



## JOURNAL OF TECHNOLOGY AND OPERATIONS MANAGEMENT

<http://e-journal.uum.edu.my/index.php/jtom>

How to cite this article:

Sukendar, I., Sugiyono, A., & Munfiqotussifha. (2020). Medicine Inventory Control By Considering Expiry Periods And Product Returns Using The Always Better Control (ABC) Analysis And The Handley Within Model Of Economic Order Quality (EOQ) At Pharmacies In Indonesia. *Journal of Technology and Operations Management*, 15(2), 20–32. <https://doi.org/10.32890/jtom2020.15.2.3>

## MEDICINE INVENTORY CONTROL BY CONSIDERING EXPIRY PERIODS AND PRODUCT RETURNS USING THE ALWAYS BETTER CONTROL (ABC) ANALYSIS AND THE HANDLEY WITHIN MODEL OF ECONOMIC ORDER QUALITY (EOQ) AT PHARMACIES IN INDONESIA

<sup>1</sup>Irwan Sukendar, <sup>2</sup>Andre Sugiyono, & <sup>3</sup>Munfiqotussifha

Department of Industrial Engineering Faculty of Industrial Technology, Universitas Islam Sultan Agung Semarang Indonesia Jl. Raya Kaligawe KM.4 Semarang Indonesia

Corresponding author: [irwansukendar@gmail.com](mailto:irwansukendar@gmail.com)

Received: 24/7/2020 Revised: 26/8/2020 Accepted: 24/11/2020 Published: 29/12/2020

### ABSTRACT

This study aims to control medicine inventories by considering the expiration period and the product return using The Always Better Control (ABC) analysis and The handley within model of Economic Order Quantity (EOQ). The results of this study indicate that there are 21% of medicines or 22 types of medicines belonging to group A with the use of 74.64%. for group B there were 25% drugs or 28 types of drugs with a budget use of 15.31% of all medicines. Meanwhile, there are 55% of medicines or 60 types of medicines belonging to group C with the use of a budget of 10.05% of the total medicines and the calculation using the EOQ method by considering the expiration period and product returns in this research has a more optimal order size compared to the previous method so that it can minimize expired medicines and estimate which medicines will expire at the end of the cycle so that the total cost of supplies at the pharmacy is more optimal.

**Keywords:** Inventory control, ABC analysis, EOQ, expiration.

### INTRODUCTION AND LITERATURE REVIEW

The development of increasingly modern science and technology has made competition between companies tighter, along with the many new companies that have sprung up in the same industry. The pharmaceutical industry is one of the industries that continues to grow with intense competition, namely the pharmacy. the tight competition of pharmacies so that good operational management is

needed to keep the business running. Good management by carrying out an efficient, effective, and economical inventory planning. Pharmacy is included in the category of trading companies because its main activity is to purchase drug supplies from drug distributors or suppliers to be resold to consumers without changing the form or function of the goods. So that the role of supply is an important component in pharmacy operational activities (Rachmawati, Syafirullah, & Faiz, 2020). According to (Apriyani & Muhsin, 2017) Inventory control is an activity in managing inventory to suit your needs and remain stable.

And currently drug checks are carried out every day by the pharmacy and it is known that the demand for generic drugs in pharmacies is quite high, but it is not balanced with good inventory control so that inventory control is not optimal. To place an order, the pharmacy only looks at previous medicine consumption and orders are made when the medicine has reached a supply crisis limit. And because medicine is a perishable product category where the value of the product will decrease over time or cannot be used again if it has passed its expiration date. So if there is a medicine that has passed the expiration limit or damage will cause high inventory costs. And medicines that are not in demand until a certain time limit will be returned with several conditions from the distributor. If the requirements for return are not met, the medicine cannot be returned so that the medicine will be destroyed with the cost of destruction being borne by the pharmacy which results in losses for the pharmacy. The above problems can be avoided if the pharmacy manages to control medicine supplies properly. So far, pharmacies have not carried out inventory control calculations by considering product expiration and returns. to find out the types of medicines that require close supervision in terms of inventory, the size of the order that should be made and the right time to reorder so as to minimize the total cost of supplies.

Several previous studies on medicines supply control are (Nafisah, Puryani, & Lukito, 2011) where in that study developed an EOQ model for pharmaceutical products by considering the expiration period and product returns. And research (Buwono, Priyandari, & Jauhari, 2014), (Hermanto, Indrajaya, & Suhendar, 2018) which only developed the EOQ method in their research so that it was developed again by (Resmana & Rukmayadi, 2019), (Ulfa, Said Salim Dahda, & Widyaningrum, 2018). For research (Dyatmika & Krisnadewara, 2017) by adding the ABC method to classify goods based on investment. From the limitations of previous studies, researchers finally developed it again (Alfanda, Pujotomo, & Wp, 2018) using the EOQ and ABC methods by considering the expiration period and product returns.

## RESEARCH OBJECTIVES

The purpose of this study is to classify medicinal products based on the level of importance and size of investment, determine the optimal order size and estimate the medicines that will expire at the end of the cycle so as to reduce the total cost of supplies by using the ABC analysis and Economy Order Quantity (EOQ).

## RESEARCH METHODOLOGY AND DATA ANALYSIS

This research begins with a preliminary study, namely a field study, conducting interviews with the person in charge and employees at the pharmacy to obtain information and data needed in the study. Then identify the problem and determine the purpose of the research, then collect data that will be used in the research, then proceed with processing the data that has been developed and then carry out analysis, finding and interpretation.

### Model Formulation

Based on previous research (Alfanda et al., 2018), researchers will perform data processing with different case studies, where in this study a probabilistic EOQ model for pharmaceutical products was

developed by considering the expiration period and product returns so as to prove that the method used can minimize inventory costs. The assumptions used in this study are as follows:

1. Demand is probabilistic because disease cannot be predicted
2. Constant order size for each order, ordering is only made when inventory reaches reorder point ( $r$ ).
3. Constant price of goods ( $P$ ) both to the quantity of goods ordered and time.
4. Shortage of inventory is calculated by backorder.
5. Order charge ( $A$ ) is constant for each order regardless of the quantity ordered.
6. The cost of holding is proportional to the amount of inventory.
7. The expiration period is known.
8. Drugs that have expired cannot be resold.
9. Medicines that can be returned to suppliers before the expiration date
10. The medicines returned will be replaced with the same drug with a longer expiration period.
11. If the medicine is less than one lot, the drug cannot be returned to the supplier.
12. Medicines that have expired will be worth Rp. 0.,

Notations :

- $Q^*$  : optimal lot (item)  
 $A$  : request cost (Rp/pesan)  
 $D$  : Demand (item)  
 $H$  : holding cost (Rp)  
 $C_u$  : stockout cost(Rp)  
 $ER^*$  : estimated number of products that will expire (item)  
 $P$  : unit price (Rp)  
 $AR$  : return cost (Rp)  
 $r$  : reorder point (item)  
 $L$  : leadtime (year)  
 $w$  : returned product number (box)  
 $s$  : units per product that can be returned (item)  
 $n$  : the number of product returns in one period  
 $a$  : the possibility of an inventory shortage  
 $Z_a$  : value the possibility of inventory shortages  
 $S$  : standar deviasi of demand  
 $N$  : expected number of items deficient  
 $m$  : fixed expiration period  
 $DL$  : demand for leadtime  
 $EAC$  : inventory cost per cycle (Rp)

### **Grouping Medicine Based on ABC Analysis**

This method is an analysis that is used solely to sort the number of uses, then classify the types of goods in an effort to find out the types of goods in an effort to find out the types of medicines movement which include various types, lots of quantities and different patterns of need (Assauri, 2004). The steps in processing medicines grouping data based on ABC analysis are as follows: The steps are :

1. Determine the number of items for each type of item
2. Determine the price per item for each type of item
3. Multiplying the price per item by the number of units to determine the total investment value of each type of item
4. Arrange the order of the types of goods according to the amount of the total investment value, where the largest total investment value is in the first order.
5. Calculate the cumulative percentage of goods from the many types of goods
6. Calculate the cumulative percentage of the investment value of goods from the total investment value.
7. Grouping classes based on the percentage of goods and the percentage of the investment value of goods.

8. Draw an ABC analysis curve or a pareto chart to show the level of importance

### **Handley Within Economy Order Quantity model**

Economic Order Quantity (EOQ) is a number of inventory items that can be ordered during a period for the purpose of minimizing the cost of these goods (Sabarguna, 2004). According to (Sukanta, 2017) to determine the value of  $q^*$  and  $r^*$ , it is searched using Handley Within model with lost sales using iteration. The first step that must be taken is to calculate the  $q$  value with the Wilson formula, as follows:

$$q_{01}^* = \sqrt{\frac{2AD}{h}} \quad (1)$$

$$a = \frac{hq_{01}^*}{C_u D + hq_{01}^*} \quad (2)$$

$$Z \propto = 1 - \alpha \quad (3)$$

$$r_1^* = DL + Z\alpha S\sqrt{L} \quad (4)$$

$$q_{02}^* = \sqrt{\frac{2D(A+C_u N)}{h}} \quad (5)$$

$$\int_r^\infty (x - r)f(x)dx = S_L[f(Z\alpha) - Z \propto \psi(Z\alpha)] \quad (6)$$

The values for  $f(Z\alpha)$  and  $\psi(Z\alpha)$  are obtained from the Standard Normal Deviation table. Then the value of  $q_2^*$  is obtained, so the value of  $r_2^*$  can be determined with the same steps. After the  $r_1^*$  and  $r_2^*$  values are obtained, the two values can be compared, if the two values do not have a significant difference and are almost the same then the shrimp paste is finished. Conversely, if the value is significantly different, the processing is continued with the next iteration with the same rate.  $r$  here is denoted by the reorder point. Where the reorder point according to (Rangkutty, 2017) is the limit or point of the number of reordering including the demand desired or needed during the grace period follows:

### **Expected Amount of Expired Products at the end of the cycle (ER)**

$$ER = \frac{hQ}{(h+C_u)} \quad (7)$$

### **Number of Product Returns**

Product returns can be made if there are still  $s$  products, where  $s$  is the quantity of the product per lot.  $w$  is the number of lots that can be returned and  $w$  is a positive integer. Since  $w$  is the unit of return, only the ER that can be calculated is as follows:

$$w = \frac{ER}{s} \quad (8)$$

$$O_E = \frac{P(ER - WS)^2}{2Q} \quad (9)$$

$$O_R = A_R \quad (10)$$

### Total Inventory Cost

$$\text{Total Inventory cost} = PD + \frac{h(Q-ER)}{2Q} + \frac{AD}{Q} + \frac{C_u(ER)^2}{2Q} + \frac{P(ER-w.s)^2}{2Q} + A_R \quad (11)$$

### Results

Tabel 1

#### *Medicines Grouping Based on ABC Analysis*

Medicines group	Group number	Percentages	value (Rp)	percentages
Group A	22	20%	Rp. 403.103.376	75%
Group B	28	25%	Rp. 82.701.635	15%
Group C	60	55%	Rp. 54.278.684	10%
Total	110	100%	Rp. 540.083.695	100%

Furthermore, the EOQ analysis was carried out. The data used in the EOQ calculation are ordering costs which include telephone costs, quota costs, paper costs. So that the total of each message in this study is Rp. 10,860. For a saving cost of 20% of the purchase price for one drug item. Where the saving cost is the cost that arises when the company stores the product in a warehouse storage area (Vrat, 2014).

Tabel 2

#### *Recapitulation of Medicines Supply Planning*

No.	Medicines	Units	Q	ROP	ss	interval	ER	s	w
1	Herbesser Cd 200	Tablet	79	13,89	7	24	13	30	0
2	Hb Vit Kaplet 30s	Tablet	59	10,60	5	22	10	100	0
3	Valsartan Tab 80mg	Tablet	392	64,25	23	48	65	30	2
4	Promag Tab Str 12s	Tablet	216	27,84	15	33	36	30	1
5	Neurofenac Plus Tab 100s	Tablet	230	26,87	11	29	38	100	0
6	Glimepirid Tab 2 Mg	Tablet	319	33,95	15	34	53	50	1
7	Vitamin B Complex	Tablet	295	45,67	15	39	49	100	0
8	Fionat Tab 0,7 Mg	Tablet	269	47,67	21	50	45	100	0
9	Odansetron Tab 4 Mg (E-Cat)	Tablet	60	8,80	5	31	10	5	2
10	Amlodipin Tab 10 Mg	Tablet	1402	149,27	42	65	234	30	8
11	Nitrokaf Retard Kap Sr 2,5 Mg	capsule	351	22,24	12	36	58	100	0
12	Livron B Plex Tab Str 10s	Tablet	264	27,12	14	39	44	10	5
13	Adalat Oros Tab 30 Mg (Nifedipin)	Tablet	132	27,43	11	41	22	30	0
14	Digest 30 Mg Cap 20s	Tablet	253	34,98	19	47	42	20	2
15	Cetirizine Hexpharm 10mg Tab 50s	Tablet	296	26,70	12	39	49	50	1
16	Vometa Flash 10	Tablet	196	19,08	9	38	33	50	0

	Mg Tab								
17	Co Amoxiclave 625 Mg Tab	Tablet	147	11,17	7	37	25	30	1
18	Mertigo Sr Tab 100 S	Tablet	160	16,16	8	38	27	100	0
19	Progastic Tab 200s	Tablet	229	20,55	10	42	38	200	0
20	Viaclav 500 Mg	Tablet	72	10,02	5	39	12	100	0
21	Spironolakton Tab 25 Mg	Tablet	320	23,26	12	59	53	10	6
22	Albiotin 300 Mg Tab	Tablet	269	19,55	10	59	45	30	1
23	Super Tetra 250 Mg Cap	capsule	595	73,38	22	70	99	120	0
24	Herbesser Cd 100	Tablet	61	6,14	4	59	10	30	0
25	Amlodipin Tab 5 Mg	Tablet	897	103,90	47	94	150	30	5
26	Azithromycin Tab 500 Mg	Tablet	14	2,05	2	59	2	20	0
27	Miniaspi (Asam Asetilsalisilat) 80 Mg	Tablet	1933	148,04	72	101	322	100	3
28	Opicef 500 Mg Cap 50 S	capsule	46	3,13	2	63	8	50	0
29	Clabat F 500 Mg Tab	Tablet	28	5,83	4	61	5	20	0
30	Cefixime Kap 100 Mg	capsule	189	15,49	10	69	31	50	0
31	Sifrol Er 0,375 Mg (Pramixsol)	Tablet	18	1,30	1	68	3	30	0
32	Daiticin 500 Mg Tab 100 S	Tablet	718	68,60	46	97	120	100	1
33	Candesartan Dexa 8mg Tab	Tablet	89	13,01	9	76	15	30	0
34	Binotal 500mg	Tablet	131	20,26	15	82	22	50	0
35	Bioprexium 5 Mg Tab	Tablet	39	5,32	3	70	6	30	0
36	Glimepirid Tab 4 Mg	Tablet	47	9,35	6	72	8	50	0
37	Acetylcysteine 200 Mg Capsul	capsule	409	44,90	20	82	68	100	0
38	Primadol Tab	Tablet	355	31,90	24	85	59	100	0
39	Arsinal Tab 100s	Tablet	434	49,48	31	94	72	100	0
40	Sanprima 480 Mg Tab	Tablet	431	35,86	21	84	72	100	0
41	Trianta Tab 100 S	Tablet	222	21,18	13	82	37	100	0
42	Almacon Tab 100 S	Tablet	199	18,72	6	79	33	100	0
43	Simvastatin 20 Mg Tablet (Pl)	Tablet	387	18,34	14	81	65	50	1
44	Imunos Tab	Tablet	13	0,84	1	79	2.13	20	0
45	Flunarizin 5mg Tab 30s	Tablet	125	14,65	10	83	21	30	0
46	Bactoprim 9600 Mg Tab 100 S	Tablet	695	36,24	20	84	116	100	1
47	Lapikot Forte Tab	Tablet	237	23,57	15	86	39	100	0
48	Ambroxol Bernofarm 30mg/5ml Syr	Botl	36	6,36	5	79	6	100	0
49	Asam Mefenamat Tab 500 Mg	Tablet	1071	33,37	21	83	178	100	2
50	Betahistin Tab 6mg	Tablet	382	18,80	14	84	64	30	2
51	Lincocin 500 Mg Cap 30 S	capsule	35	2,29	2	81	6	30	0
52	Vitamin B1 50 Mg Tab Kf	Tablet	230	10,93	8	85	38	100	0
53	Acarbose Tab 50 Mg	Tablet	327	30,26	23	95	55	100	0
54	Folavicap 400 Mg Tab 100 S	Tablet	613	77,01	54	131	102	100	1
55	Clindamycin Cap 300 Mg (E-Kat)	capsule	262	32,82	19	98	44	50	1
56	Vitamin C 50mg Tab KF	Tablet	259	10,29	8	94	43	100	0
57	Metronidazol Tab 500 MG	Tablet	41	1,21	1	93	7	100	0

58	Alpentin (Gabapentin) 100 MG Kapsul	capsule	90	5,10	3	93	15	50	0
59	Amoxicilin Tab 500 MG	Tablet	738	26,78	19	98	123	100	1
60	Antasida Doen Triman Chew Tab 100s	Tablet	282	16,15	10	97	47	100	0
61	Clopidogrel Paphrostab 75 MG	Tablet	235	8,04	3	96	39	30	1
62	Curcuma Soho Tab	Tablet	32	2,29	2	98	5	30	0
63	Paracetamol If 500 MG Tab Str	Tablet	90	13,52	9	102	15	50	0
64	Cefadroxil Kap 500 MG	capsule	234	7,59	5	102	39	100	0
65	Metformin Tab 500 MG	Tablet	2066	163,00	74	139	344	100	3
66	Piralen 10 MG Tab	Tablet	482	13,44	9	104	80	10	10
67	Harnal Ocas (Tamsulosin Hcl 0.4mg)	Tablet	20	0,82	1	104	3	30	0
68	Domperidone Novell 10MG Tab	Tablet	674	16,92	11	107	112	30	4
69	Paracetamol Kimia Farma 500 MG	caplet	89	4,14	3	109	15	100	0
70	Ampicillin Kf 500 MG Tab	Tablet	640	53,30	20	117	107	100	1
71	Dramasine Tab	Tablet	184	7,29	6	112	31	100	0
72	Amlodipine IF 10mg Tab	Tablet	166	5,07	4	112	28	30	1
73	Allopurinol Tab 100 Mg	Tablet	1254	82,25	19	120	209	100	2
74	Piracetam Novell 800 Mg Tab	Tablet	342	30,13	16	122	57	100	0
75	Bactoprim 480 Mg Tab 100 S	Tablet	801	26,49	13	119	134	100	1
76	Depakote Er 250 Mg	Tablet	26	3,87	3	118	4	100	0
77	Griseofulvin 500mg Tab	Tablet	127	6,88	5	121	21	100	0
78	Ritez 10mg Tab 30s	capsule	52	4,48	4	121	9	30	0
79	Isosorbid Dinitrat Tab 5mg (Isdn)	Tablet	1008	22,51	14	123	168	100	2
80	Cotrimoxazole Erita 480 Mg Tab 100 S	Tablet	945	62,45	28	136	157	100	1
81	Ranitidin Tab 150 Mg	Tablet	735	18,71	13	131	122	100	1
82	Ofloxacin 200 Mg Tab Novell	Tablet	364	20,15	7	135	61	50	1
83	Gabapentin 300 Mg Kapsul (Ekat)	capsule	386	15,16	10	137	64	100	0
84	Bisoprolol Tab 5mg	Tablet	383	20,10	7	142	64	30	2
85	Pyrazinamid Tab 500 Mg	Tablet	161	10,44	7	143	27	100	0
86	Citicoline Tab 500 Mg	Tablet	22	1,91	1	149	4	30	0
87	Glibenclamide Indofarma 5mg Tab	Tablet	732	11,96	7	152	122	100	1
88	Cetymin Tab	capsule	47	2,24	1	155	8	50	0
89	Captopril Errita 25mg Tab 100s	Tablet	373	8,37	6	170	62	100	0
90	Ibuprofen 200mg Tab	Tablet	790	11,67	7	176	132	100	1
91	Amlodipine Berno 10mg Tab	Tablet	83	6,90	5	184	14	30	0
92	Allopurinol Berno 100mg Tab	Tablet	616	28,95	13	187	103	100	1
93	Acyclovir Tab 400 Mg	Tablet	217	2,42	1	189	36	100	0
94	Dexymox Forte 500mg	capsule	169	11,82	7	193	28	50	0
95	Fenamin 500mg Tab 100s	Tablet	351	16,69	8	199	59	100	0
96	Lerzin 10mg Cap 50s	Tablet	299	3,06	2	201	50	50	1
97	Vectrine Cap 300 Mg (Erdostein)	capsule	29	1,11	1	202	4.90	20	0
98	Furosemid Tab 40 Mg	Tablet	685	7,36	4	208	114	200	0
99	Yusimox 500mg Tab 100s	Tablet	191	1,94	1	217	32	100	0
100	Irbesartan 150 Mg	Tablet	75	3,36	3	219	13	20	0
101	Trisela 10mg	Tablet	213	8,03	4	238	36	100	0

102	Cetrol Tab	Tablet	136	2,05	1	248	23	100	0
103	Meloxicam Tab 15 Mg	Tablet	82	1,50	1	254	14	20	0
104	Meloxicam Tab 7,5 Mg	Tablet	109	1,48	1	329	18	20	1
105	Mefenamic Acid Hexpharm 500mg	capsule	185	2,22	1	338	31	100	0
106	Hydrochlorothiazide Tablet 25 Mg	Tablet	429	2,34	1	364	72	100	0
107	Antalgin Kf 500mg Tab	Tablet	238	1,15	1	372	40	100	0
108	Amlodipine Dexa 5 Mg	Tablet	66	0,26	0	485	11	10	1
109	Propanolol Dexa 10 Mg Tab	Tablet	435	1,71	1	670	73	100	0
110	Salbutamol Tab 4 Mg	Tablet	201	0,31	0	1113	34	100	0

According to (Heizer, 2010), along with the increase in the quantity of goods ordered, the number of orders per year will decrease but the storage cost will increase because the amount of inventory that must be taken care of is more. And based on the results of the above calculations, it is known that for the example Herbesser CD 200mg the order interval is 0.066 years or 24 days. The optimal order lot for this item is as in equation (1) and an example of calculating the optimal ordering quantity on Herbesser CD 200mg with 1200 requests is 79 items.

Tabel 3

*Difference in Total Inventory Cost of research results and actual costs*

No.	Medicines	units	Total Inventory Cost ABC-EOQ analysis	Total Inventory actual Cost	differences
1	Herbesser Cd 200mg	Tablet	Rp. 40.993.703	Rp. 41.647.680	Rp. 653.977
2	Hb Vit Kaplet 30s	Tablet	Rp. 39.130.084	Rp. 39.862.942	Rp. 732.858
3	Valsartan Tab 80mg	Tablet	Rp. 38.949.849	Rp. 39.219.229	Rp. 269.379
4	Promag Tab Str 12s	Tablet	Rp. 28.676.736	Rp. 29.115.082	Rp. 438.346
5	Neurofenac Plus Tab 100s	Tablet	Rp. 28.451.764	Rp. 28.904.229	Rp. 452.465
6	Glimepirid Tab 2 Mg	Tablet	Rp. 23.035.638	Rp. 23.456.533	Rp. 420.895
7	Vitamin B Complex	Tablet	Rp. 21.249.267	Rp. 21.681.024	Rp. 431.757
8	Fionat Tab 0,7 Mg	Tablet	Rp. 18.247.934	Rp. 18.679.592	Rp. 431.658
9	Odansetron Tab 4 Mg (E-Cat)	Tablet	Rp. 17.083.919	Rp. 17.723.036	Rp. 639.117
10	Amlodipin Tab 10 Mg	Tablet	Rp. 15.829.912	Rp. 16.158.175	Rp. 328.263
11	Nitrokaf Retard Kap Sr 2,5 Mg	capsule	Rp. 14.309.377	Rp. 14.768.088	Rp. 458.711
12	Livron B Plex Tab Str 10s	Tablet	Rp. 14.090.652	Rp. 14.547521	Rp. 456.869
13	Adalat Oros Tab 30 Mg (Nifedipin)	Tablet	Rp. 14.084.224	Rp. 14.606.222	Rp. 521.998
14	Digest 30 Mg Cap 20s	Tablet	Rp. 13.777.952	Rp. 14.228.552	Rp. 450.599
15	Cetirizine Hexpharm10mgtab 50s	Tablet	Rp. 12.510.501	Rp. 12.968.136	Rp. 457.634

16	Vometa Flash 10 Mg Tab	Tablet	Rp. 12.281.235	Rp. 12.773.065	Rp. 491.830
17	Co Amoxiclave 625 Mg Tab	Tablet	Rp. 11.896.483	Rp. 12.398.351	Rp. 501.869
18	Mertigo Sr Tab 100 S	Tablet	Rp. 11.754.533	Rp. 12.260.928	Rp. 506.395
19	Progastic Tab 200s	Tablet	Rp. 10.253.401	Rp. 10.739.236	Rp. 485.835
20	Viaclav 500 Mg	Tablet	Rp. 10.068.409	Rp. 10.655.956	Rp. 587.547
21	Spironolakton Tab 25 Mg	Tablet	Rp. 4.782.316	Rp. 5.260.320	Rp. 478.004
22	Albiotin 300 Mg Tab	Tablet	Rp. 4.727.227	Rp. 5.210.160	Rp. 482.933
23	Super Tetra 250 Mg Cap	capsule	Rp. 4.676.701	Rp. 5.148.365	Rp. 471.664
24	Herbesser Cd 100	Tablet	Rp. 4.341.290	Rp. 4.922.133	Rp. 580.842
25	Amlodipin Tab 5 Mg	Tablet	Rp. 4.345.255	Rp. 4.788.352	Rp. 443.097
26	Azithromycin Tab 500 Mg	Tablet	Rp. 4.012.935	Rp. 4.935.505	Rp. 922.570
27	Miniaspi (Asam Asetilsalisilat) Tab 80 Mg	Tablet	Rp. 3.869.678	Rp. 4.309.643	Rp. 439.965
28	Opicef 500 Mg Cap 50 S	capsule	Rp. 3.784.001	Rp. 4.393.403	Rp. 609.402
29	Clabat F 500 Mg Tab	Tablet	Rp. 3.675.654	Rp. 4.364.401	Rp. 688.747
30	Cefixime Kap 100 Mg	capsule	Rp. 3.365.853	Rp. 3.873.630	Rp. 507.778
31	Sifrol Er 0,375 Mg (Pramixsol)	Tablet	Rp. 3.116.217	Rp. 3.903.542	Rp. 787.325
32	Daiticin 500 Mg Tab 100 S	Tablet	Rp. 3.087.411	Rp. 3.550.613	Rp. 463.201
33	Candesartan Dexa 8mg Tab	Tablet	Rp. 2.887.046	Rp. 3.429.234	Rp. 542.188
34	Binotal 500mg	Tablet	Rp. 2.879.015	Rp. 3.401.006	Rp. 521.991
35	Bioprexium 5 Mg Tab (Perindopril Arginnie)	Tablet	Rp. 2.868.166	Rp. 3.485.862	Rp. 617.696
36	Glimepirid Tab 4 Mg	Tablet	Rp. 2.853.974	Rp. 3.448.655	Rp. 594.680
37	Acetylcystein 200 Mg Capsul	capsule	Rp. 2.839.903	Rp. 3.330.656	Rp. 490.753
38	Primadol Tab	Tablet	Rp. 2.704.056	Rp. 3.197.498	Rp. 493.441
39	Arsinal Tab 100s	Tablet	Rp. 2.,604808	Rp. 3.093.144	Rp. 488.336
40	Sanprima 480 Mg Tab	Tablet	Rp. 2.519.999	Rp. 3.012.623	Rp. 492.624
41	Trianta Tab 100 S	Tablet	Rp. 2.484.936	Rp. 2.990.340	Rp. 505.404
42	Almacon Tab 100 S	Tablet	Rp. 2.471.966	Rp. 2.980.704	Rp. 508.738

43	Simvastatin 20 Mg Tablet (Pl)	Tablet	Rp. 2.427.424	Rp. 2.912.800	Rp. 485.376
44	Imunos Tab	Tablet	Rp. 2.347.342	Rp. 3.208.616	Rp. 861.275
45	Flunarizin 5mg Tab 30s	Tablet	Rp. 2.339.542	Rp. 2.863.200	Rp. 523.658
46	Bactoprim 9600 Mg Tab 100 S	Tablet	Rp. 2.341.956	Rp. 2.821.420	Rp. 479.464
47	Lapikot Forte Tab	Tablet	Rp. 2.325.487	Rp. 2.829.739	Rp. 504.252
48	Ambroxol Bernofarm 30mg/5ml Syr 60 Ml	Botl	Rp. 2.312.594	Rp. 2.930.585	Rp. 617.991
49	Asam Mefenamat Tab 500 Mg	Tablet	Rp. 2.308.269	Rp. 2.786.117	Rp. 477.848
50	Betahistin Tab 6mg	Tablet	Rp. 2.259.466	Rp. 2.745.858	Rp. 486.393
51	Lincocin 500 Mg Cap 30 S	capsule	Rp. 2.239.055	Rp. 2.860.546	Rp. 621.491
52	Vitamin B1 50 Mg Tab Kf	Tablet	Rp. 2.119.605	Rp. 2.626.099	Rp. 506.494
53	Acarbose Tab 50 Mg	Tablet	Rp. 2.069.193	Rp. 2.567.755	Rp. 498.562
54	Folavicap 400mcg Tab 100 S	Tablet	Rp. 1.989.384	Rp. 2.460.523	Rp. 471.138
55	Clindamycin Cap 300 Mg (E-Kat)	capsule	Rp. 1.926.858	Rp. 2.419.333	Rp. 492.475
56	Vitamin C 50mg Tab Kf	Tablet	Rp. 1.708.266	Rp. 2.214.347	Rp. 506.081
57	Metronidazol Tab 500 Mg	Tablet	Rp. 1.705.778	Rp. 2.294.918	Rp. 589.140
58	Alpentin (Gabapentin) 100 Mg Kapsul	Tablet	Rp. 1.701.629	Rp. 2.237.736	Rp. 536.107
59	Amoxicilin Tab 500 Mg	Tablet	Rp. 1.650.511	Rp. 2.135.295	Rp. 484.784
60	Antasida Doen Triman Chew Tab 100s	Tablet	Rp. 1.633.913	Rp. 2.138.861	Rp. 504.948
61	Clopidogrel Paphrostab 75 Mg	Tablet	Rp. 1.628.680	Rp. 2.126.040	Rp. 497.361
62	Curcuma Soho Tab	Tablet	Rp. 1.528.592	Rp. 2.140.762	Rp. 612.169
63	Paracetamol If 500mg Tab Str	Tablet	Rp. 1.489.102	Rp. 2.024.586	Rp. 535.483
64	Cefadroxil Kap 500 Mg	capsule	Rp. 1.446.460	Rp. 1.955.392	Rp. 508.,932
65	Metformin Tab 500 Mg	Tablet	Rp. 1.416.,562	Rp. 1.891.807	Rp. 475.245
66	Piralen 10 Mg Tab	Tablet	Rp. 1.401.963	Rp. 1.892.050	Rp. 490.087
67	Harnal Ocas Tab (Tamsulosin Hcl 0.4 Mg)	Tablet	Rp. 1.370.007	Rp. 2.050.522	Rp. 680.515
68	Domperidone Novell 10mg Tab	Tablet	Rp. 1.330.833	Rp. 1819.275	Rp. 488.442
69	Paracetamol Kimia Farma500mg	capsule	Rp. 1.259.545	Rp. 1.793.736	Rp. 534.191

						Rp.
70	Ampicillin Kf 500mg Tab	Tablet	Rp. 1.249.444	Rp. 1.737.693		488.249
71	Dramasine Tab	Tablet	Rp. 1.188.381	Rp. 1.702.454		Rp. 514.073
72	Amlodipine If 10mg Tab	Tablet	Rp. 1.198.685	Rp. 1.704.019		Rp. 505.334
73	Allopurinol Tab 100 Mg	Tablet	Rp. 1.153.042	Rp. 1.639.815		Rp. 486.773
74	Piracetam Novell 800 Mg Tab	Tablet	Rp. 1.088.598	Rp. 1.594.151		Rp. 505.553
75	Bactoprim 480 Mg Tab 100 S	Tablet	Rp. 1.084.236	Rp. 1.573.989		Rp. 489.753
76	Depakote Er 250 Mg	Tablet	Rp. 1.027.448	Rp. 1.647.297		Rp. 619.849
77	Griseofulvin 500mg Tab	Tablet	Rp. 1.016.745	Rp. 1.539.184		Rp. 522.438
78	Ritez 10mg Tab 30s	capsule	Rp. 1.016.437	Rp. 1.574.,993		Rp. 558.555
79	Isosorbid Dinitrat Tab 5mg (Isdn)	Tablet	Rp. 1.022.134	Rp. 1.511.767		Rp.489.633
80	Cotrimoxazole Erita 480 Mg Tab 100s	Tablet	Rp. 929.315	Rp. 1.419.091		Rp. 489.776
81	Ranitidin Tab 150 Mg	Tablet	Rp. 894.152	Rp. 1.386.267		Rp. 492.114
82	Ofloxacin 200 Mg Tab Novell	Tablet	Rp. 840.470	Rp. 1.337.197		Rp. 496.727
83	Gabapentin 300 Mg Kapsul (Ekat)	capsule	Rp. 804.402	Rp. 1.311.714		Rp. 507.312
84	Bisoprolol Tab 5mg	Tablet	Rp. 761.990	Rp. 1.259.020		Rp. 497.030
85	Pyrazinamid Tab 500 Mg	Tablet	Rp. 739.627	Rp. 1.257.330		Rp. 517.703
86	Citicoline Tab 500 Mg	Tablet	Rp. 661.900	Rp. 1.280.743		Rp. 618.843
87	Glibenclamideindofarma 5mg	Tablet	Rp. 661.683	Rp. 1.156.566		Rp. 494.883
88	Cetymin Tab	capsule	Rp. 618.889	Rp. 1.174.176		Rp. 555.288
89	Captopril Errita 25mg Tab 100s	Tablet	Rp. 520.960	Rp. 1.031.328		Rp. 510.368
90	Ibuprofen 200mg Tab	Tablet	Rp. 498.497	Rp. 995.289		Rp. 496.792
91	Amlodipine Berno 10mg Tab	Tablet	Rp. 442.950	Rp. 973.682		Rp. 530.731
92	Allopurinol Berno 100mg Tab	Tablet	Rp. 448.921	Rp. 947.059		Rp. 498.138
93	Acyclovir Tab 400 Mg	Tablet	Rp. 421.313	Rp. 936.703		Rp. 515.390
94	Dexymox Forte 500mg	capsule	Rp. 407.646	Rp. 925.699		Rp. 518.053
95	Fenamin 500mg Tab 100s	Tablet	Rp. 383.559	Rp. 895.793		Rp. 512.234
96	Lerzin 10mg Cap 50s	Tablet	Rp. 381.593	Rp. 884.125		Rp. 502.532

					Rp.
97	Vectrine Cap 300 Mg (Erdostein)	capsule	Rp. 366.512	Rp. 937.507	570.995
98	Furosemid Tab 40 Mg	Tablet	Rp. 347.368	Rp. 857.549	510.181
99	Yusimox 500mg Tab 100s	Tablet	Rp. 321.376	Rp. 838.656	517.280
100	Irbesartan 150 Mg	Tablet	Rp. 315.345	Rp. 846.743	531.398
101	Trisela 10mg	Tablet	Rp. 267.761	Rp. 784.501	516.740
102	Cetrol Tab	Tablet	Rp. 247.564	Rp. 768.608	521.044
103	Meloxicam Tab 15 Mg	Tablet	Rp. 236.077	Rp. 764358	528.281
104	Meloxicam Tab 7,5 Mg	Tablet	Rp. 153.643	Rp. 665,985	512.342
105	Mefenamic Acid Hexpharm 500mg Capl 100s	capsule	Rp. 134.864	Rp. 653,747	518.883
106	Hydrochlorothiazide Tablet 25 Mg	Tablet	Rp. 117.355	Rp. 633.192	515.837
107	Antalgin Kf 500mg Tab	Tablet	Rp. 112.541	Rp. 630.413	517.871
108	Amlodipine Dexa 5 Mg	Tablet	Rp. 78.315	Rp. 594.648	516.333
109	Propanolol Dexa 10 Mg Tab	Tablet	Rp. 47.371	Rp. 554.818	507.447
110	Salbutamol Tab 4 Mg	Tablet	Rp. 25.117	Rp. 534.661	509.544
Total			Rp. 546.086.226	Rp. 603.633.813	Rp. 57.547.587

## FINDINGS AND INTERPRETATION

Based on the results of the calculations above, the results of the optimal order size, the number of products that will expire, the number of medicine returns, and the cost of supplies. With an optimal lot size, orders can be placed according to the demand. And on the other hand, it will reduce the risk of loss, damage, storage of medicinal products in sufficient quantities so that the products do not accumulate so that it creates investment in pharmacies. With the method currently applied by pharmacies, the total cost of supplies is Rp. 603,633,813, -. Meanwhile, based on the EOQ method, the total cost of inventory per year is Rp. 546,086,226, -. So that the method used in this study can save the total annual inventory cost of Rp. 57,547,587, - or about 9.6%. The use of EOQ analysis can reduce expiration costs, can determine which medicines can be returned to suppliers based on existing terms and conditions, can guarantee the total cost of supplies.

## CONCLUSION

The results of the ABC analysis show that there are 22 types of generic medicines belonging to group (20%), 28 types of generic medicines belonging to group B (25%) and 60 types of generic medicines belonging to group C (55%). and based on the Economic Order Quantity (EOQ) method, the optimum order quantity for all generic medicines groups A, B and C varies from 13 - 2066 items per order. Reorder Point (ROP) or for all generic drug groups varies from 0-163 medicines. and for SS (Safety Stock) calculations, starting from 0 - 74 drugs. Meanwhile, for medicines that will expire at the end

of the period for all generic medicine groups starting from 2 - 344 items. Then the drug that will expire can be returned to the supplier with a maximum of 10 items. and by calculating using EOQ can reduce the total cost of inventory by 9.6% or Rp. 57.547.587,-

## ACKNOWLEDGMENT

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

## REFERENCES

- Alfanda, D., Pujotomo, D., & Wp, S. N. (2018). Pengendalian Obat Dengan Menggunakan *Economic Order Quantity ( EOQ ) Probabilitas Berdasarkan Analisis ABC Dengan Mempertimbangkan Masa Kadaluwarsa Dan Pengembalian Produk ( Studi Kasus : Instalasi Farmasi Rumah Sakit Nasional Diponegoro ). Jurnal Penelitian*, 7(3).
- Apriyani, N., & Muhsin, A. (2017). Analisis Pengendalian Persediaan Bahan Baku Dengan Metode Economic Order Quantity Dan Kanban Pada PT Adyawanisa Satamping Industries. *Opsi*, 10(2), 128.
- Assauri, S. (2004). *Manajemen Produksi dan Operasi* (Revisi). Jakarta: Fakultas Ekonomi Universitas Indonesia.
- Buwono, R. I., Priyandari, Y., & Jauhari, wakhid A. (2014). Usulan Perencanaan dan Pengendalian Persediaan Obat pada Gudang Farmasi Klinik XYZ dengan Menggunakan Metode EOQ. *Teknik*, 13(1), 29–39.
- Dyatmika, S. B., & Krisnadewara, P. D. (2017). Pengendalian Persediaan Obat Generik Dengan Metode Analisis ABC, Metode Economic Order Quantity (EOQ), dan Reorder Point (ROP) Di Apotek XYZ Tahun 2017. *MODUS*, 30(1), 87–95.
- Heizer, J. . (2010). *Manajemen Operasi*. Jakarta: Salemba Empat.
- Hermanto, Indrajaya, D., & Suhendar, E. (2018). Analisa Pengendalian Manajemen Persediaan Dengan Menggunakan Metode *Economic Order Quanty* (Studi Kasus di PT. XYZ. *Teknik*, 7(1), 1–6.
- Nafisah, L., Puryani, & Lukito, F. X. K. B. (2011). Model Persediaan Single-Item Dengan Mempertimbangkan Tingkat Kadaluwarsa Dan Pengembalian Produk. *Prosiding SEMNAS Manajemen Teknologi*.
- Rachmawati, S. A., Syafirullah, L., & Faiz, M. N. (2020). Perancangan Sistem Pengendalian Persediaan Barang Menggunakan Metode EOQ dan ROP Berbasis Web. *Seminar Nasional Terapan Riset Inovatif (SENTRINOV)*, 6(1).
- Rangkutty, F. (2017). *Manajemen Persediaan: Aplikasi di Bidang Bisnis*. Jakarta: PT Raja Grafindo Persada.
- Resmana, D., & Rukmayadi, D. (2019). Analisis Pengendalian Persediaan Obat generik Dengan Metode ABC Dan Metode Economic Order Quantity (EOQ) Di Apotek Anugerah Farma Bintaro. *Teknik Industri*, 228–235.
- Sabarguna, B. S. (2004). *Sistem bantu Keputusan Untuk Quality Assurance Pelayanan Rumah Sakit*. Yogyakarta: Konsorsium Rumah Sakit Islam Jateng-DIY.
- Sukanta. (2017). *Pengendalian Persediaan Bahan Baku Menggunakan Metode Continuous Review System di Moga Toys Home Industry Teknik Industri*. Fakultas Teknik. Universitas Singaperbangsa. Karawang.
- Ulfia, M., Said Salim Dahda, & Widyaningrum, D. (2018). Analisis Perecanaan Dan Pengendalian Obat Dengan Metode ABC (*Always Better Control*) Dan EOQ Probabilistik (Studi Kasus : Logistik Farmasi Rumah Sakit Muhammadiyah Gresik). *Teknik*.
- Vrat, P. (2014). Basic Concepts in Inventory Management. *Materials Management*, hal. 21–36