Blood Bag Request Tracking Application: a Case Study of PMI Surabaya

by Andreas Handojo

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Abstract. Blood is an important thing in the human body, if lack of blood can be fatal and even cause death. If a person lacks blood, it can be helped by doing a blood transfusion from someone else. The government and the Red Cross conducted a blood donation process to meet this need. Hospitals and people who need blood bags can submit a request to the Red Cross. The submission of this request is done by filling out a paper form or by telephone, there is still no application that supports submitting an online request. This is very necessary considering the speed of service to requests for blood bags is very necessary, considering this is related to a person's life. This study tries to develop a prototype application that provides an online blood bag request service so that the blood bag requester can monitor whether the request is accepted, rejected (not available), or is in the process of being sent, and so on. From testing on potential users, a total score of 3.60 was obtained (from a maximum value of 4). So it can be concluded that this application prototype is needed to be developed on the existing problems.

INTRODUCTION

Blood donation service is one form of health service that cannot be replaced. Where until now no method has been found to create blood. So the need for blood must be obtained from other people's blood donors. Blood donation is generally done for humanitarian purposes and not for commercial purposes. Indonesian Government Regulation Number 91 year 2015 [1] concerning Blood Services states that the organization of blood donation and blood processing is carried out by the Blood Transfusion Unit (UTD). UTD is organized by a social organization with the main tasks and functions in terms of the Red Cross or in this case the Indonesian Red Cross (PMI). PMI continues to campaign for blood donation as part of the community's lifestyle. Every year, PMI targets up to 4.5 million bags of blood in accordance with national blood needs, adjusted to the standards of the World Health Organization (WHO), which is 2% of the population [2].

Until 2012, PMI had established 1 UTD Central in Jakarta and 211 UTD in 210 Cities [3] spread throughout Indonesia. Blood donation services carried out by UTD PMI include the mobilization and preservation of donors, blood collection, processing of blood components, infection screening tests, storage and distribution of blood to the Hospital Blood Bank (BDRS). BDRS parties, other UTDs, and individuals can request blood bags. Currently, the Indonesian Red Cross has an information system for recording donors, requests for blood bags from BDRS and personal needs (with a doctor's request letter).

Unfortunately, the information system for requesting blood bags from BDRS, from other UTDs as well as personal needs is still in paper form and requests by telephone. This causes the length of the request process, fulfillment, and data collection of the request. Whereas the speed of service to meet the needs of blood bags is very important, considering this is related to a person's life. Currently there is no application that can make requests for blood bag needs online so that it can accelerate request services. Based on information obtained from an initial survey of the

needs of both PMI officers and hospital staff, information was obtained that the lack of an online blood bag request mechanism was quite difficult to speed up the health services provided to patients in need, especially in emergency conditions.

This study tries to develop a prototype of an online blood bag request system from BDRS, other UTDs, as well as personal needs. Through this prototype, it is hoped that it can improve the service of requesting blood bags quickly and efficiently. In addition, this application is also intended to help PMI and requesters to track requests for blood bags submitted. So that each party can check whether the request will be fulfilled, whether it has been sent, whether it is rejected or not available. With this system, it is hoped that the demand and fulfillment process can run more quickly and efficiently. This research is more focused on applied research to answer the needs of the demand and supply process, especially in the case of demand for blood bags. As a pilot project, this application takes case examples and is tested on PMI UTD Surabaya with the target of internal users from UTD. In order to maintain confidentiality, all data that appears in the application is not real data.

LITERATURE REVIEW

Blood is a very important part of the human body. If a person loses a certain amount of blood, it can be fatal and even cause death. Until now, the mechanism and science that can be done to produce blood other than the blood produced by humans have not been found [4]. So the only thing that can be done to overcome the need for blood is to do blood transfusions from other people. In order to obtain the blood, blood donation activities are carried out. In this activity someone donates blood which is then stored in a blood bag. In general, blood donation is given voluntarily without any reward.

Blood donation activities in Indonesia are managed by the Indonesian Red Cross (PMI) and the Government through the Indonesian Ministry of Health, namely at Hospital Blood Banks (BDRS) such as national and regional hospitals [3]. According to the WHO report in 2016, blood transfusion centers in Indonesia totaled 211 units managed by PMI and 164 units managed by the government [2]. Meanwhile, according to a report from the Ministry of Health of the Republic of Indonesia in 2019 [3], Indonesia has had 420 units of blood transfusion (220 units managed by PMI and 200 managed by the government) distributed to 34 provinces (Fig. 1). Considering that Indonesia is an archipelagic country, the adequacy and distribution of blood transfusion centers is a challenge.

In terms of the number of blood bags obtained, Indonesia needs 5.1 million blood bags/year, which is 2% of the total population of Indonesia which is approximately 255 million people (World Health Organization - WHO standards). Meanwhile, Indonesia is only able to obtain 4.1 million blood bags/year [5]. So there are only 16 blood bags available per year per 1000 people. This causes a high rate of death due to lack of blood. For example, 28% of deaths in childbirth are caused by lack of blood. This of course can be prevented by providing sufficient blood reserves [6].

From the research side, research on supply and demand factors in terms of humanity has been very widespread, such as in the case of natural disasters. Existing research includes not only the need for food and equipment needed [7], [8], [9] but also to the need for blood bags [10], [11]. From supply and demand research, the research's try to develop the worst case scenario, minimize the total response time and total operational costs through simulation and through existing methods such as Mixed Integer Linear Programming, Goal Programming and others. There is still a lack of research that tries to develop a supply and demand model for the need for blood bags, considering PMI facilitates the public to donate blood through the Blood Transfusion Unit (UTD) located in certain locations in cities in Indonesia. PMI also provides blood donation activities in the form of special cars/buses that are routinely located at certain locations to facilitate people who will donate blood. In addition, blood donation activities are also intensively carried out by PMI such as on campuses and religious places, government offices, as well as at special events. Currently, information on blood donation activities can be viewed on the official PMI central website. The selection of the location where the blood is drawn, usually chooses crowded places that are often visited by the public. In addition, the community can also submit a request to carry out blood donation activities at a certain location with predetermined conditions. There is currently no in-depth study of the location selection. Often blood donation activities are not effective so that they do not get the expected number of donors.

No	Provinsi	Jumlah UTD		
		Pemerintah/ Pemerintah Daerah	Palang Merah Indonesia (PMI)	Jumlah
(1)	(2)	(3)	(4)	(5)
1	Aceh	15	4	19
2	Sumatera Utara	17	8	25
3	Sumatera Barat	12	4	16
4	Riau	8	5	13
5	Jambi	8	1	9
6	Sumatera Selatan	11	5	16
7	Bengkulu	6	3	9
8	Lampung	4	7	11
9	Kepulauan Bangka Belitung	5	3	8
10	Kepulauan Riau	2	3	5
11	DKI Jakarta	1	2	3
12	Jawa Barat	2	23	25
13	Jawa Tengah	0	36	36
14	DI Yogyakarta	1	5	6
15	Jawa Timur	2	37	39
16	Banten	0	7	7
17	Bali	0	10	10
18	Nusa Tenggara Barat	4	3	7
19	Nusa Tenggara Timur	8	4	12
20	Kalimantan Barat	8	4	12
21	Kalimantan Tengah	10	3	13
22	Kalimantan Selatan	9	3	12
23	Kalimantan Timur	1	7	8
24	Kalimantan Utara	1	3	4
25	Sulawesi Utara	2	5	7
26	Sulawesi Tengah	7	5	12
27	Sulawesi Selatan	13	6	19
28	Sulawesi Tenggara	6	2	8
29	Gorontalo	3	2	5
30	Sulawesi Barat	3	2	5
31	Maluku	9	1	10
32	Maluku Utara	7	1	8
33	Papua Barat	7	2	9
34	Papua	8	4	12
	Indonesia	200	220	420

FIGURE 1. Number of Blood Transfusion Units in 2018 by Province and Operator [3]

IMPLEMENTATION

The existing application will be equipped with a dashboard view of the current blood supply (Fig. 2). This view will complement existing applications. This display will make it easier for PMI to monitor the availability of existing blood bags.
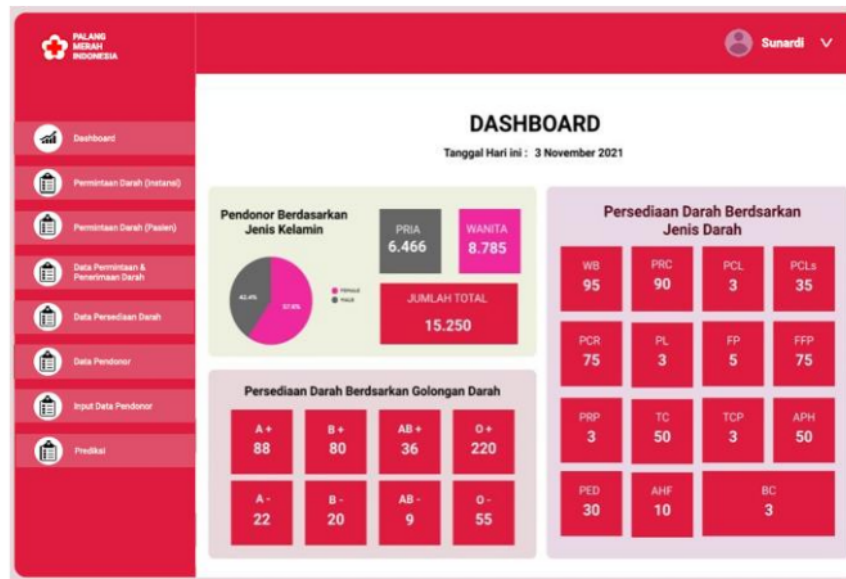
FIGURE 2. UTD Blood Availability Dashboard

Each BDRS and other UTDs can request a blood bag through online application (Fig. 3). Generally, BDRS and other UTDs enter a sufficient number of blood bag requests for a particular request date. This is possible because BDRS and other UTDs have storage media for blood bags that are suitable with regulations. For personal needs requests, the request can be entered by the patient's doctor or BDRS or Hospital (Fig. 3). The inputted request data will also state the patient's illness or information concerning the need for blood reserves, for example for the patient's surgery.

FIGURE 3. Blood Request from BDRS or Others UTD

FIGURE 4. Blood Request for Personal Needs Requests

PMI will be able to monitor incoming requests (as shown in Fig. 5). From this data, PMI then determines which requests can be fulfilled (accepted), which requests cannot be fulfilled (rejected), which requests are sent (delivery in progress), which requests have been received by the requester (received), which request was canceled by the requester (cancelled). Fulfillment of requests sometimes cannot be fully fulfilled given the possibility that the number of blood bags for the request is not available (for example, rare blood types such as AB with rhesus negative). If the supply of blood bags is not available, the patient is advised to immediately find a donor (usually from family or friends).

FIGURE 5. Blood Bags Request and Fulfillment List on UTD

The blood bag requesting party can monitor the requests that have been submitted through the application. Whether the request is accepted, rejected, is being sent, and so on (Fig. 6). This will make it easier for the requesting party to monitor the clarity of the status of the submitted blood bag request. If there is a cancellation of the request, the requesting party will fill out the cancellation form along with the reason (for example, the patient already passed away so the blood bag request is canceled).

FIGURE 6. Blood Bags Request Tracking Status on BDRS or Others UTD

As a test of the research results in the form of a prototype application that has been made, testing is carried out on prospective users at PMI (IT staff & Logistics staff). After testing, prospective users are then asked to fill in a numerical value on the questionnaire sheet with a value range of 1 (worst) and 4 (best) on assessment factors such as the user interface of the application, information available on the application, usefulness and effectiveness from the application. From the results of the questionnaire as shown in Table 1, it can be concluded that the application prototype received a positive response (with overall value 3.60). In term of appearance (user interface), usability, and effectiveness of the application, the score is quite high, namely 3.80, so it can be concluded that this application is expected to be developed for future needs. Meanwhile, the information provided is still lacking in detail (scores 3.00).

Some inputs from respondents are that the information provided is felt to be lacking and less comprehensive. For example, respondents expect more detailed information from each blood bag that is given/sent and more detailed information on the health screening status of each blood bag. In addition, users expect an application that can provide tracking information for each blood bag to track production process batches, blood collection process batches, health screening process batches, and others. This tracking information is needed to carry out a blood bag withdrawal (if needed), for example a batch of a production process has a processing failure. With this information, it is hoped that the quality of the blood bag processing process can be improved. This additional feature will try to be added in the next research.

TABLE 1. Application Testing on Prospective Users

	User Interface	Available Information	Usefulness	Effectiveness	Average/Person
IT Head	4	3	4	4	3.75
IT Staff 1	4	3	3	4	3.5
IT Staff 2	4	3	4	3	3.5
Logistic Staff 1	4	3	4	4	3.75
Logistic Staff 2	3	3	4	4	3.5
Average/Aspect	3.80	3.00	3.80	3.80	3.60

CONCLUSION

Blood is one of the important things in the human body, if a person lacks blood it will be fatal and can even cause death. Current human technology has not been able to create blood that can replace the blood of the human body, so the need for blood must be met by the blood of others. The government and the Red Cross are tasked with meeting this blood need through blood donation activities. The blood obtained is then managed to produce blood bags that are ready to be given to those in need. The party who needs the blood bag (BDRS, other UTD, individual) can make a request for the blood bag. Unfortunately, until now requests for blood bags have to be submitted via a request form and by telephone. There is no application that can provide online blood bag request services.

This study tries to make an application prototype that makes it easy for users to submit requests for blood bags online. This application is also equipped with a tracking system for the submitted request. With this system, the blood bag requesting party can find out whether the condition of the submitted request can be accepted, rejected, or is in the process of being sent. With this up-to-date information, it is hoped that the process of giving blood transfusions can be smooth and can be followed up immediately. This is very important, considering this can have an impact on the safety of someone's life.

The results of the application prototype have been carried out through trials on prospective PMI users. From these tests, it can be concluded that the application made obtained a positive value with a total value of 3.60 (out of a maximum value of 4). From the input from respondents to the development of this application, it was obtained that it was hoped that there would be additional information, especially in terms of tracking information on existing blood bags. Starting from batch information from the production process, batch information from the blood drawing process, and others. This is considered important in withdrawing the blood bag (if needed) when a defect is found in a process.

In order to develop the results of this research, the application prototype needs to be tested on events in the field. Of course, this trial requires broad involvement of other parties such as the BDRS, other UTDs, as well as individuals who need blood bags. Increased effectiveness can also be done by using the latest technology such as the use of RFID to speed up the process of collecting blood bags in the storage and distribution process.

ACKNOWLEDGMENTS

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