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Controlling Vaccine Inventory Using a Reorder Point Approach for Cost Optimization

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ABSTRACT

In the world of health, vaccines are one of the biological products that have a very important role in human immunity because the function of vaccines is to produce immunity against certain diseases. Indonesia has several types of immunization ranging from mandatory immunizations and additional immunizations. For mandatory immunization, it is not difficult to determine the amount of supply, in contrast to additional immunization. In addition to the price which is much more expensive than compulsory immunization, the desire to carry out additional immunization is certainly not as much as compulsory immunization, so it is necessary to manage a proper vaccine supply so that the number of vaccines in the pharmaceutical department is still fulfilled but controlled so that the costs spent are optimal. The approach using Reorder Point is used to find out when is the right time to order the vaccine again so that the number of vaccines ordered is according to need. The data used are data on vaccine demand, vaccine prices, storage costs, and vaccine ordering costs. The results obtained are the total purchases using the Reorder Point for the rotavirus vaccine are 62 and 70 for the hospital and the Hexa vaccine is 61 with Reorder Points and 67 for the hospital. The cost spent on the Hexa vaccine is IDR 58,380,060 and IDR 63,971,000 for the hospital with a difference of IDR 5,590,940. For the rota vaccine, the results obtained are IDR 28,274,948 with Reorder Points and IDR 31,801,500 for hospitals with a difference of IDR 3,585,000. So it can be seen that the use of Reorder Points can control the amount of inventory in the pharmaceutical department so that the number of orders will be more optimal.

1. Introduction

Inventory control is very important to manage. The purpose of supply management is to create a balance between demand and supply. Good inventory management is intended so that consumer needs can be met and avoid inventory vacancies in the warehouse section. In inventory management, there is a lead time, costs arising from ordering, maintenance of goods, and storage space [1].
Vaccines are a special type of drug whose quality is very susceptible to temperature [2], the availability of vaccines greatly affects the coverage of routine immunizations and can be used to identify the influence between demand factors and the health system [3]. Vaccination is one method used to prevent an outbreak of disease [4].
The need for drugs, vaccines, and other medical devices will increase along with the development of a hospital and the biggest cost incurred by the hospital comes from the pharmacy with the development of a hospital [5].

In Indonesia, there are several types of vaccines, namely mandatory vaccines and recommended vaccines. For mandatory vaccines, of course, it is a little easier to see the number of

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requests. The recommended vaccine has a price that is not cheap, different from the mandatory vaccine. The Rotavirus vaccine and the Hexaxim vaccine are examples of the recommended vaccines. For types of vaccines that are not required by the government but are advised to have difficulties in predicting the amount of demand so that supply management is needed with the aim that the number of vaccines available in the pharmaceutical department is continuously fulfilled but under control.

In the supply chain, arrangements are needed to determine how much safety stock is needed to face uncertain demand [6]. The reorder point is a method that can be used to conduct an analysis of inventory control by balancing the amount of supply and demand [7]. The number of vaccine requests recommended by the number of mandatory vaccine requests is very different. So that the wrong amount of vaccine purchases can affect storage space, the costs used to purchase vaccines, and the cost of ordering vaccines. In addition, if the amount of inventory is not managed properly, it will be able to disrupt demand from consumers.

For the estimated average amount of use and avoiding out of stock, safety stock is used as a limit [8], and to control the inventory is done by determining how many safety stocks and to reorder points are based on sales data received by the system [9]. Determination of safe points in ordering vaccines is highly recommended so that it can optimize the costs incurred later by the vaccine. This research is intended to control the amount of vaccine supply by using a reorder point in the inventory control system so that the costs incurred will be optimal. The results obtained in this calculation will later be compared with hospital calculations. So that it will be obtained how much the hospital costs by using manual calculations and calculations using reorder points.

2. Related Work

Control of an inventory has an important role in monitoring the condition of goods. For controlling inventory, it is calculated by minimizing costs in the supply chain. So that the inventory control system can optimize supply chain costs [10]. The calculation of the initial order point is a starting point in determining when is the right time to place an order by taking into account the increase in the manufacture of goods, waiting time, and system costs to maximize efficiency and profit from the system. Additionally to get the batch size taking into account the costs incurred on the system. However, the extension of this study is to obtain the optimal batch size by considering the costs incurred for the system by the safety stock [11].

Order quantity and reorder points are two major challenges in supply chain management. The reorder point as well as the number of orders can increase the overall supply chain advantage with the uncertainty of the number of requests and waiting times [12]. The application of technology into the supply chain in a supply chain management can make an optimal decision regarding the number of refills and reorder points which will be used to minimize the costs used for supplies [13].

In supply management with a supply chain environment with a seasonal amount of demand requires an appropriate selection. The effect of capacity on the number of orders and the reorder point inventory control model has been followed by lead time requests and repeated solutions to obtain optimal solutions regarding the problem of order quantity or reorder point, optimization, and limits on the choice of order quantities and reorder points [14].

In making decisions with uncertainty and the consequences that will occur, all quantitative and qualitative information must be available because the calculations carried out for testing are low in demand so that the results obtained can be used to solve the problem of costs that exist in the supply chain [15].

3. Method

Controlling the number of vaccines can not only affect activities or activities in the pharmaceutical department but also affect the budget to be incurred [16]. The input data process consists of lead time, vaccine demand data, vaccine storage costs per unit, vaccine censorship costs, vaccine price per unit, and quantity of requests. From the data that has been entered, then calculate the safety stock value, Reorder Point, and Economic Order Quantity (EOQ) then the resulting output is the optimal number of vaccine orders. As shown in Figure 1.

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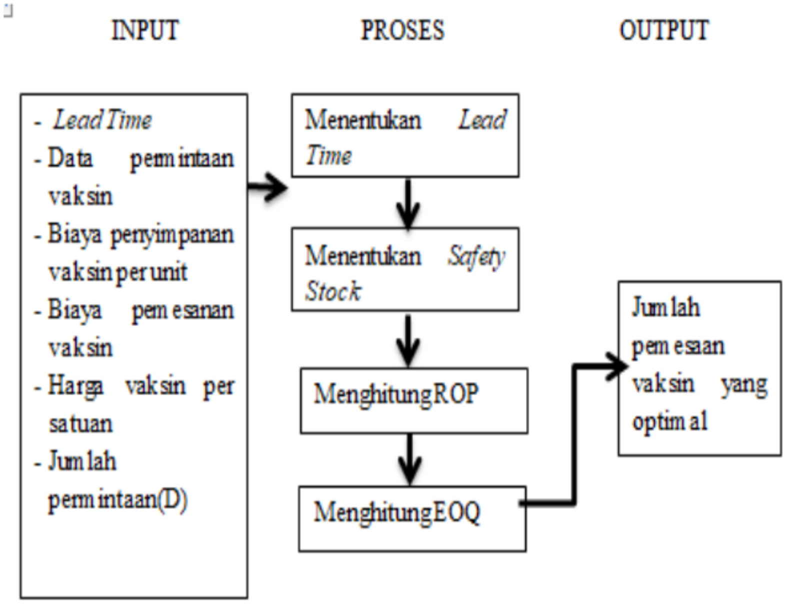

Figure 1. Information Systems Framework

Control of the number of vaccines at the hospital is used so that the number of supplies at the pharmacy department does not experience shortages and excess or lack of stock. So that activities or activities regarding the administration of vaccines at the pharmacy department do not experience a disruption in service to hospital patients. So that the amount of safe inventory can be done by calculating through sales data so that the amount of inventory will be optimal [17].

3.1. Reorder Point

To optimize the costs in the supply chain, an approach is used through the calculation of safe stocks and reorder points so that the amount of inventory and ordering of goods can be controlled properly. Optimization of costs used in the supply chain can be used as a basis for calculating safe stocks and reorder points so that to determine a safe position in the inventory system, a safe stock placement is needed so that it can help or support decision making when ordering goods [9]. The point of reordering an item is an action that must be taken to replenish the inventory [18].

Several factors can affect the reorder point, lead time, level of usage per unit time and safety stock. To calculate the minimum amount for reorder, reorder point assumes that the demand during the waiting time and the waiting time itself is constant. So that the equation used to calculate the reorder point is as in Equation 1.

$$ROP = (d \times L) + SS \quad (1)$$

where ROP is the reorder point, while d is the average demand then multiplied by L, namely the lead time or the time it takes from ordering to the goods until then added to the amount of safety stock.

3.2. Lead Time

Lead time is the time needed between orders and goods that arrive in the warehouse [19], this time appears because when the order is placed it does not automatically exist so it requires a time lag in delivery. The lead time is constant, but the lead time varies to anticipate it, so safety stock is needed.

3.3. Safety Stock

Safety stock (SS) is an additional amount of inventory that is used to avoid inventory void and order lead time. The goal is to protect inventory from several things such as delivery time, types of needs,

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number of shipments, and inventory variations. The equation used to obtain safety stock is like Equation 2 [20]:

$$SS = Z \times \sigma LTD \quad (2)$$

where SS is the safe stock, Z is the service factor and σLTD is the standard deviation. To get the service factor value on the safety stock calculation as in Table 2

Table 2. Normal Distribution Table

Service Level	Servive Factor
50%	0,0
60%	0,3
70%	0,5
80%	08
90%	1,3
93%	1,5
95%	1,6
97%	1,9
98%	2,1
99%	2,3
99,90%	3,1

Meanwhile, to find the standard deviation value, Equation 3 is used as follows:

$$\text{Standard deviation } (\sigma) = \sqrt{\frac{\sum_{i=1}(x_i - x)^2}{n-1}} \quad (3)$$

Where xi is the demand data i, and x is the average demand and n is the amount of data.

3.4. Cost optimization

To find out how much inventory will be ordered, use Equation 4 as follows:

$$EOQ = \sqrt{\frac{2 \times F \times S}{C}} \quad (4)$$

by calculating F, which is the cost of each message times the number of goods needed (S), then dividing the cost for storage (C).

4. Results and Discussion

Data processing is used to process the information that has been obtained and perform data analysis so that the data can be processed and become necessary information for this research.

4.1. Lead Time

Data processing is used For data processing, the first step is to determine the lead time. The lead time required when an order is made to the pharmacy warehouse is 1 day because the pharmaceutical supplier is located in the same city.

4.2. Safety Stock

The calculation of the amount of safe inventory (Safety Stock) for pharmaceutical warehouses is to find the Z value (Service Level) which can be seen in Table 2 and σLTD (standard deviation). The service level placed in the study is 95% meaning that the service level can be placed at 95% and out of stock at 5%. The 95% number is a commonly used probability distribution.

Table 2. Calculation Table Finding Standard Deviation for Rotavirus

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I	Order *i* xi	Average demand (ẋ)	(xi - ẋ)	(xi - ẋ)2
1	0	3	-3	9
2	5	3	2	4
3	1	3	-2	4
4	5	3	2	4
5	4	3	1	1
6	2	3	-1	1
7	0	3	-3	9
8	5	3	2	4
9	3	3	0	0
10	4	3	1	1
:	:	:	:	:
19	1	3	-2	4

From the normal distribution table, the service level is placed at 95% so that the service level is located at 1.6. After getting the service level and service factor values, then we calculate the value of the standard deviation (σ) which is a measure of variation. The value of σLTD is the standard deviation of weekly demand. To calculate the value of the standard deviation there are several steps such as preparing the demand data every week, then calculating the average demand, subtracting the average demand for each data, then squaring and summing all the squared results. So that the data is obtained as in Table 2 which is a calculation looking for the standard deviation for the Rotavirus vaccine. After seeing Table 2 about calculating the standard deviation for the Rotavirus vaccine, the standard deviation value is 2.42.In calculating the standard deviation of the Hexaxim Vaccine, some of the same steps are needed as used in the Rotavirus Vaccine, such as the weekly demand for Hexaxim Vaccine, then the same calculation is done, see Table 3.

Table 3. Calculation of Finding Standard Deviation for Hexaxim Vaccine

I	Order *I* Xi	Average demand (ẋ)	(xi - ẋ)	(xi - ẋ)2
1	0	3	-3	9
2	2	3	-1	1
3	3	3	0	0
4	0	3	-3	9
5	0	3	-3	9
6	6	3	3	9
7	5	3	2	4
8	0	3	-3	9
9	9	3	6	36
10	2	3	-1	1
:	:	:	:	:
19	0	3	-3	9

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So that the value obtained after looking at Table 3 for the standard deviation of the Hexaxim Vaccine is 3.16. After the value for the service factor and standard deviation is obtained, the value of the safety stock for the rotavirus vaccine is 1.6 x 2.442 = 3.87 rounded to 4 and 1.6 x 3.16 = 5 for the Hexaxim vaccine safety stock.

4.3. Average weekly demand

The average demand for vaccines is to add up all the data on demand for vaccines, both Rotavirus and Hexaxim Vaccines. Consider Table 4.

Tabel 4. Data Historis Mingguan Permintaan Vaksin Rotavirus Dan Vaksin Hexaxim

Minggu Ke	Permintaan Vaksin	
	Vaksin Hexaxim	Vaksin Rotavirus
1	0	0
2	2	5
3	3	1
4	0	5
5	0	4
6	6	2
7	5	0
8	0	5
9	9	3
10	2	4
11	2	3
12	8	6
13	6	0
14	0	4
15	3	6
16	0	3
17	7	9
18	7	4
19	0	1
	Σ =60	Σ=65

From the data in Table 4, the calculation results for the average demand for Hexaxim Vaccine are 3.15 and 3.4 for the Rotavirus vaccine. This value is obtained from the number of each vaccine divided by the number of weeks. In this period it is 19 weeks.

4.4. Reorder Point

Order control uses the Reorder Point approach, which is to determine the amount of inventory that will be reordered by looking at how much safety stock is. So to be able to find out how much the reorder point value obtained is 7 for the Hexaxim vaccine and 8 for the rotavirus vaccine the figure is obtained by multiplying the average demand by the waiting time plus the safety stock.

After determining the amount of inventory to reorder, then you can calculate how much the cost optimization will be by calculating the number of vaccine orders to be ordered

4.5. Cost Optimization

The application of the Economic Order Quantity is closely related to the lack of final stock in the inventory, by applying the Economic Order Quantity policy, how much vaccine orders will be obtained.

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This is of course closely related to the cost of the EOQ message so that it can overcome out of stock. By using the equation according to the costs used in Table 5. This table is the type of costs used for calculations, please look at Table 5.

Table 5. Estimated Cost Table for Vaccines

Name	Cost
Cost Order	IDR 1.500,- / ordered
	IDR 19.500,- / month
Cost Safe	IDR 56,612.,- /month
Price Vaccines Rotavirus	IDR 450.000,-
Price Vaccines Hexaxim	IDR 950.000,-

After calculating for cost optimization, the values obtained are 8 for the Hexaxim vaccine and 8 for the Rotavirus vaccine. Both values are obtained by performing calculations using Equation 4.

4.6. Accuracy calculation

The calculation of accuracy is done by comparing the results of calculations from the hospital with the research, so that the results obtained are as shown in Table 6 for the Hexaxim vaccine and Table 7 for the Rotavirus vaccine. Consider Table 6 and Table 7.

Table 6. Comparison of Cost Table between Hospital and Hexaxim Vaccine Research

Conclusion	RS	Research
Purchase Amount	67	61
Vaccine Purchase Costs	IDR 63.650.000	IDR 57.950.000
Save Costs	IDR 210.000	IDR 283.060
Message Fee	IDR 111.000	IDR 147.000
total	IDR 63.971.000	IDR 58.380.060
difference	IDR -	IDR 5.590.940

Table 7. Comparison of Cost Table between Hospital and Rotavirus Vaccine Research

Conclusion	Rumah Sakit	Penelitian
Purchase Amount	70	62
Vaccine Purchase Costs	IDR 31.500.000	IDR 27.900.000
Save Costs	IDR 210.000	IDR 268.448
Message Fee	IDR 91.500	IDR 106.500
total	IDR 31.801.500	IDR 28.274.948
difference	IDR -	IDR 3.526.552

5. Conclusions

By using the approach through Reorder points and Economic Order Quantity, it is possible to determine how much inventory can be re-ordered and how many vaccine orders to ordering so that using these two approaches can reduce the cost of storing, purchasing, and ordering vaccines so as to avoid excess and shortage of supplies.

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7. References

[1] H. S. S. S. Vishavdeep Singh, "Drug Inventory Management of A Pharmacy store by Combined ABS-VED Analysis," International Journal on Mechanical Engineering and Robotics, vol. 3, no. 5, pp. 19-55, 2015.

[2] Q. Z. B. L. Qi Lina, "Cold chain transportation decision in the vaccine supply chain," European Journal of Operational Research, vol. 283, no. 1, pp. 182-195, 2020.

[3] E. S. Y. Emily Gooding, "Impact of vaccine stockouts on immunization coverage in Nigeria," Vaccine, vol. 37, no. 35, pp. 5104-5110, 2019.

[4] W. v. J. R. D. Evelot Duijzera, "The vaccine supply chain," European Journal of Operational Research, vol. 268, no. 1, pp. 174-192, 2018.

[5] J. W. H. S. Peter Kellea, "Pharmaceutical supply chain specifics and inventory solutions for a hospital case," Operations Research for Health Care, vol. 1, no. 2-3, pp. 54-63, 2012.

[6] Y. Boulaksil, "Safety Stock placement in Supply Chains with Demand Forecast Updates," Operations Research Perspective, vol. 3, pp. 27-31, 2016.

[7] S. E. P. R. Chandandeep S. Grewal, "Dynamic reorder point replenishment strategies for a capacitated supply chain with seasonal demand," Computers & Industrial Engineering, vol. 80, pp. 97-110, 2014.

[8] M. F. I. J. J.M. Maestre, "An application of economic model predictive control to inventory management in hospitals," Control Engineering Practice journal, vol. 71, pp. 120-128, 2018.

[9] M. M. S. Aldena Dona Sabila, "Inventory Control System by Using Vendor Managed Inventory (VMI)," in E3S Web of Conferences, Semarang, 2018.

[10] M. R. R. I. Devi Ajeng Efrilianda, "Inventory Control Systems with Safety Stock and Reorder Point Approach," in International Conference on Information and Communications Technology (ICOIACT), 2018.

[11] A. H. A. S. L. E. C.-B. Amir Hossein Nobil, "Reorder point for the EOQ inventory model with imperfect quality items," Ain Shams Engineering Journal, 2020.

[12] J. H. I. S. Kamal Chaharsooghi, "Supply chain coordination for the joint determination of order quantity and reorder point using credit option," European Journal of Operational Research, vol. 204, no. 1, pp. 86-95, 2010.

[13] S. L. K. M. K. Y. A. Pan, "Optimal reorder decision-making in the agent-based apparel supply chain," Expert Systems with Applications, vol. 36, no. 4, pp. 8571-8581, 2009.

[14] C.-H. Wang, "Some remarks on an optimal order quantity and reorder point when supply and demand are uncertain," Computers & Industrial Engineering, vol. 58, no. 4, pp. 809-813, 2010.

[15] V. L. B. S. Valery Lukinskiy, "Control of inventory dynamics: A survey of special cases for

ISSN 2502-3357 (Online)
ISSN 2503-0477 (Print)

products with low demand," Annual Reviews in Control, vol. 49, pp. 306-320, 2020.

[16] M. Lenny Margaretta Huizen, "Inventory Control System for Vaccines Distribution With Model Predictive Control In Hospital," in E3S Web of Conferences, Semarang, 2018.

[17] K. Funaki, "Strategic safety stock placement in supply chain design with due-date based demand," Intern. Journal of Production Economics, vol. 135, no. 1, pp. 4-13, 2012.

[18] J. Heizer, B. Render and C. Munson, Operations management : Sustainability and Supply Chain Management, Boston: Person Education, 2017.

[19] O. H. Sandra transchel, "Supply Planning and Inventory Control of Perishable Products Under Lead-Time Uncertainty and Service Level Constraints," in International Conference on Production Research Manufacturing Innovation:, Chicago, 2019.

[20] A. C. RĂDĂŞANU, "Inventory management, Service Level and Safety Stock," Journal of Public Administration, no. 9, pp. 145-153, 2016.

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---

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---

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