# Inventory Control Analysis of Patent Medicine Using Activity Based Costing and Economic Order Quantity Method

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## Abstract

Pharmacy X is located on Jendral Sudirman Street, Duri Barat Village, Mandau District, Bengkalis Regency, Riau Province, Indonesia. Due to the lack of grouping for medications and a mechanism for calculating the frequency of reorders, this pharmacy struggled to manage its supply of medications. This study aims to identify patent medicine type A using Activity-Based Costing (ABC) Analysis, as well as the optimal number of medicine orders using the Economic Order Quantity (EOQ) Method and reordering. Data is gathered through observation and interviews with medicine supplier companies, lead time, storage costs, ordering costs, and sales data. The ABC grouping analysis of patent medicine type A yielded 31 types of medicine, according to the findings. The use of EOQ proved to be more optimal, with a dispute of Rp. 582. 498,373, as did the use of Reorder Point, with an average of when the drug stayed 1 unit the company had to reorder. Pharmacy X is expected to consider using EOQ to perform minimum ordering on prioritized drugs in an effort to reduce excessive inventory costs.

## Keywords
Activity Based Costing, EOQ, Inventory, Lead Time and Reorder Point.

## 1. Introduction
Pharmacy X is located on Jl. Jendral Sudirman, Duri Barat Village, Mandau District, Bengkalis Regency, Riau. It is one of the most frequently visited pharmacies in Duri due to its central location. So far, Pharmacy X's drug inventory control consists solely of checking the stock of each drug. Orders are only placed when the drug supply is depleted. There is no drug grouping and no special calculation to determine the number of reorders.

According to the findings of interviews with pharmacy owners, the most common problems are drug shortages and drug excess, with the latter resulting from the fact that consumers rarely purchase drugs, but pharmacies maintain excessive quantities of these drugs. There were numerous expired patent drugs in 2021, with the pharmacy suffering the most losses due to expired drugs in January, totaling Rp. 6,561,000. Due to expired patent drugs, Pharmacy X incurred a loss of Rp. 15,752,500 in 2021.

To determine whether inventory control is effective, three questions must be answered: what to control, how much to order, and when to reorder. The ABC method can then be used to determine which drugs are the most important to control, the Economic Order Quantity (EOQ) method to determine how many drugs to order, and the Reorder Point (ROP) method to determine when the drugs will be delivered and reordered (Abbas et al. 2021).

### 1.1 Objectives
The purpose of this study, based on the problem stated above, is to classify the group of patent drugs type A based on the ABC method, which is a group of patented drugs that provide high-cost benefits for Pharmacy X. Its purpose is to determine the optimal number of drug orders using the EOQ method and to determine when to reorder using the EOQ method. ROP at Pharmacy X and provide Pharmacy X with recommendations or suggestions for dealing with inventory control issues in Type A Patent Drugs.

## 2. Literature Review

A. Inventory Control

Inventory control is the effort by a company's logistics management to control inventory in the face of inescapable costs. It is because it has inventory and includes these costs, which are storage costs, ordering costs, and shortage costs. All of these costs have unique characteristics that must be comprehended by the business, particularly those in charge of the logistics sector (Prastyorini 2020).

B. ABC method

The ABC method classifies a group of materials in descending order according to how much it costs to use each material for a given amount of time (price per unit of material multiplied by the volume of use of the material during a certain period). One year is the most typical duration (Gaspersz 2006). The group is classified into(Rikomah2017):

1. Group A

Group A is a drug that consumes 70% of the budget while using no more than 20% of the medicine. Drugs in the class A group are extremely dangerous, and they must be strictly controlled and monitored on a continuous basis.

2. Group B

Group B takes up a 20% budget with a drug amount of around 10-80%. Group B drugs are subject to less stringent supply restrictions than group A drugs. However, reports on their use and the remainder of the drug are still required, so that inventory management can always be managed.

3. Group C

Group C consumes 10% of the budget, with medicine accounting for 10-15%. More medicinal goods in Class C, but no impact on warehouse and financial activities because they are less expensive and use less energy.

C. Forecasting

Forecasting is a tool or method for predicting or estimating a future value by paying close attention to relevant data or information, both past and present. Forecasting is almost always performed by everyone, whether they work for the government, a business, or are simply concerned about the weather, the inflation rate, political issues, or the exchange rate of a country's currency (Maricar 2019).

D. EOQ (Economic Order Quantity) Method

EOQ is one of the most commonly employed inventory control techniques. Knowing the assumptions of the known quantity of demand, constant waiting time or lead time, lack of quantity discounts, variable costs only ordering costs and holding costs, and complete avoidance of out-of-stock situations makes it a simple technique to implement (Dyatmika & Krisnadewara 2017). Following is the formula for calculating the EOQ:

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

Where Q is the number of Order Quantities, and DS/H is holding cost of each unit product.

Using the above formula, we can also determine the number of orders (P) during a specific time period, namely by the formula(Heizer and Render2011):

$$P = \frac{D}{Q}$$

Where D is the product demand and Q is the economic order quantities. The total annual inventory cost (TIC) is calculated by adding up the total ordering cost (TS) and the total holding cost (TH), is(Efendi et al., 2019):

TIC = Ordering fee + Storage fee

$$TIC = S + H\frac{D}{Q}\frac{Q}{2}$$

WhereTIC is Total inventory cost (total inventory cost), S is storage costs.

E. Safety Stock

Safety stock refers to an inventory that protects or maintains the possibility of a product shortage. For instance, when the use of goods exceeds the original estimate or there are delays in receiving the ordered goods. The calculation formula for safety stock is(Ryando and Susanti 2019):

$$SS = Z \times std$$

Where:

Z = factor of safety used by the company

SS = Safety stock

*std* = Standard deviation of demand
In this case, the safety factor in question is the possibility that the company will use stockout. For example, a company uses a 5% probability of running out of stock, then by using a normal frequency distribution table with a value of 0.05 = 1.65 (Heizer and Render2011).

F. Reorder Point (ROP)
The reorder point is the time or point at which a similar order must be held so that the arrival or receipt of the ordered material coincides with the moment when the safety stock inventory reaches zero (Ryando and Susanti2019).
The ROP equation is as follows:(Efendi et al.2019):

$$ROP = (dx\ L) + SS$$

Where:
ROP = Reorder Point
d = daily demand
L = lead time (waiting time)
SS = safety stock (safety stock/buffer stock)

G. Total Company Cost
Calculation of the total cost of inventory or Total Inventory Cost (TIC) in the Company with the following formula(R et al. 2019):

Factory TIC = (frequency of orders x cost of one order) + (use of raw materials for one year x holding costs)

$$TICper = holding\ fee + ordering\ fee$$

$$TICper = (D\ x\ H) + (nx\ S)$$

Where:
TICper = Company Inventory Cost
D = Average use of raw materials per year
S = Ordering Fee
H = Storage Cost
n = Number of orders per year

## 3. Methods

PT. X was the subject of this investigation. The goal of data collection was to allow someone to answer the research questions, test hypotheses, and evaluate the results. This study required both primary and secondary data, particularly:

a. Primary data

This primary data was collected through direct observation of Pharmacy X. Primary data is a type of research data obtained from company interviews to gather information or data for further data processing. The information gleaned from the interviews included the names of companies that supplied patented drugs to Pharmacy X.

b. Secondary data

This secondary data was gathered from already-existing sources, specifically internal company data. Among the information obtained were:

1) Company profile
2) Booking fee
3) *Lead time*
4) Storage fee
5) Company sales data.

### 3.1. ABC Analysis Method

ABC analysis identifies, by grouping the types of drugs whose use or high prices necessitate the greatest expenditures or budgets. The ABC analysis is conducted as follows:

1. Calculating the revenue value of each patented drug during 2021
2. Calculating the total revenue from all patent drug inventories in 2021
3. Calculating the percentage of income generated by each patented drug
4. Sorting patent drugs by percentage of their income value, from largest to smallest
5. Calculating the total percentage value of patent drug revenue

6. Group A patented drugs have a revenue value of 70% of total drug revenue, Group B patented drugs have a revenue value of 20% of total drug revenue, and Group C patented drugs have a revenue value of 10% of total drug revenue.

### 3.2. Forecasting (Forecast)

After group A patent drugs were obtained, the forecasting method was applied to forecast demand in 2022. Forecasting is carried out in the following way:

1. Identify request data patterns
2. Forecasting using the QM application for Windows version 5.0
3. Forecasting accuracy measurement
4. Determine the method with the least amount of error

### 3.3. Eqonomic Order Quantity (EOQ) Method

After determining the demand, the Eqonomic Order Quantity (EOQ) method was used. Utilizing this method, the amount of each inventory order was determined to reduce ordering and storage costs while increasing the efficiency of the overall inventory cost. Additionally, this technique can establish how frequently each group A patented drugs are ordered in a given year.

The steps for calculating the Economic Order Quantity on patented drugs are as follows:

1. Calculate the demand or need for drugs over a one-year period, beginning in January 2021 and ending in December 2021. (forecast).
2. Lead Timeor the waiting time required from the time the order is placed until the drug arrives at the pharmacy, as determined by interviews with the pharmacy owner.
3. Order Costor the cost each time you make an order, which includes phone and stationery costs, is Rp. 1.500,00, as determined by interviews with Pharmacy owners.
4. Storage fee
5. Finally, perform the EOQ Method calculation.

### 3.4. *Reorder Points*(ROP)

Before calculating the ROP, the safety stock or safety stock must be determined. The ROP calculation is performed after determining the safety stock. The term "reorder point" refers to the inventory level at which an order must be placed. The company determines the necessary reorder point to avoid running out of stock (stockout) or having excess stock when the amount of inventory in stock starts to steadily decline (over stock).

The steps involved in calculating Reorder Point for patented drugs are as follows:

1. Look for safety stock or calculate safety stock. The company uses a probability of 5% of stockouts, then by using the normal frequency distribution table, the obtained value of $Z0.05 = 1.65$(Heizerand Render, 2011).
2. Lastly,conduct the ROP calculation.

## 4. Data Collection

Pharmacy X information was collected through interviews and direct observations. The generated data included company profiles, the names of drug suppliers to Pharmacy X, as well as order and sales information for 2021. The retrieved data for this study are:

### 4.1. X Duri Pharmacy Profile

Pharmacy X is located on Jl. Jendral Sudirman, Duri Barat Village, Mandau District, Bengkalis Regency, Riau. It is one of the most frequented pharmacies in Duri due to its central location.

### 4.2. X Pharmacy Suppliers

This pharmacy receives drugs from 10 different suppliers, including PT. Amtar Mitra I-3 Sembada, PT. Kebayoran Farma, PT. Indo Farma Global Medica, PT. Harapan Raya Mandiri, PT. Bina Sanprima, PT. Anugrah Arigon Medica, PT. Global Medica Pekanbaru, PT. Kimia Farma, PT. Mensa Bina Sukses, and PT. pentavalent. Orders for drugs are decided to make when the supplier comes to the pharmacy, which occurs at the beginning of every month.

### 4.3. Ordering Costs

The cost of ordering is known as a result of interviews with pharmacies, where the costs incurred to place an order are included in a single message. The reservation fee is Rp. 1.500,00.-

**4.4.Lead Time**

The leadtime of each order is the interval or grace period between the time an order is placed and the time it arrives at the pharmacy. Each drug requires a two-day lead time.The following is Table 1 which provides the holding cost details.

Table 1. Holding Costs at Pharmacy X

| No | Medicine Name | Selling Price (Rp) | Holding Cost (Rp) |
|---|---|---|---|
| 1 | Ventolin Inhaler | 140000 | 233,333 |
| 2 | Diane | 190000 | 316,667 |
| 3 | Nexium 40 Mg | 200000 | 333,333 |
| 4 | Lipitor 10 Mg | 290000 | 483,333 |
| 5 | Pariet 10 Mg | 260000 | 433,333 |
| 6 | Sucralfat suspensi 500 mg/5 ml 100 ml | 20000 | 33,333 |
| 7 | Inpepsa Sirup 100 ml | 95000 | 158,333 |
| 8 | Depakene Sirup | 226000 | 376,667 |
| 9 | Mexon | 12000 | 20,000 |
| 10 | Lodia 2 Mg | 20000 | 33,333 |
| 11 | Histigo 6 Mg | 20000 | 33,333 |
| 12 | Gramamine 50 Mg | 25000 | 41,667 |
| 13 | Lapibal 500 Mg | 40000 | 66,667 |
| 14 | Imodium | 120000 | 200,000 |
| 15 | Myonal | 110000 | 183,333 |
| 16 | Pregabalin 75 Mg | 65000 | 108,333 |
| 17 | Alofar 100 Mg | 10000 | 16,667 |
| 18 | Rhinofed | 45000 | 75,000 |
| 19 | Tarivid Otic Sol | 100000 | 166,667 |
| 20 | Akilen (Ear Drop) | 60000 | 100,000 |
| 21 | Fg Troces | 16000 | 26,667 |
| 22 | Kandistatin Drops | 65000 | 108,333 |
| 23 | Fitaquin Cream | 75000 | 125,000 |
| 24 | Dobrizol | 30000 | 50,000 |
| 25 | Burnazin Cream | 90000 | 150,000 |
| 26 | Concor 2,5 Mg | 73000 | 121,667 |
| 27 | Mucopect 15 Mg/5ml | 82000 | 136,667 |
| 28 | Lerzin Drops 15 ml | 40000 | 66,667 |
| 29 | Lameson 8 Mg | 80000 | 133,333 |
| 30 | Phenytoin 100 Mg Capsule | 70000 | 116,667 |
| 31 | Ryvel Sirup | 60000 | 100,000 |

Table 2 below provides information on the total sales of dispensary X in 2021. The information has included the price of each unit product.

Table 2. Sales Data at Pharmacy X in 2021

| No | Medicine Name | Selling Price | Total | No | Medicine Name | Selling Price | Total |
|---|---|---|---|---|---|---|---|
| 1 | Alegi | 27000 | 128 strips | 58 | Lasal Sirup | 48000 | 25 bottles |
| 2 | Acifar 400 Mg | 10000 | 70 strips | 59 | Licostan | 15000 | 165 strips |
| 3 | Akita Tablet | 7000 | 227 strips | 60 | Melanox 2% Cream 15g | 45000 | 50 tubes |
| 4 | Alermax | 3000 | 140 strips | 61 | Miratrim | 10000 | 62 strips |
| 5 | Akilen (Ear Drop) | 60000 | 78 bottles | 62 | Molexflu | 8000 | 333 strips |
| 6 | Alletrol (Eye Drop) | 21000 | 56 bottles | 63 | Nifural Sirup | 74000 | 38 bottles |
| 7 | Alofar 100 Mg | 10000 | 525 strips | 64 | Norpid 10 Mg | 20000 | 55 strips |
| 8 | Alofar 300 Mg | 15000 | 110 strips | 65 | Omegestic | 5000 | 152 strips |
| 9 | Bidaxtam | 14000 | 154 strips | 66 | Omestan | 5000 | 64 strips |
| 10 | Borraginol N Oint | 105000 | 28 tubes | 67 | Oxicobal | 3000 | 63 strips |
| 11 | Burnazin Cream | 90000 | 47 tubes | 68 | Pamol 125 Mg Supos | 20000 | 75 sups |
| 12 | Buscopan Tablet | 5000 | 88 strips | 69 | Pariet 10 Mg | 260000 | 48 strips |
| 13 | Captopril 50 Mg | 5000 | 93 strips | 70 | Phenytoin 100 Mg Capsule | 70000 | 55 bottles |
| 14 | Cerini | 55000 | 55 strips | 71 | Planotab | 4000 | 98 strips |
| 15 | Danasone | 3000 | 233 strips | 72 | Polofar Plus | 3000 | 485 strips |
| 16 | Decubal Cream 40 g | 65000 | 25 tubes | 73 | Pratifar 40 Mg | 6500 | 70 strips |
| 17 | Depakene Sirup | 226000 | 34 bottles | 74 | Primadex Tablet | 6000 | 68 strips |
| 18 | Dobrizol | 30000 | 147 strips | 75 | Pregabalin 75 Mg | 65000 | 82 strips |
| 19 | Hormico 200 Mg | 7000 | 47 strips | 76 | Pronicy | 4000 | 562 strips |
| 20 | Grafamic | 6000 | 138 strips | 77 | Proxona | 3000 | 67 strips |
| 21 | Hufadine | 10000 | 141 strips | 78 | Ranivel 75mg/5 ml Sirup 60 ml | 70000 | 46 bottles |
| 22 | Imodium | 120000 | 48 strips | 79 | Quantidex | 5000 | 84 strips |
| 23 | Kandistatin Drops | 65000 | 70 strips | 80 | Retaphyl Sr 300 mg | 15000 | 152 strips |
| 24 | Lipitor 10 Mg | 290000 | 44 strips | 81 | Rhemafar 4 Mg | 5000 | 300 strips |
| 25 | Lodia 2 Mg | 20000 | 370 strips | 82 | Rhinofed | 45000 | 110 strips |
| 26 | Histigo 6 Mg | 20000 | 346 strips | 83 | Groferton 30 mg | 6000 | 149 strips |

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|---|---|---|---|---|---|---|---|
| 27 | Inpepsa Sirup 100 ml | 95000 | 97 bottles | 84 | Ryvel Sirup | 60000 | 59 strips |
| 28 | Lameson 8 Mg | 80000 | 49 strips | 85 | Sagestam Cream | 18000 | 82 tubes |
| 29 | Lerzin Drops 15 ml | 40000 | 101bottle | 86 | Samquinor | 16000 | 76 strips |
| 30 | Mertigo 6 Mg | 50000 | 61 strips | 87 | Sanprima | 12000 | 63 strips |
| 31 | Mexon | 12000 | 632 strips | 88 | Seremig | 10000 | 70 strips |
| 32 | Mixalgin | 10000 | 253 strips | 89 | Soldextam | 4000 | 110 strips |
| 33 | Molacord 0,5 Mg | 13000 | 124 strips | 90 | Sistenol Kaplet | 28000 | 63 bottles |
| 34 | Molafate Sirup | 33000 | 49 bottles | 91 | Solinfec | 11000 | 276 strips |
| 35 | Molasic | 7000 | 99 strips | 92 | Spasminal | 10000 | 168 strips |
| 36 | Mucopect 15 Mg/5ml | 82000 | 50 bottles | 93 | Sucralfat suspensi 500 mg/5 ml 100 ml | 20000 | 490 bottles |
| 37 | Muzoral (Ketoconazole) 200 mg | 4000 | 128 strips | 94 | Supertetra | 9000 | 102 strips |
| 38 | Myonal | 110000 | 50 strips | 95 | Tarivid Otic Sol | 100000 | 48 bottles |
| 39 | Nebacetin Powder 5gr | 25000 | 99 bottles | 96 | Tera F | 6000 | 98 strips |
| 40 | Neuralgin | 10000 | 120 strips | 97 | Teosal | 3000 | 506 strips |
| 41 | Nexitra 500 Mg | 3000 | 72 strips | 98 | Tifestan Forte | 4000 | 71 strips |
| 42 | Nexium 40 Mg | 200000 | 74 strips | 99 | Trinordiol 28 Mg | 24000 | 82 strips |
| 43 | Norvom | 3000 | 84 strips | 100 | Valsartan 80 Mg | 38000 | 81 strips |
| 44 | Novaxicam | 1500 | 235 strips | 101 | Ventolin Inhaler | 140000 | 283bottle |
| 45 | Farsifen 400 Mg | 15000 | 94 strips | 102 | Vesperum | 4000 | 77 strips |
| 46 | Farizol | 4000 | 151 strips | 103 | Fitaquin Cream | 75000 | 59 tubes |
| 47 | Farmoten 25 Mg | 4000 | 153 strips | 104 | Concor 2,5 Mg | 73000 | 57 strips |
| 48 | Fg Troces | 16000 | 292 strips | 105 | Cortidex | 5000 | 116 strips |
| 49 | Cludepatic 500 Mg | 5000 | 209 strips | 106 | Dexteem Plus | 4000 | 112 strips |
| 50 | Glocovance 500 Mg/5Mg | 8000 | 132 strips | 107 | Diane | 190000 | 96 packs |
| 51 | Inflason | 4000 | 213 strips | 108 | Rivoltar 50 Mg | 5000 | 503 strips |
| 52 | Interdoxin 100 Mg | 40000 | 41 strips | 109 | Gramamine 50 Mg | 25000 | 258 strips |
| 53 | Kalmethasone 0,5 Mg | 2000 | 52 strips | 110 | Claneksi Forte 125 Mg 60 Ml | 70000 | 42 bottles |
| 54 | Katitra 500 Mg | 8000 | 50 strips | 111 | Etadexta | 3000 | 66 strips |

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|---|---|---|---|---|---|---|---|
| 55 | Klorfeson Cream | 10000 | 89 tubes | 112 | Etaven 400 Mg | 4000 | 81 strips |
| 56 | Klordema Lotion 30 Ml | 100000 | 35 bottles | 113 | Estalex 50 Mg | 10000 | 72 strips |
| 57 | Lapibal 500 Mg | 40000 | 161 strips | | | | |

## 5. Results and Discussion

Pharmacy X has conducted drug planning based on the results of interviews. Pharmacy X placed orders with suppliers for an average of 20 strips/tablets, 10 bottles/syrup, 5 tubes/ointment, and 5 suppositories of Pamol 125 mg. However, Pharmacy X frequently over-ordered when the drug's stock was still abundantly available, causing many drugs to accumulate and expire.

Pharmacy X sold a wide range of medications. The supplies studied in this study were drugs, particularly patent drugs. According to the results of the document processing, there were 113 different types of patent drugs. The ABC analysis of patented drugs based on investment value for the period January 2021-December 2021 is as follows here in Table 3.

Table 3. Results of Grouping Patent Drugs Based on ABC Method

| Group | Drug Type | Percentage (%) | Income (Rp) | Percentage of Income (%) |
|---|---|---|---|---|
| A | 31 | 31.940% | 241,561,000 | 70% |
| B | 30 | 29.778% | 70,813,000 | 20% |
| C | 52 | 38.282% | 35,535,500 | 10% |
| Total | 113 | 100% | 347,909,500 | 100% |

The table above shows the results of the ABC analysis. The ABC analysis of investment value revealed that group A had 31 types of drugs or 31.940% of all patented drugs, absorbing 70% of investment, while group B had 30 types of drugs or 29.778% of all patented drugs, absorbing 20% of investment. While group C contains up to 52 different types of drugs, accounting for 38.282% of all patented drugs, drug items only absorb 10% of investment.
The EOQ was calculated by taking the number of sales in a period, ordering costs, and holding costs. The ABC analysis was used to calculate the sales amount. The cost of ordering Pharmacy X was Rp. 1,500.00 per phone call. Holding costs are the expenses incurred when inventory is held or carried for an extended period of time. Appendix 1 lists the Pharmacy X storage costs. The calculation of the EOQ for Group A Patented Drugs yielded the following results, which can be seen in Table 4.

Table 4. The Calculation of EOQ of Group A Patent Drugs

| No | Medicine name | Total Drug Sales | Drug Ordering Fee (Rp) | Storage Fee Per-Drug (Rp) | Order before using EOQ (Times) | EOQ | Reorder with EOQ (Times) |
|---|---|---|---|---|---|---|---|
| 1 | Ventolin Inhaler | 276.083 | 1500 | 233.333 | 27 | 59.579 | 4,634 |
| 2 | Diane | 71,832 | 1500 | 316,667 | 13 | 26.087 | 2,754 |
| 3 | Nexium 40 Mg | 91,118 | 1500 | 333.333 | 12 | 28,637 | 3.182 |
| 4 | Lipitor 10 Mg | 41,457 | 1500 | 483.333 | 12 | 16,041 | 2,584 |
| 5 | Pariet 10 Mg | 24,000 | 1500 | 433.333 | 12 | 12,890 | 1,862 |
| 6 | Sucralfate suspension 500 mg/5 ml 100 ml | 478,308 | 1500 | 33,333 | 37 | 207,480 | 2,305 |
| 7 | Inpepsa Syrup 100 ml | 97.564 | 1500 | 158,333 | 14 | 42,995 | 2,269 |
| 8 | Depakene Syrup | 40,951 | 1500 | 376,667 | 12 | 18.060 | 2,268 |
| 9 | Mexon | 605,117 | 1500 | 20,000 | 38 | 301,277 | 2.009 |
| 10 | Lodia 2 Mg | 372,917 | 1500 | 33,333 | 31 | 183,202 | 2.036 |
| 11 | Histigo 6 Mg | 351,672 | 1500 | 33,333 | 23 | 177,907 | 1,977 |
| 12 | Gramamine 50 Mg | 254,411 | 1500 | 41,667 | 18 | 135,342 | 1,880 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 13 | Lapibal 500 Mg | 164,526 | 1500 | 66.667 | 14 | 86.044 | 1,912 |
| 14 | Imodium | 49,715 | 1500 | 200,000 | 12 | 27.308 | 1,821 |
| 15 | Myonal | 79,153 | 1500 | 183,333 | 12 | 35,989 | 2,199 |
| 16 | Pregabalin 75 Mg | 85.553 | 1500 | 108,333 | 12 | 48,674 | 1,758 |
| 17 | Alofar 100 Mg | 517,189 | 1500 | 16.667 | 38 | 305,110 | 1,695 |
| 18 | Rhinofed | 87,846 | 1500 | 75,000 | 12 | 59,278 | 1,482 |
| 19 | Tarivid Otic Sol | 71,019 | 1500 | 166.667 | 12 | 35,754 | 1,986 |
| 20 | Akilen (Ear Drops) | 83,001 | 1500 | 100,000 | 12 | 49,900 | 1,663 |
| 21 | Fg Troces | 290.445 | 1500 | 26.667 | 20 | 180,761 | 1,607 |
| 22 | Candistatin Drops | 63.342 | 1500 | 108,333 | 13 | 41,882 | 1,512 |
| 23 | Fitaquin Cream | 31.308 | 1500 | 125,000 | 13 | 27,412 | 1.142 |
| 24 | Dobrizol | 175,924 | 1500 | 50,000 | 14 | 102,740 | 1,712 |
| 25 | Burnazine Cream | 20,315 | 1500 | 150,000 | 13 | 20,157 | 1.008 |
| 26 | Concor 2.5 Mg | 53,220 | 1500 | 121,667 | 12 | 36,225 | 1,469 |
| 27 | Mucopect 15 mg/5ml | 37,916 | 1500 | 136.667 | 112 | 28,850 | 1.314 |
| 28 | Lerzin Drops 15 ml | 104.829 | 1500 | 66.667 | 14 | 68,682 | 1.526 |
| 29 | Lameson 8 Mg | 44,080 | 1500 | 133.333 | 12 | 31,493 | 1,400 |
| 30 | Phenytoin 100 mg Capsule | 52.482 | 1500 | 116.667 | 12 | 36,736 | 1,429 |
| 31 | Ryvel Syrup | 35,334 | 1500 | 100,000 | 12 | 32.558 | 1.085 |

According to the calculation above, before using the EOQ of the drug with the most orders in 2021, Mucopect 15mg/5ml was 112 times, and after using the EOQ, the order was only made 1 time with the number of orders being 28,850 bottles. Before and after the implementation of the EOQ method, a substantial number of orders for patented drugs were placed. This demonstrates its efficacy, as using EOQ can reduce the number of reorders of type A patent drugs in a year. Ordering efficiently can reduce excess storage costs.

To calculate the ROP, the safety stock/buffer stock must first be calculated. So far, Pharmacy X's safety stock or buffer stock is only estimated; there is no special calculation to determine the buffer stock. The average lead time for drugs, according to interviews, is 2 days. Table 5 following the ROP calculations for patented drugs from Group A:

Table 5. Calculation of ROP for Group A Patent Drugs

| No | Medicine name | Number of Requests | D | L | SS(Strips/Box/Bottle/Tubes) | dx L | ROP |
|---|---|---|---|---|---|---|---|
| 1 | Ventolin Inhaler | 59.579 | 0.163 | 2 | 0.292 | 0.326 | 0.618 |
| 2 | Diane | 26.087 | 0.071 | 2 | 0.998 | 0.143 | 1,141 |
| 3 | Nexium 40 Mg | 28,637 | 0.078 | 2 | 0.707 | 0.157 | 0.864 |
| 4 | Lipitor 10 Mg | 16,041 | 0.044 | 2 | 0.081 | 0.088 | 0.169 |
| 5 | Pariet 10 Mg | 12,890 | 0.035 | 2 | 0.000 | 0.071 | 0.071 |
| 6 | Sucralfate suspension 500 mg/5 ml 100 ml | 207,480 | 0.568 | 2 | 0.076 | 1.137 | 1,213 |
| 7 | Inpepsa Syrup 100 ml | 42,995 | 0.118 | 2 | 0.262 | 0.236 | 0.498 |
| 8 | Depakene Syrup | 18.060 | 0.049 | 2 | 0.401 | 0.099 | 0.500 |
| 9 | Mexon | 301,277 | 0.825 | 2 | 0.579 | 1,651 | 2,230 |
| 10 | Lodia 2 Mg | 183,202 | 0.502 | 2 | 0.307 | 1.004 | 1.311 |
| 11 | Histigo 6 Mg | 177,907 | 0.487 | 2 | 0.062 | 0.975 | 1.037 |
| 12 | Gramamine 50 Mg | 135,342 | 0.371 | 2 | 0.117 | 0.742 | 0.859 |
| 13 | Lapibal 500 Mg | 86.044 | 0.236 | 2 | 0.146 | 0.471 | 0.617 |
| 14 | Imodium | 27.308 | 0.075 | 2 | 0.508 | 0.150 | 0.658 |
| 15 | Myonal | 35,989 | 0.099 | 2 | 1,208 | 0.197 | 1,405 |
| 16 | Pregabalin 75 Mg | 48,674 | 0.133 | 2 | 0.253 | 0.267 | 0.519 |
| 17 | Alofar 100 Mg | 305,110 | 0.836 | 2 | 4,455 | 1,672 | 6,127 |
| 18 | Rhinofed | 59,278 | 0.162 | 2 | 0.915 | 0.325 | 1,240 |
| 19 | Tarivid Otic Sol | 35,754 | 0.098 | 2 | 0.626 | 0.196 | 0.822 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 20 | Akilen (Ear Drops) | 49,900 | 0.137 | 2 | 0.478 | 0.273 | 0.751 |
| 21 | Fg Troces | 180,761 | 0.495 | 2 | 0.318 | 0.990 | 1.309 |
| 22 | Candistatin Drops | 41,882 | 0.115 | 2 | 0.420 | 0.229 | 0.650 |
| 23 | Fitaquin Cream | 27,412 | 0.075 | 2 | 1.144 | 0.150 | 1,294 |
| 24 | Dobrizol | 102,740 | 0.281 | 2 | 0.569 | 0.563 | 1.132 |
| 25 | Burnazine Cream | 20,157 | 0.055 | 2 | 1,102 | 0.110 | 1,213 |
| 26 | Concor 2.5 Mg | 36,225 | 0.099 | 2 | 2,331 | 0.198 | 2,530 |
| 27 | Mucopect 15 mg/5ml | 28,850 | 0.079 | 2 | 0.499 | 0.158 | 0.657 |
| 28 | Lerzin Drops 15 ml | 68,682 | 0.188 | 2 | 1.164 | 0.376 | 1.541 |
| 29 | Lameson 8 Mg | 31,493 | 0.086 | 2 | 0.233 | 0.173 | 0.406 |
| 30 | Phenytoin 100 mg Capsule | 36,736 | 0.101 | 2 | 0.104 | 0.201 | 0.305 |
| 31 | Ryvel Syrup | 32.558 | 0.089 | 2 | 0.978 | 0.178 | 1,156 |

This quantity is the optimal point for reordering in order to avoid stock shortages caused by stock-outs and stock shortages due to increased demand. By calculating the ROP and storing safety stock, the pharmacy can improve service quality and avoid losses caused by backorders.

After calculating the EOQ and ROP, the TIC (Total Inventory Cost) is calculated using EOQ, while TICp below is The Existing Total Inventory Cost of the Pharmacy. Both Cost comparison is calculated to determine the before and after Total Inventory Cost (TIC) at the pharmacy. The calculation of the TIC and TICp for group A patent drugs appears in Table 6 below:

Table 6. Calculation of TIC and TICPer of Patent Drugs Group A

| No | Medicine name | Number of Needs | Average Drug Needs/year | Ordering Cost (Rp) | Storage Cost (Rp) | EOQ (units) | TIC (Rp) | Many Orders Yearly (times) | TICp (Rp) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Ventolin Inhaler | 276.083 | 23,583 | 1500 | 233.333 | 59.579 | 13901,720 | 27 | 46002,770 |
| 2 | Diane | 71,832 | 8,000 | 1500 | 316,667 | 26.087 | 8260.779 | 13 | 22033,336 |
| 3 | Nexium 40 Mg | 91,118 | 6,167 | 1500 | 333.333 | 28,637 | 9545,570 | 12 | 20055,554 |
| 4 | Lipitor 10 Mg | 41,457 | 3,667 | 1500 | 483.333 | 16,041 | 7753,232 | 12 | 19772,221 |
| 5 | Pariet 10 Mg | 24,000 | 4,000 | 1500 | 433.333 | 12,890 | 5585,694 | 12 | 19733,332 |
| 6 | Sucralfate suspension 500 mg/5 ml 100 ml | 478,308 | 40,833 | 1500 | 33,333 | 207,480 | 6915,947 | 37 | 56861,098 |
| 7 | Inpepsa Syrup 100 ml | 97.564 | 8,083 | 1500 | 158,333 | 42,995 | 6807.555 | 14 | 22279,858 |
| 8 | Depakene Syrup | 40,951 | 2,833 | 1500 | 376,667 | 18.060 | 6802.549 | 12 | 19067,223 |
| 9 | Mexon | 605,117 | 52,667 | 1500 | 20,000 | 301,277 | 6025,531 | 38 | 58053,333 |
| 10 | Lodia 2 Mg | 372,917 | 30,833 | 1500 | 33,333 | 183,202 | 6106,663 | 31 | 47527,768 |
| 11 | Histigo 6 Mg | 351,672 | 28.833 | 1500 | 33,333 | 177,907 | 5930,164 | 23 | 35461.102 |
| 12 | Gramamine 50 Mg | 254,411 | 21,500 | 1500 | 41,667 | 135,342 | 5639,293 | 18 | 27895.841 |
| 13 | Lapibal 500 Mg | 164,526 | 13,417 | 1500 | 66.667 | 86.044 | 5736,320 | 14 | 21894,449 |
| 14 | Imodium | 49,715 | 4,000 | 1500 | 200,000 | 27.308 | 5461.593 | 12 | 18800,000 |
| 15 | Myonal | 79,153 | 4,167 | 1500 | 183,333 | 35,989 | 6598,035 | 12 | 18763.888 |
| 16 | Pregabalin 75 Mg | 85.553 | 6,833 | 1500 | 108,333 | 48,674 | 5273,010 | 12 | 18740,276 |
| 17 | Alofar 100 Mg | 517,189 | 43,750 | 1500 | 16.667 | 305,110 | 5085,270 | 38 | 57729,181 |
| 18 | Rhinofed | 87,846 | 9,167 | 1500 | 75,000 | 59,278 | 4445,824 | 12 | 18687,500 |
| 19 | Tarivid Otic Sol | 71,019 | 4,000 | 1500 | 166.667 | 35,754 | 5958,991 | 12 | 18666.668 |
| 20 | Akilen (Ear Drops) | 83,001 | 6,500 | 1500 | 100,000 | 49,900 | 4990,020 | 12 | 18650,000 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 21 | Fg Troces | 290.445 | 24,333 | 1500 | 26.667 | 180,761 | 4820,362 | 20 | 30648.897 |
| 22 | Candistatin Drops | 63.342 | 5,833 | 1500 | 108,333 | 41,882 | 4537,189 | 13 | 20131,943 |
| 23 | Fitaquin Cream | 31.308 | 4,917 | 1500 | 125,000 | 27,412 | 3426,441 | 13 | 20114,583 |
| 24 | Dobrizol | 175,924 | 12,250 | 1500 | 50,000 | 102,740 | 5136,984 | 14 | 21612,500 |
| 25 | Burnazine Cream | 2729,600 | 3,917 | 1500 | 150,000 | 20,157 | 204637,240 | 13 | 20087,500 |
| 26 | Concor 2.5 Mg | 53,220 | 4,750 | 1500 | 121,667 | 36,225 | 4407,420 | 12 | 18577,918 |
| 27 | Mucopect 15 mg/5ml | 37,916 | 4,167 | 1500 | 136.667 | 28,850 | 3942,791 | 112 | 168569,446 |
| 28 | Lerzin Drops 15 ml | 104.829 | 8,417 | 1500 | 66.667 | 68,682 | 4578,854 | 14 | 21561,114 |
| 29 | Lameson 8 Mg | 44,080 | 4.083 | 1500 | 133.333 | 31,493 | 4199.042 | 12 | 18544.443 |
| 30 | Phenytoin 100 mg Capsule | 52.482 | 4,583 | 1500 | 116.667 | 36,736 | 4285.878 | 12 | 18534.724 |
| 31 | Ryvel Syrup | 35,334 | 4,917 | 1500 | 100,000 | 32.558 | 3255,795 | 12 | 18491,667 |
| | | | | | | | 380,051,757 | | 963,550,130 |

Based on the calculation of TIC and TICPer, the difference of Rp. 582,498,373 indicates that the use of EOQ is more effective.

## 6. Conclusion

The following conclusions can be drawn from the results of processing and analysis performed:

1. By using the ABC method, it has been revealed that the patented drugs that must be prioritized are 31 types of drugs in which the drug has a very high investment value of Rp. 241,561,000 of the total Rp. 347,909,500. Consequently, its inventory needs to be controlled under strict supervision.
2. According to the EOQ calculation, the Ventolin Inhaler can be ordered up to 59,579 bottles with an ordering frequency of 4,634 times. The summary results of the EOQ calculation can be found in Appendix 1. Based on the EOQ calculations for 31 type A patent drugs, an average of 80 pieces of the maximum quantity of drugs can be ordered, with a frequency of two orders per month. When using the EOQ method, ordering patent drugs is more efficient, as demonstrated by reducing the number of drug orders to reduce excess inventory costs. According to the EOQ, the cost of inventory is Rp.380,051,757. According to Pharmacy X, the real cost of inventory is Rp.963,550,130. It means that using the EOQ Method saves Rp. 582,498,373.
   The ROP calculation shows that the Ventolin Inhaler drug must be reordered when the stock is 0.618 bottle or less than 1 bottle; the results of the ROP calculation recapitulation can be found in Appendix 2. And, if, according to the overall ROP calculation, the average order is one drug, and each drug stock remains one piece, the pharmacy must place another order with the amount of inventory determined by the EOQ method.
3. Recommendations or proposals for controlling the inventory of type A Patent Drugs based on research findings, for example, this Ventolin Inhaler Brand Patent Drug can be reordered when the drug is left with 1 bottle with a total order of 60 bottles, and it is recommended to order the drug 5 times in a year. Appendix 3 contains recommendations for other Type A patent drugs. All of the drugs in Table 4.43 are group A drugs, because group A is the most beneficial to the pharmacy. As a result, controlling the supply of this class of drugs should be prioritized. To avoid drug shortages, pharmacies are expected to check drugs at least three times per week, and pharmacies are expected to prioritize drugs ordered during the previous period, so they do not expire.

The following recommendations can be made in light of this study:

1. Based on the findings of the study, the authors recommend that Pharmacy X consider using the ABC analysis method to identify prioritized patent drugs and the EOQ method to implement a minimum order policy for prioritized drugs to reduce excessive inventory costs.
Further researchers can investigate the most recent inventory control strategies to minimize errors in the previous EOQ method.

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