	YUSIMOX TAB	3698	10	2	1.65	33	54
19	KUTOIN INJ 100MG/2ML	6540	18	2	1.65	59	95
20	GRESERIC 150	2032	6	2	1.65	18	30
21	KUTOIN	3476	10	2	1.65	31	50
22	RIAMICYN TAB 10X10	434	1	2	1.65	4	6
23	FLUTOP C SYRUP	979	3	2	1.65	9	14
24	FLUTIAS 125 INHALER	3169	9	2	1.65	29	46
25	TB VIT 6 TABLET	3127	9	2	1.65	28	45
26	NUFACOBAL	136	0	2	1.65	1	2
27	KUTILOS	109	0	2	1.65	1	2
28	HALMEZIN SYRUP	7323	20	2	1.65	66	106
29	CORONET CROWN	7215	20	2	1.65	65	105
30	TROPIDENE 20MG KAPSUL	2105	6	2	1.65	19	31
31	METOLON TAB	2262	6	2	1.65	20	33
32	GRICIN 500	2152	6	2	1.65	19	31
33	QUANTIDEX	3328	9	2	1.65	30	48
34	NUVOPECT TAB	6581	18	2	1.65	59	96
35	SINTROL KAPLET 3X10	3630	10	2	1.65	33	53
36	CEDROX 500MG TABLET	1896	5	2	1.65	17	28
37	POLAMEC TAB	6041	17	2	1.65	55	88
38	EKACETOL SYRUP	389	1	2	1.65	4	6
39	FLUTAMOL SYRUP	257	1	2	1.65	2	4
40	ABILIFY 10 MG	1134	3	2	1.65	10	16
41	BIMADEX 0,5	6675	18	2	1.65	60	97

After analyzing the data, present the research results descriptively. An analysis of drug stock at Pharmacy A shows that inventory control carried out by Pharmacy A is not efficient. Pharmacies only reorder drugs when they run out of stock, leading to erratic orders for any purchases over the next period. In administering medicines at Pharmacy A, no special calculations are made regarding the number of medicines ordered. The time an order is made at Pharmacy A is done every month, but there is no definite schedule for when the order will be made.

If there is a stock shortage, it can result in inadequate service to patients or consumers, which can reduce profits. On the other hand, if there is excess stock, it will result in overstock, which will result in additional costs due to drug storage. This is due to the implementation of drug inventory control in pharmacies that has not been implemented. To carry out inventory control efficiency at Pharmacy A, researchers conducted an analysis using the ABC and Economic Order Quantity (EOQ) methods.

4.4. Discussion of the ABC Method

After analyzing drug inventory control using the ABC method, ABC grouping results were obtained. Group A, a group of goods that are critical to the function and operations of a company in carrying out higher control and supervision, has a high monthly volume. In Group A, there are 41 drugs with a percentage of 84.57% and an investment value of Rp.188,145,542. The drug with the highest investment value for group A is Zonal 50 mg, with a total use of 6498 pcs and a revenue value of Rp.18,337,356. Group B is a group of goods that are important but not critical, which must also be monitored and controlled for supplies that are included in the group B category.

In Group B, there are 24 medicines with a percentage of 13.47% and an investment value of Rp.36,062,044. The drug with the highest investment value for group B is Bimacyl Tab, with a total use of 3825 pieces and an income value of Rp.1,816,875. Group C, a group of goods

that are not very important to a company but are also considered in inventory control, is included in the group C category. In Group C, there are 19 medicines with a percentage of 1.97% and an investment value of Rp.11,832,280. The drug with the highest investment value for group C is EFLAGEN 50 mg, with a total usage of 2383 and an income value of Rp.1,131,925.

After knowing what types of drugs are included in the grouping categories, it can be seen that drugs that are included in the group A category must be strictly observed in inventory control. If products in this category are not controlled in terms of inventory control, this will lead to increased storage or overstock, and the medicine may expire. However, if the inventory is too small, it will cause stockouts because the goods are not in stock when customers need them.

4.5. Discussion of the Economic Order Quantity (EOQ) method

The items that will be calculated using the EOQ method are items that are included in group A in the ABC analysis because the items that are included in this group have a high cumulative cost percentage, which of course has a high monetary value. Determining the optimum order quantity using the EOQ method requires calculations regarding drug demand, ordering costs, and storage costs. The number of requests known from the previous ABC analysis was 416,589 drugs. The ordering fee covers the costs required to place an order, including telephone fees and administration fees.

Based on interviews, the average time required for each order is 4-5 minutes. Local telephone rates are Rp. 250 per 2 minutes (PT. Telkom Indonesia, 2016), so the telephone cost per minute is Rp.125. So the cost for 5 minutes is Rp. 625. And the administration costs used by Pharmacy A are order letters, invoice exchange books, and printer ink. Storage costs, according to Heizer and Render (2010), are 26% of the unit cost or price of goods. After the ordering costs and storage costs are known, the data is entered into the formula. Based on the Economic Order Quantity (EOQ) method in group A, the maximum optimum order quantity for the SELES B6 1000Tab drug was 3170 items per order, and the minimum optimum order quantity for the KUTILOS drug was 109 items per order.

4.6. Discussion of the safety stock and Reorder Point (ROP) methods

After the data has been grouped using the ABC method and the optimum order quantity has been determined using the EOQ method, the next step is to determine the safety stock for products included in Group A, inventory that has a percentage of 0-80%. Safety stock is a method used to determine safety stock in inventory. This aims to prevent stockouts from occurring in the warehouse. The service standard used is 95%, which means group A has 95% availability and a 5% shortage of inventory. The percentage used is 95%, so the service level used is 1.65. According to the informant, the lead time required from ordering medicine until the goods arrive is 2 days. From the safety stock calculation that has been carried out with the example of the Zonal 50 mg drug with the time between orders until the goods arrive 2 days with an average demand per day of 18 items, the results of the safety stock calculation for the Zonal 50 mg drug are 58.75 items per supply. There are still 94 items remaining in the product. If an order ordered from a supplier when the product quantity reaches the reorder point experiences delivery problems so that the product arrives from the supplier at the wrong time and demand is high at that time, the company will use this safety stock product to overcome the stock shortage.

A reorder point is a method used to determine the point for ordering raw material requirements or a product. This ordering point plays an important role in inventory control in order to minimize storage costs in the warehouse and overcome stockouts. From the reorder point calculation that has been carried out using the example of the drug Zonal 50 mg, the results obtained for the reorder point are when there are 94 items of the drug in the warehouse. If the company places an order before there are 94 items in stock, it will experience a buildup of excess product, which will reduce warehouse capacity. However, if the company places a reorder when the amount of inventory is below the reorder point, for example, for the Zonal 50 mg drug product, it is at the 94 item point, then if demand increases, there will be a stockout.

5. Conclusion

Based on the results of the analysis and discussion, the conclusion of this research is that the supply of patent medicines at Pharmacy A uses the ABC (Always Better Control) method, namely that class A patent medicines produce 41 items of medicine, or 84.57% of all types of drug supplies. patent with a usage value of 352,298 and an investment value of Rp.188145542, or 80% of the total investment. Class B patented medicines amount to 24 or 13.47% of all patented medicines, with a usage value of 56,099 and an investment value of Rp.36062044 or 15% of the total investment in patented medicines. Meanwhile, class C patent medicines account for 19 or 1.97% of all patent medicines, with a usage value of 8.192 and an investment value of Rp.11832280, or 5% of the total investment. After knowing what types of drugs are included in the grouping categories, it can be seen that drugs that are included in the group A category must be paid strict attention to in inventory control. By implementing the ABC method, it is hoped that Pharmacy A will find it easier to determine which type of medicine to prioritize when making a purchase.

Based on the results of calculations using the Economic Order Quantity method, the economic order quantity for group A varies in the range 9–3170 items per type of drug; namely, the maximum optimum order quantity is for the drug Sels B6 1000 Tab with a quantity per order of 3170 items, and the minimum optimum order quantity is for the drug KUTILOS with a quantity per order of 11 items. For example, to order Zonal 50 mg medication for the 2021 period, Pharmacy A can order 199 pieces in one order with an order frequency of 33 orders and make a reorder if the supply of Zonal 50 mg medication has reached the point of as many as 94 pieces. It can be concluded that before this method existed, there

was no specific calculation regarding how many orders would be placed and when reorders would be made, so problems could occur such as excess stock and drug shortages. And with the Economic Order Quantity (EOQ) method, controlling Pharmacy A's drug inventory will be more helpful in reducing excess stock and drug shortages.

Suggestions for Pharmacy A need to apply the ABC analysis method to patented drugs to give different priorities to each group of drugs because drugs with high investment value require stricter supervision than drugs with low investment value. And it is necessary to apply the EOQ method to patented drugs so that there is no excess stock or shortage of drugs. It is hoped that future research will be able to more critically analyze Pharmacy A's inventory control based on the ABC-VEN method. This method combines the ABC method with the VEN method (Vital, Essential, and Non-essential) which classifies inventory items based on their impact on health. This method is suitable for controlling drug supplies in hospitals or pharmacies. Probabilistic EOQ is a modification of the EOQ method which considers the uncertainty of demand and delivery time and is dynamic. EOQ method: This method is a modification of the EOQ method which takes into account changes in the price of goods in inventory over time. This method can be used to determine the optimal time and order quantity so that total inventory costs are minimal.

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