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Development of Inventory Model to Reduce Total Inventory Costs at RSUD Mentawai

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ABSTRACT

The inventory policy problem is a problem in the inventory system related to how to ensure that each usage demand can be met at minimal cost. In the healthcare industry, it is imperative that the procurement and use of stock is not only cost-effective, but also that the required stock is always available. Discrepancies between total inventory and usage can lead to damage to BMHP inventory as the items have expiry dates, as well as excess total inventory costs. The problem of total inventory costs exceeding the budget occurs because overstock is 83% of the total need, overstock is caused by an excessive number of drug orders purchased. The purpose of this study is to reduce the total cost of inventory by considering expiry costs, inspection cost, shortage cost, order cost, holding cost using the EOQ method. The first stage in this study is to calculate the optimal order quantity value, then find the expected number of drug expirations. These results will be used to calculate the total inventory cost of five types of medical materials. for the inspection cost value, if the number of expired medical materials is above 20, the inspection cost value is not equal to zero. The calculation results found that the total inventory cost was Rp. 162,904,965, this cost is less than the actual cost of Rp. 185,843,346.00 with a difference of 12%.

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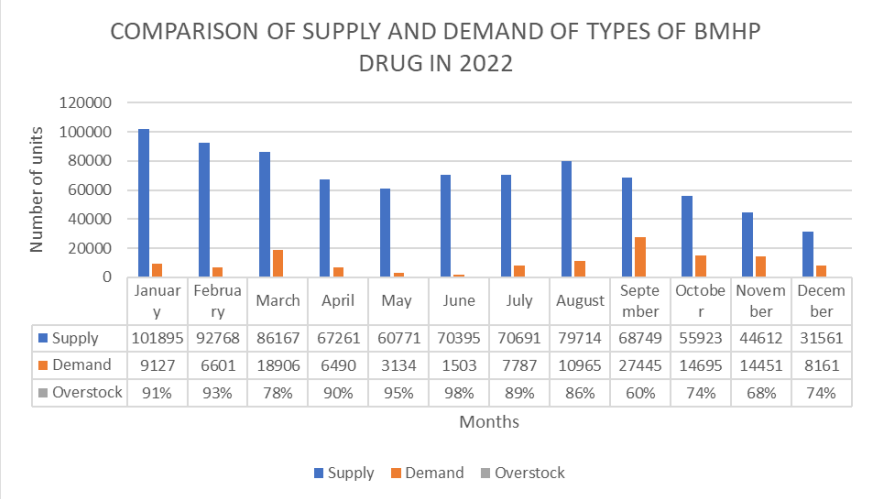
1. INTRODUCTION

RSUD Mentawai Islands Regency has a Pharmaceutical Logistics division that is responsible for providing medicines needed by RSUD patients. In hospital pharmaceutical installations there are various activities such as planning, procurement, storage, and distribution that are interrelated and influence each other so that they must be coordinated optimally. Supply chain management is key in organizing workflows and tracking inventory, purchases, orders, and payments. In the context of healthcare settings, supply chain management requires skills in managing costs, forecasting inventory, and managing space. Meanwhile, inventory management involves a deep understanding of logistics and financial aspects. Hospital supply systems must ensure there is adequate inventory of all necessary items to maintain uninterrupted continuity of supply. Thus, effective and efficient pharmaceutical inventory management is required, while still managing the close monitoring of vital drugs, preventing theft, as well as setting priorities in drug purchasing and distribution [1].

The inventory policy problem is a problem in the inventory system related to how to ensure that each usage demand can be met at minimal cost. In the healthcare industry, it is very important that the procurement and use of stock is not only cost-effective, but also that the required stock is always available [2]. A big concern regarding inventory levels is the uncertainty of demand, and because inventory management needs to consider the risk of uncertainty when calculating inventory levels [3]. This problem is related to determining the size of operating stock and safety stock. The risk arising from demand inconsistency is the accumulation of goods due to fluctuating demand, resulting in damaged or expired goods [4].



	January	February	March	April	May	June	July	August	September	October	November	December
Supply	101895	92768	86167	67261	60771	70395	70691	79714	68749	55923	44612	31561
Demand	9127	6601	18906	6490	3134	1503	7787	10965	27445	14695	14451	8161
Overstock	91%	93%	78%	90%	95%	98%	89%	86%	60%	74%	68%	74%

Figure 1 – Comparison of Supply and Demand of Types of BMHP

Figure 1- shows the Comparison of Inventory and Use of medical consumable Types showing a very significant difference, as the amount of inventory exceeds the amount of demand. The difference between total inventory and demand can cause damage to medical consumables inventory because the item has an expiration date, as well as excess total inventory costs. The problem of total inventory costs exceeding the budget occurs due to overstock of 83% of the total need, overstock is caused by an excessive number of drug orders purchased [5]. In today's global competition, companies are required to save money in order to survive. One of the costs that can be reduced is the cost of inventory control. To minimize these costs, proper inventory planning and management are required [6].

Inventory handling systems can be classified by product category. Product categories are divided into two types, namely non-perishable products and perishable products. Perishable products are products that can be used within a certain period such as food, medicine, fruits and others. Perishable products have a direct impact on sales, prices, inventory levels and costs, while the cost considered is the expiration cost. Many studies consider various factors such as product characteristics, level of competition, internal and external constraints, price impact on demand, product availability, nature of demand and so on [7]. Based on the lifetime of perishable products, they are classified into two, namely fixed lifetime and random lifetime. [8], [9]. Medicines belong to perishable goods that are part of medical products [10], or expired where the condition of the drug whose concentration has decreased between 25-30% of its initial concentration and physical form that has changed, drugs whose form or condition can no longer be used. Drugs are an important component that must be available in health services, drugs become a link between patients and health care facilities, because the presence or absence of drugs in health care facilities will have a positive or negative impact on the quality of service [11].

The consequence of the presence of expired drugs is material loss. The percentage of expired drugs is still acceptable if the percentage value is below 1% of the total expired drugs [12]. If the percentage of drugs is above 1%, it indicates ineffectiveness and efficiency in managing drug inventory. In mathematical model for perishable goods (food, vegetables, grains, etc.), the damage rate plays an important role in the optimal policy.

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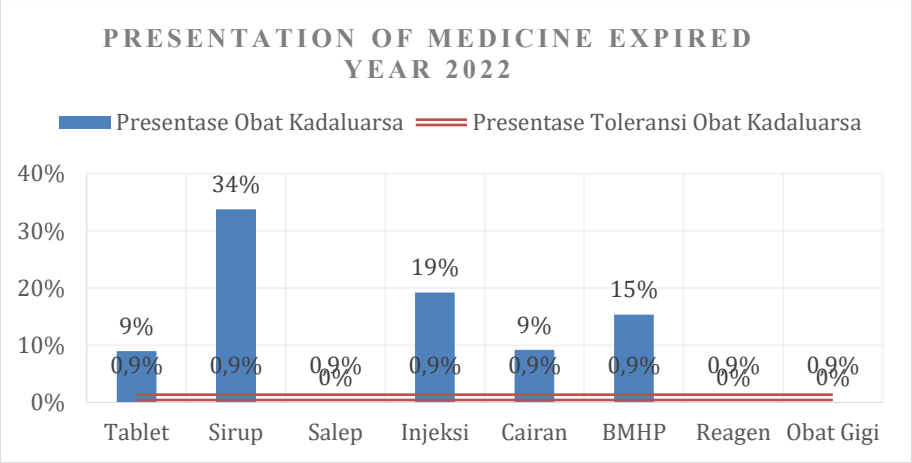

Figure 2 – Presentation of Medicine Expired Year 2022

Drug supply planning at the Mentawai Islands Hospital has not gone well because there are still 5 types of drugs whose percentage of Expired in 2020 is above the tolerance limit, namely tablets 9%, syrup 34%, injection 19%, liquid 9%, medical consumables 15%. This happens because drug evaluation is still not optimal and drug stock data collection is not accurate. The occurrence of expired drug stocks can cause material losses.

Table 1 - Disadvantages of Expired Drugs

Types of drugs	Loss	Percentage of Expired Drugs
Tablets	IDR 3,620,814.11	9%
Syrup	IDR 7,481,544.30	34%
Ointment	IDR 0	0%
Injection	IDR 24,693,892.74	19%
Liquid	IDR 1,468,575.05	9%
medical consumables	IDR 45,033,866.95	15%
Reagents	IDR 0	0%
Dentistry	IDR 0	0%

Table 1 illustrates that the largest loss of the five types of drugs whose percentage exceeds the tolerance limit is the type of medical consumables drug, namely IDR 45,033,866.95, Medical consumables are medical devices intended for single use (PMK N0. 58 of 2014) some examples of medical consumables: syringes, urine collection devices (urine bags), gauze, masks etc.

The related research that is in accordance with the research conducted is research by [13] discussing the category of perishable products using the simulation annealing and continuous review (r, Q) with the aim of reducing inventory costs. Assuming demand is usually distributed with a fixed lifetime. The continuous review method is used to determine the appropriate order quantity for perishable products as well as to replicate inventory costs. Modified Simulated Annealing (SA) is also used to find the optimal order The results showed that the optimal order quantity was equal to 16.51 units, obtained from the modified simulation with a runtime of 0.51 seconds. The expected total cost decreased by 69.85 percent, when compared to the results obtained from the EOQ model.

Research by [14] which discusses perishable products with a fixed lifetime, with decision variables, namely the optimal order quantity (Q) and reorder point (r) using a continuous review (r, Q), with the objective function of minimizing inventory and supply chain costs. Research by [15] discusses perishable products where demand is stochastic with decision variables for optimal order quantity (Q) and reorder point (R), with the aim of increasing profits. Research by [16] discusses perishable products with uncertain demand, with a periodic review policy (R, S) to reduce inventory costs.

Research by [17] discusses the Stochastic production routing problem for perishable products with a model and solution algorithm, the purpose of this study is to minimize the inventory cost of wasted products, considering the product life, uncertain demand with a fixed life.

Table 2 - Research Position

Research		1 [18]	2 [19]	3 [8]	4 [9]	5 [20]	6 [15]	7 [21]	8 [16]	9 Proposal models
Product Type	Perishable	✓	✓	✓	✓	✓	✓	✓	✓	✓
Method	Continuous review			✓	✓					
	Periodic review					✓	✓		✓	
	FEFO	✓								
	EOQ		✓							✓
Objective Function	Minimization of Total Inventory Cost	✓		✓				✓	✓	✓
	Increase Profit		✓		✓	✓	✓			
Decision Variable	Optimal reorder point		✓	✓						✓
	Optimal Order Quantity	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Inventory Level							✓		
	Cycle length				✓					
Consider Demand	Probabilistic							✓		✓
	Stochastic			✓		✓	✓		✓	
	Deterministic	✓	✓							
Leadtime	Probabilistic									
	Stochastic						✓			
	Deterministic	✓	✓		✓	✓			✓	✓
	Zero			✓		✓		✓		
Lifetime	Probabilistic									
	Stochastic									
	Deterministic	✓	✓	✓	✓	✓	✓	✓	✓	✓
Number of products	Single item		✓	✓	✓					
	Multi item	✓				✓	✓	✓	✓	✓
Inventory cost	Ordering cost			✓	✓	✓	✓	✓	✓	✓
	Holding cost	✓	✓	✓	✓	✓	✓		✓	✓
	Purchase cost		✓		✓		✓	✓		✓
	Shortage cost	✓	✓		✓	✓				✓
	Outdate cost	✓		✓		✓		✓	✓	✓
	Cost motivation strategy								✓	
	Commuting cost								✓	
	Inspection cost				✓					✓
	Emergency cost							✓		

Table 2 is a research position where several variables used in this study are determining the optimal order quantity and reorder point, the objective function is to reduce the total cost of inventory costs, the cost components used are order cost, shortage cost, purchasing cost, outdate cost, inspection cost, this component is a combination of research [21], [16], [9], the contribution in this study is the inspection cost variable where in the case of Consumable Medical Materials expired products must be burned by high temperature incineration.

Based on eight previous studies related to the research to be carried out, namely on the type of product that is a perishable product, the objective function to reduce inventory costs and the decision variable, namely order quantity, so that the design and solution of this research is the development of a drug inventory model by paying attention to how many optimal drug orders to reduce expired drugs that can cause losses, as well as the total cost of excessive inventory at the Mentawai Islands Hospital. The development of the inventory model is carried out using the EOQ method, where the assumptions used are that purchases are made for five types of goods (multi-items), known material expiration times and are fixed [14]

2. METHOD

2.1. Economic Order Quantity (EOQ)

EOQ (Economic Order Quantity) is an order quantity that can minimize total inventory costs, and optimal purchasing. To find how much total material should be purchased in each purchase to cover the needs for one period. An overview of EOQ is a method that aims to optimize the costs incurred by the company regarding inventory, so that the company can balance ordering costs and storage costs. To achieve this goal, there are several influencing factors.

1. Estimated Usage
   Before inventory purchase activities are carried out, management must estimate the inventory that will be stored for the sales process.
2. Inventory Cost
   Inventory costs must be taken into account, including:
   a) Holding cost: The holding cost per period will increase if the number or amount of materials stored is higher. materials stored are higher. Examples of material maintenance costs, insurance costs, insurance costs, etc.
   b) Ordering: Ordering costs will increase the greater the frequency of ordering. Example of administrative costs
   c) Purchasing costs: Purchase cost is the cost that must be incurred by the hospital to purchase the required product as much as the amount of demand for the product during the year.
   d) Outdating cost: Products that have decreased in value or expired that can no longer be sold, especially in consumable medical products, the cost of expired products in consumable medical materials is equal to the purchase price of the product.
   e) Shortage cost: Shortage costs are expenses incurred by the hospital due to unfulfilled demand for drugs. The hospital implements a backorder policy, that is, when demand is not met, the hospital still allows patients to place orders so that the shortage cost can use the purchase price of consumable medical materials.
   f) Inspection cost: Products that have decreased selling value or expired will be destroyed by high temperature incineration. Where a minimum of 20 medical materials are put into plastic and a maximum of 50 which will then be burned, so that the combustion process occurs thoroughly until it completely becomes dust.
3. Actual Demand
   The use of actual inventory from past periods (actual demand) is one of the factors that need to be considered because it is used to determine actual demand.as one of the basic considerations in inventory procurement for the next period.
4. Lead time
   Lead time is the time required between when an order is placed and when the goods are ready for sale. Order until the goods are ready for sale. Lead time needs to be considered because it is closely related to determining the reorder point. With the right lead time, the company will be able to buy at the right time, so that the risk of inventory buildup can be minimized.

2.2. Research Design

The purpose of the research design is to reduce the total cost of inventory by determining the optimal order quantity, for the stages as shown in Figure 3.

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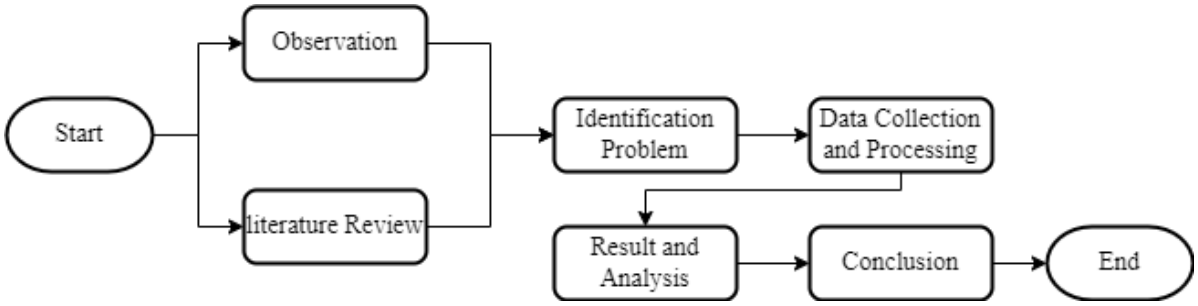

Figure 3 – Stage of Research

1. Literature Review: collect relevant information in accordance with the topic raised, namely supply chain management where the supply chain also discusses inventory policy (inventory management).
2. Observation: obtaining information from secondary data, namely historical data on demand for medical materials in 2022, purchase prices for medical materials, and inventory price components.
3. Problem identification: Identify problems with the data obtained, namely the gap between supply and demand of 83%, so it is necessary to determine the optimal policy to determine the optimal order quantity to determine the optimal inventory cost.
4. Data collection and processing: collect all the data needed to conduct research such as demand data, purchase price data, storage price, order price, shortage price which then the cost component will be calculated Total Cost Inventory, by developing the EOQ model to determine the optimal order quantity
5. Data analysis: data analysis of the results of data processing that has been carried out, by comparing the actual Total Cost of Inventory results with the results of the proposal.
6. Conclusion: conclude the results of the research conducted in accordance with the research objectives, namely to reduce the cost of drug supply at Mentawai Islands Hospital.

2.3. Model Mathematics

To find an inventory model or to determine the optimum quantity (Q*) for drug inventory considering drug expiry times, the first step is to determine the total cost of inventory over the planning horizon. The inventory costs in the developed model include several cost elements, which are as follows:

1. Purchase Cost
   The cost for each quantity of products purchased, the amount of costs incurred depends on how many products are purchased and the unit price:

$$Cp = (pi \times R) \quad (1)$$

Where (Cp) is total purchase cost. (R) is demand, (Pi) is drug price/unit

2. Ordering Cost
   Cost for each quantity of products ordered:

$$Co = \frac{SR}{Q} \quad (2)$$

Where (Co) is total ordering cost, (S) is one time order cost, (R) is demand, (Q) is the number of drugs ordered.

3. Holding cost
   Holding costs are all expenses incurred as a result of storing the product (assuming the product expires immediately unused):

$$Cs = \frac{H(Q^2 - Qkd^2)}{2Q} \quad (3)$$

Where (Cs) is total holding cost, h is holding cost per planning period, (Qkd) number of expired drugs, Q is number of drugs ordered.

4. Shortage cost
   Product shortage costs are the entire costs incurred due to product shortages due to expired products:

$$Ckn = \frac{Ck.Qkd^2}{2Q} \quad (3)$$

Where (Ckn) is total shortage cost, (Ck) is cost of product shortage, (Qkd) is number of expired drugs, Q is number of drugs orders.

5. Drug expiry cost
   Product expiry costs are costs incurred due to expired products:

$$Ckd = Qkd \times J \tag{4}$$

Where (Ckd) is total expiry cost of the drug, J is expiry cost of the drug, (Qkd) is number of expired drugs

6. Inspection cost
   A minimum of 20 expired medical materials are assumed in one box, so the equation is as follows:

$$Ic = Qkd \times i \tag{5}$$

Where (Ic) is total inspection cost of the drug (i), is inspection cost of the drug, (Qkd) is number of expired drugs

Thus, the total cost of inventory during period T is:

$$Tc = (pi \times R) + \frac{SR}{Q} + \frac{h(Q^2 - Qkd^2)}{2Q} + \frac{Ck.Qkd^2}{2Q} + \frac{Pi \times J}{2Q} + Qkd \times i \tag{6}$$

7. Optimal ordering quantity
   To obtain the optimum Q* or optimum ordering quantity, TC is derived against Q and Qkd. The first derivative of TC for Q and Qkd equated to zero is produced:

$$Q* = \sqrt{\frac{2SR + (Qkd^2)(h - Ck)}{h}} \tag{7}$$

8. Expected number of expired products

$$Qkd = \frac{Q.h}{h + Ck} \tag{8}$$

3. RESULT AND DISCUSSION

3.1. Model Verification and Validation

The inventory model that has been obtained is then validated to find out whether the model is true or not. This validation is done by entering the values Qkd = 0 and P1 = P2 = P3 = Pi = P, so that the inventory model from this development will return to the basic EOQ model:

$$Q* = \sqrt{\frac{2SR}{h}} \tag{9}$$

This model can reduce inventory costs by 12% from the initial condition, where the objective function of this study is to reduce inventory costs, taking into account order cost, shortage cost, purchasing cost, outdating cost, holding cost, inspection cost.

3.2. Numerical Examples

To find out the total cost of medical supplies consisting of Sterile Handscoon 7.5/Tro-sensosurge, sterile surgical glove 7.5/2020, Sterile Handscoon No/2020, Supercare Surgical Face Mask/Earloop 3 Ply/2020, Sterile Handscoon 7.0/Tro-sensosurge, sterile surgical glove 7.0/2020, PPE Tcc Wr/Blue/120/2020 as follows:

3.2.1. Actual Calculations

Order cost	: IDR 20.000
Shortage cost	: IDR 174.000
Amount of stock of the drug	: 200 unit
Order frequency	: 1
Number of stockouts	: 0
Unit price	: IDR 174.000
Holding cost	: IDR 14.000/unit/period

Expiry cost : IDR 174.000
The amount of expired drug : 10 unit

Table 3 - Formulation Total Actual Inventory Cost

Cost Component	Formula	Result
Holding cost	$h \times$ Amount of stock of the drug	IDR 2.784.000
Purchasing cost	$pi \times amount\ order$	IDR 34.800.000
Order cost	$S \times order\ frequency$	IDR 20.000
Shortage cost	$Ck \times number\ of\ stockout$	IDR 0
Expiry cost	$Ckd \times amount\ of\ expired\ drug$	IDR 1.740.000
Inspection cost	$ic \times amount\ of\ expired\ drug$	IDR 0
Total inventory cost	$Tc = Os + Ob + Op + Okd + Ok$	IDR 39,343,771.74

Table 3 describes an example of actual total inventory cost. Based on the calculation of the total actual inventory cost (TC) where the cost component consists of purchase costs, storage costs, order costs, expiry costs, inspection cost, shortage costs, so that the actual TC results are Rp. 184,089,782.00. for further results see Table 4.

Table 4 - Total Actual Inventory Costs of five Types of Medical Materials

Types of Medical Materials	Holding Cost	Order Cost	Expired Cost	Purchasing Cost	TC
Sterile Handscoon 7.5	IDR 2,901,800	IDR 20,000.00	IDR-	IDR 36,272,500.00	IDR 39,194,300.00
Sterile Handscoon No/2020	IDR 2,783,983	IDR 20,000.00	IDR 1,740,000	IDR 34799798	IDR 39,343,782.00
Supercare Surgical Face Mask	IDR 3,200,000	IDR 20,000.00	IDR-	IDR 40,000,000.00	IDR 43,220,000.00
Sterile Handscoon 7.0	IDR 2,374,200	IDR 20,000.00	IDR-	IDR 29,677,500.00	IDR 32,071,700.00
BAJUAPD WR/Blue/120/2020	IDR 2,369,893	IDR 20,000.00	IDR-	IDR 29,623,671.00	IDR 32,013,564.00
Total Cost	IDR 13,629,876.00	IDR 100,000.00	IDR 1.740.000	IDR 170,373,469.00	IDR 185,843,346.00

3.2.1. Calculation of Proposals
To find out the application of this newly developed EOQ model, an example calculation will be given in the case of Mentawai Islands Hospital, namely Handscoon Medical Material No Sterile / 2020 as follows:

Annual demand (R) : 190
Lead time (L) : 30 days/365 = 0.082
Order cost (S) : IDR 20.000
Holding cost (h) : IDR 14.000
Shortage cost (Ck) : IDR 174.000
Unit price (pi) : IDR 174.000
Expiry cost (Ckd) : IDR 174.000
Inspection cost (ic) : IDR 5000

Before determining the total cost of inventory, first determine the optimal order quantity Q* using equation (7)

$$Q* = \sqrt{\frac{2SR + (Qkd^2)(h - Ck)}{h}} = \sqrt{\frac{(2 \times IDR\ 20.000 \times 190) + 10(IDR\ 14.000 - IDR\ 174.000)}{IDR\ 14.000}} = 21\ unit$$

After obtaining the optimal ordering quantity value, then calculate the expected amount of expired drug using equation (8)

$$Qkd = \frac{Q \times h}{h + Ck} = \frac{21 \times IDR\ 14.000}{IDR\ 14.000 + IDR174.0000} = 2\ unit$$

Calculates the total cost of inventory consisting of cost components as follows:
Purchase cost using equation (1)

$$Cp = (pi \times R) = (IDR\ 174.000 \times 190) = IDR\ 33.060.000$$

Ordering cost using equation (2)

$$Co = \frac{SR}{Q} = \frac{IDR\ 20.000 \times 190}{21} = IDR\ 180.952$$

Holding cost using equation (3)

$$Cs = \frac{H(Q^2 - Qkd^2)}{2Q} = \frac{IDR\ 14.000(21^2 - 2^2)}{2 \times 21} = IDR\ 145.000$$

Shortage cost using equation (4)

$$Ckn = \frac{Ck.Qkd^2}{2Q} = \frac{IDR\ 174.000 \times 2^2}{2 \times 21} = IDR.16.571$$

Expiry cost using equation (5)

$$Ckd = Qkd \times J = 2 \times IDR\ 174.000 = IDR\ 384.000$$

Inspection cost using equation (6)

$$Ic = Qkd \times i = 0 \times IDR\ 5000 = IDR\ 0$$

Thus, the total cost of proposed inventory by applying the EOQ model that has been developed with equation (7), namely:

$$Tc = (pi \times R) + \frac{SR}{Q} + \frac{h(Q^2 - Qkd^2)}{2Q} + \frac{Ck.Qkd^2}{2Q} + \frac{Pi \times J}{2Q} + ic \times Qkd$$
$$= IDR\ 33.060.000 + IDR\ 180.952 + IDR\ 145.000 + IDR\ 16.571 + IDR\ 384.000 + IDR\ 0 = IDR\ 33.786.523$$

The total cost inventory value of sterile Handscoon medical materials 2020 was IDR 33,450,781. For the results of five medical materials can be seen in Table 5.

Table 5 - Total Proposed Inventory Costs of five Types of Medical Materials

Types of Medical Materials	Holding Cost	Order Cost	Expired Cost	Shortage Cost	Purchasing Cost	TC
Sterile Handscoon 7.5	IDR 150,000	IDR 158,000	IDR 19,785	IDR 2,549	IDR 36,272,500	IDR 36,602,834.00
Sterile Handscoon No/2020	IDR 145,000	IDR 180,952	IDR 384,000	IDR 16,571	IDR 33,060,000.00	IDR 33,786,523.00
Supercare Surgical Face Mask	IDR 134,000	IDR 210,324	IDR 160,000	IDR 29,219	IDR 32,000,000	IDR 32,522,219.00
Sterile Handscoon 7.0	IDR 123,000	IDR 176,551	IDR 19,785	IDR 9,935	IDR 29,677,500	IDR 30,006,771.00
BAJUAPD WR/Blue/120/2020	IDR 120,000	IDR 211,886	IDR 0	IDR 31,061	IDR 29,623,671	IDR 29,986,618.00
Total Cost	IDR 654,000	IDR 1,035,886	IDR 583,000	IDR 89,000	IDR 160,633,479	IDR 162,904,965.00

Table 5 which is the result of the total inventory cost after determining the optimal Q value, the total inventory cost is IDR. 162,904.9g5 with each cost component, namely message costs of IDR. 1,035,886, storage costs of IDR. 654,000, purchase costs of IDR. 160,633,479, expiry costs of IDR. 583,000 and shortfall costs of IDR. 89,000.

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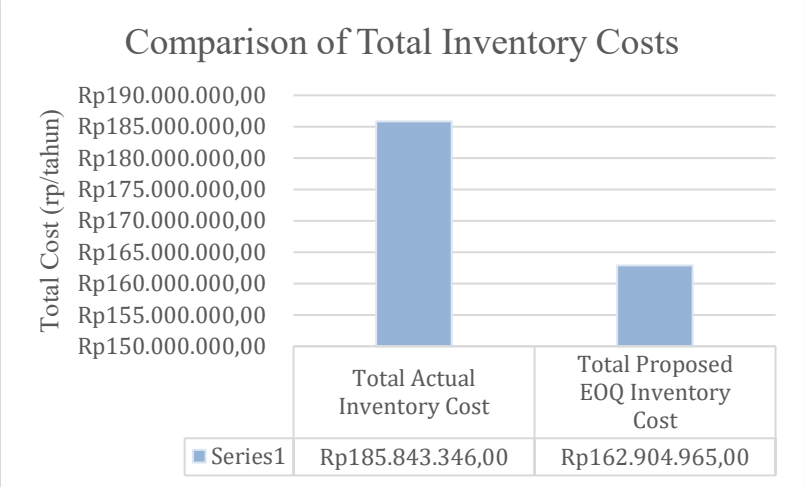

Figure 4 – Comparison of Total Inventory Cost

Figure 4. By using the EOQ model by determining the optimal order quantity, taking into account expiry costs and shortage costs so as to reduce the cost of consumable medical supplies at the Mentawai Islands Hospital where the calculation results show the total inventory cost of IDR. 162,904,965, this inventory cost is smaller than the actual total inventory cost of IDR. 185,843,346.00. The inventory model with EOQ can save 12% of the total inventory cost. As for the explanation of each cost component can be seen in Table 6.

Table 6 - Comparison of Component Cost Inventory

Component Cost Inventory	Actual	EOQ
Total Purchase Cost	IDR 170,373,469.00	IDR 160,633,479
Total Order Cost	IDR 100,000.00	IDR 1,035,886
Total Holding Cost	IDR 13,629,876.00	IDR 654,000
Total Shortage Cost	IDR -	IDR 89,000
Total Expired Cost	IDR 1.740.000	IDR 583,000
Total Inspection cost	IDR 0	IDR 0

Table 5 describes with different product purchase prices for each type of medical material, the total amount of existing purchase costs with the total proposed purchase costs has, decreased by IDR. 9,739,990. The total purchase cost of the proposed conditions has decreased because the inventory policy for the number of purchases of Q with the EOQ method produces the optimal value.

The total cost of ordering medical materials has increased because the results of the calculation of the optimal order quantity have an impact on the frequency of ordering more frequently so as not to store a lot of inventory in the warehouse but all requests are still fulfilled, while in the existing conditions the frequency of ordering is only done once so that more storage is in the warehouse.

The total cost of storing actual conditions is IDR 13,629,876.00, with the results of the total cost of storing using the EOQ method of IDR 1,035,886.00 can save 92% of storage costs. This huge saving occurs because the amount of inventory of the type of medical material to be stored in the proposed conditions is less than the existing conditions.

The total cost of actual condition shortages is Rp. 0 because there is no shortage, after calculating with the EOQ method there is a shortage due to expired products, so the shortage cost is IDR. 89,000.

The total cost of expired actual conditions is Rp. 1,740,000 because in actual conditions there are expired products at the end of the year, while for calculations with EOQ obtained a 66% decrease in expired costs to IDR. 583,000.

4. CONCLUSION

Based on the calculation results using the EOQ method by considering the expiration cost of medical drug types, namely Sterile Handscoon 7.5/Tro-sensosurge, sterile surgical glove 7.5/2020, Sterile Handscoon No/2020, Supercare Surgical Face Mask/Earloop 3 Ply/2020, Sterile Handscoon 7.0/Tro-sensosurge, sterile surgical glove 7.0/2020, PPE Tcc Wr/Blue/120/2020 obtained a decrease in total cost by 12% from actual conditions. Where the inventory cost component consists of message costs, purchase costs, shortage costs, storage costs and expiry costs. The result of the total optimal inventory cost is IDR 162,904,965.

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Disclaimer

The authors whose names are written certify that they have no conflict of interest.

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