

The Implementation of Continuous Review System Method on Blood Inventory Control at Indonesian Red Cross Jember

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Abstract: Blood plays a very important role in the human body. Unfortunately, when the Covid-19 pandemic began to strike, the level of demand for blood soared dramatically so it was not uncommon for shortages to occur. This study aims to determine and analyze how the application of the continuous review system method in creating an optimal blood inventory system at the Indonesian Red Cross (Palang Merah Indonesia, as known as PMI) which is located at Jember Regency. This study is using descriptive quantitative research and action research models. The main focus of this study will be put on the inventory section for whole blood bags for each blood type. The data used in this study are qualitative and quantitative data and came from primary and secondary data. Data was collected through literature studies and direct interviews with PMI Jember and will be analyzed using the continuous review system method. The results showed that: 1) PMI Jember had an average lead time of 3.4 days to replenish the blood inventory. 2) Safety stock for blood type A is 14, blood type B is 19, blood type AB is 8, and blood type O is 29. 3) Reorder point for blood type A is 16, blood type B is 21, blood type AB is 8, and blood type O is 32.4) The maximum capacity for blood type A is 150, blood type B is 210, blood type AB is 60, and blood type O is 240.

Keywords: Blood, Continuous Review System, Lead Time, Reorder Point, Safety Stock.

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I. Introduction

Blood is an important thing of the human body to transport oxygen and carbon dioxide, circulate food juices, attack bacteria, and regulate body temperature¹. The adult human body carries around 4.5 - 5.5 liters of blood. Thus, when we're facing a lack of blood, our bodies will immediately feel the effects². Given the importance of the role of blood, blood will always be needed in every field, especially on the medical side. Blood donation is indispensable in the medical world aimed at patients in the recovery process through blood transfusions, for example, patients with special diseases, accidents, and even pregnant women³. Talking about the need for blood, the hospital does not work alone. There is a party that helps in fulfilling the blood donation, namely the Indonesian Red Cross (Palang Merah Indonesia, as known as PMI).

The Indonesian Red Cross (PMI) is a national organization that carries out the main task of the red cross and becomes an organization that plays an active role in the social and humanitarian field⁴. The establishment of PMI is based on a goal, where one of the PMI's strategic objectives for the 2019-2024 period aims to increase the availability of the stock of blood in a safe, qualified, and evenly distributed throughout Indonesia⁵. During the process of fulfilling these tasks, especially to control the management in each region, PMI has a special unit called the Blood Donor Unit (Unit Donor Darah, as known as UDD).

UDD is an important part of PMI to control the movement of blood supplies in each region, where one of them is UDD PMI in Jember Regency. This unit plays an important role in managing the availability of blood in the Jember area by bringing a vision in the form of blood needs being met, where the fulfillment of blood is safe, precise, and fast⁶. Unfortunately, PMI Jember is often faced with uncertain demand problems that bring them to stockout. In the long run, this problem has been able to be overcome through the high public interest in donating blood. This is shown by the number of donor agencies in the Jember Regency that collaborates with PMI Jember. However, this thing is still not able to meet the overall demand for blood from the patients⁷. The Regent of Jember, H. Hendy Siswanto, said that the blood supply at PMI Jember, especially during the Covid-19 pandemic, was in very limited conditions⁸. During the restrictions on community activities that are enforced during the Covid-19 pandemic, the stock of blood at PMI Jember has automatically decreased by around 20-30%⁹.

Based on the problems, PMI Jember's inventory management needs to be managed properly so that the blood supply does not face such a limitation or even stockout. Based on the pattern of blood demand and receipt that has occurred, it is necessary to analyze which blood types have a high level of demand but often experience

obstacles in the fulfillment process. It is also necessary to analyze the inventory method to get an idea of how much and when to fulfill the stock of blood when the supply has run out, especially for items that have a high critical level. One method that can be applied is the continuous review system method, where this method serves to provide an overview of how many orders would be called "optimal" when the number of requests that occur is uncertain¹⁰. One of the previous studies that were able to prove that the continuous review system was able to produce an optimal amount of blood supply and time was a research conducted on blood supplies at PMI Pekanbaru³. Through this research, it is known that PMI obtains inventory cost savings of around Rp. 75,000 or equivalent to 56% per bag of blood³. Then, PMI can also estimate when the right time to fulfill the stock of blood again, as well as how much safety stock is needed while the blood fulfillment process is still ongoing. Therefore, the application of a continuous review system is considered to support improving blood supply management through information on how much safety stock must be owned, and when the right time for PMI Jember to refill the stock of blood is. Thus, this study will analyze how the implementation of the continuous review system method can control the blood inventory at PMI Jember to be more optimal.

II. Material And Methods

Research Design

This study is using quantitative descriptive research, where this study explains how to increase the optimal level of blood inventory control at PMI Jember by analyzing it using the continuous review system method. This study is also using action research by contributing directly to the field through 4 stages of research, consisting of problem identification, data collection, data analysis and interpretation, and action planning¹¹.

Research Object

The object of this study is the whole blood supply for each blood type. This study will be conducted at PMI Jember Regency, specifically in the Blood Donation Unit (Unit Donor Darah/UDD).

Source of Data

The data in this study came from primary and secondary data. Primary data was obtained from direct interviews with UDD PMI Jember as the party who knows the information, patterns, as well as schemes in the inventory control system that has been implemented so far. The secondary data were obtained through a literature study, which consisted of data on the maximum number of requests, acceptance, lead times, as well as the frequency of blood draw for whole blood at UDD PMI Jember during 2021.

Data Analysis Method

The data analysis process is carried out quantitatively with the continuous review system method. The process of data analysis involves data related to the amount of demand, acceptance, lead time, and frequency of blood draw at PMI Jember during 2021. The continuous review system method will go through 4 stages¹⁰, including:

1. Lead Time Analysis

In this study, the lead time itself was analyzed through the duration of the blood's fulfillment process obtained from data related to the interval time between blood draws was started until it ends.

2. Safety Stock Analysis

Safety stock analysis was carried out to find out how much reserve stock needed to be prepared while PMI Jember was still doing a blood draw routine. Safety stock can be analyzed by determining the service level that is adjusted to the value in the normal distribution table, and then multiplied by the standard deviation of the demand for blood bags, as well as the lead time¹².

3. Reorder Point Analysis

Reorder point was carried out to find out when PMI Jember needs to do a blood draw again when the blood bag supply is almost out of stock. The reorder point can be determined by multiplying the average demand by the lead time and continuing by adding up with the safety stock¹².

4. Maximum Inventory Analysis

In every blood draw, PMI Jember has exclusive storage to put each blood bag before distribution, which has a specific limit regarding how many blood bags can be accommodated.

III. Result

Data of Whole Blood Bag Request in 2021

Table 1: Whole Blood Bag Request in 2021
(Numbers are Counted in Units of Bag)

Month	Blood Type			
	A	B	AB	O
January	17	13	5	31
February	12	16	2	10
March	16	15	2	20
April	16	17	1	41
May	9	28	9	26
June	16	27	1	8
July	11	18	1	18
August	12	7	1	18
September	18	22	2	21
October	22	19	1	30
November	19	23	5	29
December	5	27	1	31
Total	173	232	31	283
Average	14.417	19.34	2.584	23.584

Source: PMI Jember’s Secondary Data, 2021

The results in Table 1 clearly show that blood type O has the highest demand among all the blood types. Besides that, blood type AB has the lowest demand. However, this should not be underestimated since getting the AB blood type is also difficult because only a few people are having this blood type as well.

Data of Whole Blood Bag Acceptance in 2021

Table 2: Whole Blood Bag Acceptance in 2021
(Numbers are Counted in Units of Bag)

Month	Blood Type			
	A	B	AB	O
January	18	31	2	37
February	8	6	3	7
March	10	4	1	13
April	6	16	1	30
May	8	24	8	17
June	15	16	0	7
July	6	13	4	15
August	14	17	2	22
September	17	20	2	15
October	19	15	1	29
November	12	18	6	17
December	6	18	4	24
Total	139	198	34	233
Average	11,584	16,5	2,84	19,4171

Source: PMI Jember’s Secondary Data, 2021

The results in Table 2 clearly show that blood type O has the highest rate of acceptance among all the blood types and received around 233 blood bags (38.5% out of all blood bags’ acceptance in 2021). Besides that, blood type AB has the lowest rate of acceptance among all the blood types and received only around 34 blood bags (5.63% out of all blood bags’ acceptance in 2021).

Frequency of Whole Blood Draw in 2021

Table 3: Frequency of Whole Blood Draw in 2021
(Numbers are Counted in Units of Time)

Blood Type	Frequency
A	47
B	66
AB	11
O	78
Total	202

Source: PMI Jember's Secondary Data, 2021

The results in Table 3 clearly show that the highest frequency rate of blood draw is blood type O, which is around 78 times a year. It was affected by the high demand from people who need blood bags for blood type O. Meanwhile, blood type AB has the lowest frequency rate of blood drawing, which is only around 11 times a year.

Interval Time for Blood Draw in 2021 (Lead Time)

Table 4: Lead Time in 2021
(Numbers are Counted in Units of Day)

Month	Lead Time
January	4.5
February	3.625
March	3.6
April	2.9
May	3.584
June	3
July	5.142
August	2.647
September	3.692
October	3.045
November	2.791
December	2.533

Source: PMI Jember's Secondary Data, 2021

The results in Table 4 clearly show that the shortest lead time occurred in December, which is around 2.5 days. Meanwhile, the longest lead time occurred in July, which is around 5.1 days. On average, the lead time in 2021 is around 3.4 days.

Safety Stock Analysis Results

Table 5: Safety Stock Analysis Results
(Numbers are Counted in Units of Bag)

Blood Type	Safety Stock
A	14
B	19
AB	8
O	29

Source: Data Processing Results, 2022

Table 5 shows that the safety stock analysis result for blood type A is 14 blood bags, blood type B is 19 blood bags, blood type AB is 8 blood bags, and blood type O is 29 blood bags.

Reorder Point Analysis Results

Table 6: Reorder Point Analysis Results
(Numbers are Counted in Units of Bag)

Blood Type	Reorder Point
A	16

B	21
AB	8
O	32

Source: Data Processing Results, 2022

Table 6 shows that the reorder point analysis results for blood type A is 16 blood bags, blood type B is 21 blood bags, blood type AB is 8 blood bags, and blood type O is 32 blood bags.

Maximum Quantity Analysis Results

**Table 7: Maximum Quantity Analysis Results
(Numbers are Counted in Units of Bag)**

Blood Type	Maximum Quantity
A	150
B	210
AB	60
O	240

Source: Data Processing Results, 2022

Table 7 shows that the maximum quantity of blood type A is 150 blood bags, blood type B is 210 blood bags, blood type AB is 60 blood bags, and blood type O is 240 blood bags.

IV. Discussion

Blood Supply System at UDD PMI Jember

The uncertain number of requests and acceptance of blood bags is a phenomenon that will always be faced by UDD PMI Jember. To overcome this problem, UDD PMI Jember applied a fairly simple blood inventory system, which is the FIFO (First In First Out) method, where if there are blood bags that are received first, then that blood bags will be distributed first to meet the demand.

Before the distribution process is carried out, the blood that has been received from the donor must pass a screening process to ensure whether the blood is still in good condition for distribution. Through this screening test, the blood needs to be tested whether there are bacteria or viruses in it that can potentially transmit disease to the recipient. For the qualified blood, it needs to be stored in a blood bank at a temperature of 2⁰-6⁰ celsius with a maximum shelf life of 35 days. If the blood exceeds the maximum shelf life, then the blood becomes expired and is categorized as damaged blood.

The high demand for blood is affecting the rapid flow of the blood supply itself. The method that has been applied by UDD PMI Jember is very appropriate to do to minimizing the amount of expired blood. Unfortunately, UDD PMI Jember does not have a specific calculation to control how much safety stock needs to be prepared, as well as when a reorder point needs to do. In this case, the FIFO application itself is not enough to be applied in dealing with the demand for blood which is running uncertainly.

The Implementation of the Continuous Review System Method on the Blood Supply of UDD PMI Jember

The continuous review system method is used in reviewing inventory that occurs continuously so that stockout would not occur¹⁰. Based on the analysis result, it is known that the average lead time for UDD PMI Jember while doing blood draw during 2021 spent 3.4 days. It means that UDD PMI Jember needs 3.4 days to replenish the blood supply until the blood obtained is ready and suitable for distribution.

During the process of refilling the blood supply, there is still a chance for UDD PMI Jember on receiving a demand for blood bags that may come in at the same time. Therefore, UDD PMI Jember needs to have reserved supplies that can be used to meet demand during the lead time period. Based on the safety stock analysis, it was found that the highest amount of safety stock belongs to blood type O, which is around 29 blood bags. It means that during the lead time process, UDD PMI Jember needs to prepare a reserve supply of 29 blood bags only for bloodtype O, which can be used to meet demand when UDD is in the process of replenishing the blood stocks. Besides that, blood type B has a safety stock of 19 blood bags, where blood type B is the blood type with the second-highest demand after blood type O. Meanwhile, the safety stock required for blood type A is 14 blood bags. Then, safety stock for blood type AB only requires around 8 blood bags. It is because blood type AB is the blood type with the lowest level of demand. However, blood type AB is also a rare blood type which affects the small acceptance rate as well. So, regardless of whether the demand for blood type AB is high or not, it is still important for blood type AB to have a safety stock that needs to be prepared to meet the demand during the lead time period.

Based on the data analysis, it was also found the reorder point needed for UDD PMI Jember in scheduling the blood drawing program. It is known that the reorder point for blood type A is 16 blood bags.It

means that when the blood bag supply for blood type A has reached 16 blood bags, then the UDD PMI Jember must find a donor to replenish supplies for blood type A which is almost facing stockout. As for blood type B, the UDD PMI Jember is obliged to do a blood draw when it reaches 21 blood bags. Meanwhile, blood type AB can do a blood draw again when there are 8 blood bags left. Meanwhile, blood type O, which is the blood type with the highest demand, has a reorder point of 32 blood bags. Therefore, even though there are still 32 blood bags left for O blood bags, UDD PMI Jember has had to do a blood draw to the donor group to deal with the high incoming demand. If the reorder point is well-known, the blood drawing process is going to be more scheduled. Thus, the lead time period itself will also become more constant.

It didn't stop at the safety stock and reorder point, the process will be continued with further methods that need to be applied to make the scheduling of the blood drawing program becomes more systematic. Two bin system is a method that can be implemented by UDD PMI Jember in controlling the inventory. Through this method, the inventory system will be divided into two bins, where the first bin is only filled with blood bags according to the amount of reorder points. Meanwhile, if the blood supply in the second bin has run out, UDD PMI Jember can immediately be doing the blood draw process. During the lead time period, the first bin which contains blood bags according to the amount of reorder point can be used to fulfill the incoming requests while waiting for the second bin to be fulfilled again. By taking into the continuous review system's assumption which said that if the conditions for the requests and acceptance numbers of blood bags are running constantly, accompanied by the lead time that is also running constantly, then it will encourage the application of this method becomes more optimal, where the supply of blood bags becomes easier to monitor, easier to control, as well as being able to minimize the possibility of stockout or expiration.

V. Conclusion

UDD PMI Jember still applies a quite simple method in controlling blood supply, which is FIFO (First In First Out) method. This method is very appropriate to be applied in minimizing the possibility for the blood bag that ends in expiration. However, the method does not consider how much safety stock needs to be prepared, and when is the right time for UDD PMI Jember to do a blood draw process.

The application of the continuous review system method is a method that can be implemented if the number of requests is uncertain. Based on the analysis results, the blood bag supply system at UDD PMI Jember becomes more optimal and more controlled through the information related to the amount of safety stock and reorder points needed. In addition, the implementation of the two-bin system is also needed to improve the blood draw scheduling process carried out by UDD PMI Jember.

VI. Limitation

This study only analyzes what is the best method that can be applied to control the supply of blood bags, but does not pay attention to costs due to confidential reasons from the company, so these costs cannot be included in the data analysis process.

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