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Turnaround time for the provision of packed red cells (PRC) and factors affecting their achievements in the Blood Transfusion Unit of Dr. Sardjito General Hospital, Yogyakarta

Surawijaya Bakhtiar Kaslam*, Usi Sukorini, Teguh Triyono

Departement of Clinical Pathology, Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada/ Dr. Sardjito General Hospital, Yogyakarta, Indonesia

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ABSTRACT

Turnaround time (TAT) is defined as the time it takes since request/sample is received at the blood bank until blood is cross-matched/reserved and available for transfusion. Turnround time prolongation affects patient care and satisfaction. This study aimed to evaluate TAT for the provision of packed red cells (PRC) at the Blood Transfusion Unit of Dr. Sardjito General Hospital, Yogyakarta, analyze factors affected in TAT prolongation, and provide solution the prolongation. It was an analytical descriptive study with a qualitative design, by calculating the time since receipt of the PRC request at the Blood Transfusion Unit or since blood collection from donors until data input of the crossmatch results in Dr. Sardjito General Hospital management information system (SIMETRIS) completed. Moreover, the delay in the provision of PRC at the Blood Transfusion Unit was also analyzed. There were 3 (1.5%) of 200 ER samples that met TAT for the provision of the PRC, which was 30 min after receipt of the request at the Blood Transfusion Unit in cito conditions. There were 20 (10%) of 200 samples from the wards that met TAT for the provision of the PRC, which was 2 h after receipt of the request at the Blood Transfusion Unit if the blood stock was available. There were 55 (27.5%) of 200 samples from the wards that met TAT for the provision of the PRC, which was 4 h after the blood was collected from the donor. TAT for the provision of the PRC at the Blood Transfusion for the available blood stock group was 179.08 (67.2 – 396.27) min, replacement blood donor group was 485.38 (126.43 – 910.68) min, and cito group was 121.29 (27.68 – 421.38) min. In conclusion, there is TAT prolongation of PRC provision at the Blood Transfusion Unit of Dr. Sardjito General Hospital.

ABSTRAK

Turnaround time (TAT) didefinisikan sebagai waktu yang dibutuhkan dari saat permintaan/sampel diterima di Bank Darah sampai darah dilakukan uji silang serasi/dicadangkan dan tersedia untuk transfusi. Pemanjangan TAT pada layanan pemeriksaan laboratorium dan Bank Darah mempengaruhi perawatan pasien serta kepuasan pasien. Penelitian ini bertujuan untuk mengetahui TAT penyediaan PRC di Unit Pelayanan Transfusi Darah (UPTD) RSUP Dr. Sardjito, Yogyakarta dan menganalisis faktor yang berperan dalam pemanjangan TAT, dan memberikan solusi permasalahan jika terjadi pemanjangan TAT. Penelitian ini merupakan penelitian deskriptif analitik dengan desain kualitatif, dengan menghitung waktu sejak penerimaan permintaan PRC di UPTD atau sejak pengambilan darah dari donor sampai pemasukan data hasil uji silang serasi di SIMETRIS selesai. Selain itu juga dianalisis jika terjadi keterlambatan penyediaan PRC di UPTD. Terdapat 3 (1,5%) sampel dari 200 sampel IGD yang memenuhi TAT penyediaan PRC yaitu 30 menit sejak SPKD diterima di UPTD pada kondisi *cito*. Didapatkan 20 (10%) sampel dari 200 sampel ruang rawat yang memenuhi TAT penyediaan PRC yaitu 2 jam sejak penerimaan SPKD di UPTD apabila tersedia stok darah. Didapatkan 55 (27,5%) sampel dari 200 sampel ruang rawat yang memenuhi TAT penyediaan PRC yaitu 4 jam sejak pengambilan darah dari donor. *Turnaround time* penyediaan PRC di UPTD RSUP Dr. Sardjito untuk kelompok stok darah tersedia adalah 179,08 (67,2 – 396,27) menit, kelompok donor darah pengganti 485,38 (126,43 – 910,68) menit, kelompok *cito* 121,29 (27,68 – 421,38) menit. Dapat disimpulkan, terdapat pemanjangan TAT penyediaan PRC di UPTD RSUP Dr. Sardjito.

Keywords:
turnaround time;
prolongation;
provision;
packed red cells;
blood transfusion unit

*corresponding author: zoera_ku2000@yahoo.com

INTRODUCTION

Turnaround time (TAT) is a crucial quality indicator in clinical laboratories. Timely blood supply is crucial for efficient and satisfactory laboratory services, especially during emergency operations.[1] Turnaround time is one of the 10 blood bank quality indicators. Turnaround time is defined as the time it takes from the time the request/sample is received at the blood bank until the blood is crossmatched/reserved and available for transfusion. Blood banks are required to set upper limits for routine and emergency requests separately.[2] The TAT prolongation of blood banking services affects patient care and patient satisfaction.[3] Studies reported that blood transfusion improves survival only if given immediately when needed.[4]

In terms of the definitions of TAT, a point to note is the different TAT definitions, e.g. from time of reception of a request to time at which the blood unit was handed over to the attender for transporting it to bedside, from time of request to when packed red cells (PRC) exited the blood bank, or from receipt of specimens/order in the transfusion service until units are available for issue (routine 8 h, ASAP 4 h, and STAT 2 h).[5] Because the condition of patients served in transfusion is different from routine laboratory services, the quality of service and the quality of analytics must be considered together and equally crucial. From the clinician's point of view, timely receipt of required blood units can be the most crucial performance indicator of a blood bank. In case of emergency services, a delay of just a few min in blood availability can make an overall difference. It indicates that monitoring and correcting TAT is highly recommended and beneficial for transfusion services.[2]

Regular monitoring of quality indicators including TAT in transfusion improves patient safety and customer satisfaction. The first step to reducing TAT towards the desired goal is to find out the variations of TAT for different services, products, and schedules. It is also necessary to identify the cause of the delay in TAT and take corrective action to eliminate it. The cause with the greatest effect should be addressed first, given the limited time, effort, and resources to deal with all the problems at once.[6] Root cause analysis (RCA) is a method by which researchers try to identify the underlying cause of the error or problem that caused the incident and try to correct or overcome it.[7-9]

Based on the standard operating procedure (SOP) at the Blood Transfusion Unit of Dr. Sardjito General Hospital, Yogyakarta, blood is ready to be collected within 2 h from the time of receipt of the blood components get requested if the blood stock is available. Meanwhile, if the blood still has to be collected from the donor, it is ready within 4 h. In cito conditions, the Blood Transfusion Unit must prepare blood within 30 min immediately after getting requested blood components.

From the results of interviews with internal medicine residents and nurses at the Inpatient Installation I, Dr. Sardjito General Hospital (Dahlia 1, Dahlia 2, Bugenvil 3), received information on complaints that there is often a delay in the availability of the PRC units requested, especially for cancer patients who will undergo chemotherapy protocols. To handle these complaints, the Blood Transfusion Unit must try its best to resolve the problems complained in order to maintain the trust of clinicians and the good image of the Blood Transfusion Unit itself. Complaints should be considered as indicator of agency performance appraisal, signaling some problems or failures in internal processes that require prompt resolution.[10]

MATERIALS AND METHODS

Design of study

This was a descriptive-analytic study with a qualitative design, by calculating the time since the receipt of the PRC request at the Blood Transfusion Unit (available blood stock group and cito group) or from the time of taking blood from the donor (replacement blood donor group) until the data input from the crossmatch results at SIMETRIS (Dr. Sardjito General Hospital management information system) is complete, as well as analyzing if there is a delay in the provision of PRC in Blood Transfusion Unit using Ishikawa diagrams/fish-bone analysis. This study was conducted at the Blood Transfusion Unit of Dr. Sardjito General Hospital. The time of study was carried out starting in September 2021.

Procedure

The study subjects were patients with a request for a PRC unit at the Blood Transfusion Unit of Dr. Sardjito General Hospital who met the inclusion and exclusion criteria. The inclusion criteria were all hospitalized adult patients who received PRC transfusions. The Exclusion criteria were patients who received a request for delayed PRC transfusion and patients who did not receive the first PRC from the number of PRC units requested.

Data on requests for PRC units from the Anggrek (Neuro), Bugenvil (Obsgyn), Cendana (Surgery), Dahlia (Internal Medicine), Pavilion, Intensive, Maternal wards, and Emergency Room as well as data on the provision of PRC units at the Blood Transfusion Unit of Dr. Sardjito General Hospital was taken from SIMETRIS during the period from February to May 2021. Observations and in-depth interviews were carried out with 10 blood transfusion technical officers at the Blood Transfusion Unit of Dr. Sardjito General Hospital to determine the factors that affect the TAT. The transcription and coding process was carried out from interview data.[11] The prolongation of the TAT will be evaluated by root case analysis (RCA) using Ishikawa diagrams/ fishbone analysis and solutions will be taken to solve the problems that occur.

This study used ethical clearance issued by the Medical and Health Research Ethics Committee (MHREC), Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada/ Dr. Sardjito General Hospital (Ref. No. KE/ FK/1027/EC/2021).

Data analysis

Data was presented in the mean and standard deviation (SD) if the data were considered as normal or median and the minimum-maximum value if the data were not normal. The normality of the data was carried out using the Kolmogorov-Smirnov test. Data analysis using Medcalc software version 13. Analysis and discussion of the results displayed using Ishikawa Diagram/ fishbone analysis.[12]

RESULTS

A total of 7821 PRC requests were received at the Blood Transfusion Unit of Dr. Sardjito General Hospital, Yogyakarta for the period of February to May 2021 and obtained 4132 PRC requests at the Blood Transfusion Unit of Dr. Sardjito General Hospital which met the inclusion and exclusion criteria. Based on the estimated proportion for the calculation of the sample size, a minimum sample size of 200 samples for each group was obtained according to the SOP of Dr. Sardjito General Hospital (available blood stock group, replacement blood donor group, and cito group).[13]

The characteristics of the subjects are presented in TABLE 1. The subjects in the available blood stock group and the replacement blood donor group were at

most > 60 y.o. (31% and 25%), while in the cito group, most subjects were 18-30 y.o. (29%). Female subjects were found to be dominant in the 3 groups, i.e. 63, 57, and 52% for the available blood stock group, the replacement blood donor group, and the cito group, respectively. The majority of subjects from the available blood stock group (45.5%), the replacement blood donor group (36.5%), and the cito group (44.5%) were blood type O. Two PRC units were requested by 62 (31%) subjects in the available blood stock group while 3 PRC units were requested by 63 (31.5%) subjects in the replacement blood donor group and 87 (43.5%) subjects in the cito group.

From the available blood stock group, the replacement blood donor group, and the cito group, the length of time from each ward was calculated from the time the PRC request was received at the Blood Transfusion Unit or from the time the blood was collected from the donor until the data input of the crossmatch results at SIMETRIS was completed, and analysis of the prolongation of the TAT for the provision of PRC in Blood Transfusion Unit was carried out.

TABLE 1. Characteristics of study subjects

Parameter	Available blood stock group (n=200)	Replacement blood donor group (n=200)	Cito group (n=200)
Age [years, n (%)]			
• 18-30	49 (24.5)	47 (23.5)	58 (29)
• 31-40	18 (9)	31 (15.5)	31 (15.5)
• 41-50	31 (15.5)	32 (16)	26 (13)
• 51-60	40 (20)	40 (20)	39 (19.5)
• > 60	62 (31)	50 (25)	46 (23)
Sex [n (%)]			
• Male	74 (37)	86 (43)	96 (48)
• Female	126 (63)	114 (57)	104 (52)
Blood type [n (%)]			
• A	34 (17)	39 (19.5)	43 (21.5)
• B	62 (31)	70 (35)	58 (29)
• AB	13 (6.5)	18 (9)	10 (5)
• O	91 (45.5)	73 (36.5)	89 (44.5)
Number of requests for PRC units [n (%)]			
• 1	52 (26)	21 (10.5)	6 (3)
• 2	62 (31)	58 (29)	36 (18)
• 3	46 (23)	63 (31.5)	87 (43.5)
• 4	16 (8)	11 (5.5)	24 (12)
• ≥ 5	24 (12)	47 (23.5)	47 (23.5)

Length of time for the provision of PRC

The total length of time since receiving the PRC request at the Blood Transfusion Unit or from the time of taking blood from the donor until the data input of the crossmatch results at SIMETRIS was completed for the period of February to May 2021 (TABLE 2). In the available blood stock group, the shortest time was found in the intensive ward [176.85 (77.28 – 344.42) min]. In the replacement blood donor group, the shortest period was found in the Pavilion ward [(374.23 (137.12 – 895.57)] min. In the cito group taken from the ER, the period was 121.29 (27.68 – 421.38) min. There were 3 (1.5%) samples of 200 ER samples that met the TAT for the provision of PRC according to the SOP, which was 30 min since the blood components requests were received at the Blood Transfusion Unit in cito condition.

TABLE 3 describes the minimum and maximum time for the wards from the time the PRC request was received at the Blood Transfusion Unit until the data input of the crossmatch results at SIMETRIS was completed during the period February-May 2021. There were 20 (10%) samples of 200 samples from the wards (2 samples from Bugenvil, 2 samples from Cendana, 3 samples from Dahlia, 4 samples from the Pavilion, and 9 samples from the Intensive) that met the TAT for the provision of PRC according to the SOP, which is 2 h from receiving the blood components requests at the Blood Transfusion Unit if the blood stock is available.

TABLE 4 presents the minimum and maximum time for the wards from the time of blood collection from the donor until the data input of the crossmatch results at SIMETRIS was completed for the period of February to May 2021. There were 55 samples (27.5%) of 200 samples from the wards (2 samples from Anggrek, 15 samples from Bugenvil, 11 samples from Cendana, 5 samples from Dahlia, 12 samples from Pavilion, 8 samples from Intensive, and 2 samples from Maternal) that met the TAT for the provision of PRC according to SOP, namely 4 h from the time of blood collection from the donor.

TABLE 2. The total length of time since receiving the PRC request at the Blood Transfusion Unit or since the blood collection from the donor until the data input of the crossmatch results at SIMETRIS was completed (in min) for the period of February to May 2021

Wards	Mean ± SD/median (min-max) (in min)		
	Available blood stock group (n=200)	Replacement blood donor group (n=200)	Cito group (n=200)
Anggrek (Neuro)	180.32 ± 41	525.42 ± 237.33	
Bugenvil (Obsgyn)	178.12 (67.2 – 337.17)	451.06 (126.43 – 894.78)	
Cendana (Surgery)	197.11 ± 66.67	592.25 (129.58 – 910.68)	
Dahlia (Internal Medicine)	198.62 ± 71.99	458.07 ± 234	
Pavilion	198.55 ± 73.6	374.23 (137.12 – 895.57)	
Intensive	176.85 (77.28 – 344.42)	377.22 (126.75 – 907.28)	
Maternal	228.48 ± 81.01	405.59 ± 218.65	
Emergency room			121.29 (27.68 – 421.38)

TABLE 3. The minimum and maximum time for the wards from the receipt of the PRC request at the Blood Transfusion Unit until the data input of the crossmatch results at SIMETRIS was completed (in min) during the period February-May 2021

Wards	Available blood stock group (n=200)			
	Frequency n (%)	Minimum time (min)	Maximum time (min)	TAT achievement n (%)
Anggrek (Neuro)	12 (6)	134.28	283.08	0 (0)
Bugenvil (Obsgyn)	32 (16)	67.2	337.17	2 (6.25)
Cendana (Surgery)	35 (17.5)	70.3	308.22	2 (5.71)
Dahlia (Internal medicine)	23 (6.5)	76.93	339.47	3 (13.04)
Pavilion	36 (18)	72.12	396.27	4 (11.11)
Intensive	56 (28)	77.28	344.42	9 (16.07)
Maternal	6 (3)	133.33	339.52	0 (0)

TABLE 4. The minimum and maximum time for the wards from the time of blood collection from the donor until the data input of the crossmatch results at SIMETRIS was completed (in min) for the period of February to May 2021.

Wards	Replacement blood donor group (n=200)			
	Frequency n (%)	Minimum time (min)	Maximum time (min)	TAT achievement n (%)
Anggrek (Neuro)	15 (7.5)	141.77	864.78	2 (13.33)
Bugenvil (Obsgyn)	44 (22)	126.43	894.78	15 (34.09)
Cendana (Surgery)	55 (27.5)	129.58	910.68	11 (20)
Dahlia (Internal medicine)	19 (9.5)	168.5	865.05	5 (26.32)
Pavilion	33 (16.5)	137.12	895.57	12 (36.36)
Intensive	29 (14.5)	126.75	907.28	8 (27.59)
Maternal	5 (2.5)	141.83	654.32	2 (40)

From the results of this study, it was found that most of the prolongation of the TAT in the provision of PRC between wards was from the available blood stock group, the replacement blood donor group, and the cito group. Based on the SOP at the Blood Transfusion Unit of Dr. Sardjito General Hospital, blood is ready to be collected within 2 h from the time of receipt of the blood components requests at the Blood Transfusion Unit if the blood stock is available, whereas if the blood still has to be taken from the donor, the blood is ready to be collected within 4 h from the blood collection from the donor. In cito conditions, the Blood Transfusion Unit must prepare blood within 30 min of receiving the blood components requests at the Blood Transfusion Unit.

Analysis of TAT prolongation of PRC provision

Before doing the troubleshooting, the first step that must be done is to identify

the cause of the problem. The problem that will be identified as the cause is the prolongation of the TAT for the provision of PRC in the Blood Transfusion Unit of Dr. Sardjito General Hospital. An analysis using Ishikawa Diagram was carried out to identify the cause of the problem with the approach of human resources (man), process flow (method), blood requests (material), instruments/tools (machine), samples (measurement), and blood products (milliue).

Human resources

Human resources are the main factors related to the timeliness of providing PRC at the Blood Transfusion Unit of Dr. Sardjito General Hospital, it is necessary to have an appropriate number of human resources based on workload analysis in order to not cause excessive workloads that can trigger a prolongation of the TAT. The workload analysis conducted at the Blood Transfusion Unit of Dr. Sardjito General Hospital in September 2021, obtained the number of personnel needed which was 43 blood transfusion technical personnel. The current workforce is 20 people which means there is still a shortage of 23 people.

Based on interviews conducted with 10 blood transfusion technical officers at the Blood Transfusion Unit of Dr. Sardjito General Hospital, who represented the 5 existing departments (distribution, serology, AFTAP, components and testing, and release), the problem of staff shortages became the main issue that emerged. The lack of a number of officers in each department causes the work to be carried out not optimally, such as the following interview: "If it's enough or not, it depends on what parameters we want to pursue. For example, a job must be finished, then it can be finished. But if the work must be completed in a faster time, then this is not achieved. Because if one person does multiple works at the same time he/she will need a pause or break. Thus, from the completion of the work, its effectiveness, around 70-80% of the blood from AFTAP can be processed and examined, but the time will be a bit backward than if we do each part." (Interview 02, components and testing).

In the process of taking blood from donors, the lack of staff also slows down the system, especially the night shift where there is only 1 person while the work is carried out concurrently alone. This can be seen from the following quote: "In the morning and evening shifts, there is 1 blood drawing officer and 1 hemoglobin checking officer. But in practice the admin helps check hemoglobin and there is a doctor who takes a history of the donor, so that 2 officers can focus on taking blood. On the night shift, there is only 1 officer who does everything himself: donor history, hemoglobin and blood pressure checks, blood collection." (Interview 10, AFTAP)

The incoming blood request and the requested blood collection are the responsibility of the distribution department. This department is the one that most often interacts with doctors, nurses, or families of patients who need blood. In the morning and evening shifts the number of officers is 2-3 people, while on the night shift is only 1 person on duty. The lack of human resources will increase the workload of officers and it will affect the quality of the service. A high workload will cause the timeliness of completing work to be low, as illustrated in the following quote: "In the morning and evening shifts, there are 3 people/shift: 1 operator, 1 admin, 1 technician. On Sunday mornings and evenings there are only 1 operator and 1 technician. Meanwhile, on the night shift, there is only 1 technician. The ideal number of employees is 3 people/shift both morning, afternoon, and evening shifts. The operator is in charge of answering calls from the ward and administering whatever is requested on the phone, for

example asking for blood stocks, etc. The admin is in charge of inputting the blood flask data using SIMETRIS. Technicians do checking blood type, processing of warming blood products and checking blood product labels. The new input is done when the distribution process is free for several patients at once, it can be for 10-20 patients at once. As for input, the distribution process is carried out directly every time blood is released from Blood Transfusion Unit." (Interview 06, distribution).

The serology department is the last filter before the blood is collected. The lack of staff is also a problem in the serology department because there are many stages of the process that must be carried out for a crossmatch examination in serology until the blood can be collected. "It's not enough, the problem is that 1 shift must only have 1 person. One person prepares a sample, prepares the blood that you want to crossmatch, later you have to write a label, then for example there are not enough people in front of us who will take blood sometimes, prepare our own blood, it takes too long to look for samples. Especially if you are on night shift, night shift is the most you crossmatch the sample. It's not enough, because there must be only 1 person in 1 shift. One person prepares a sample, prepares blood for crossmatch, writes a label. If there are not enough people in the distribution department, we will also collect blood, prepare blood, and look for samples. Especially if we work on the night shift, we do most of the crossmatch samples." (Interview 03, serology).

Process flow

The blood supply process at the Blood Transfusion Unit starts from the time the blood components requests are received until the blood can be collected at the distribution department. The blood components requests and samples received will then be checked for blood type and get inputted on the computer. The patient data will also be written in the blood request book and grouped by wards. The blood is ready to be collected if the blood stock has been checked and a crossmatch test is carried out in the serology department. Based on the results of the interview, it was still found that the communication system was not yet integrated between the Blood Transfusion Unit and the ward. The ward expects the blood to be processed after the blood components requests are received at the Blood Transfusion Unit, while the Blood Transfusion Unit expects confirmation from the ward for the timing of the use of blood before the blood is processed. "If there is a request from the ward for a patient who has a transfusion, we usually wait for confirmation from the ward, unless there is already a note, for example, how many hemoglobin or platelet levels are in the blood request, we usually sort it from there. If the hemoglobin level is 4 or 5, we usually process it immediately, or if the platelets are below 10,000 or low, we usually process it right away. So we are the ones who sort the blood request ourselves." (Interview 04, distribution).

In the case of a request for emergency blood, information from the distribution department will be directly forwarded to the serology department for crossmatch test before the blood is issued. This condition requires immediate treatment in order that crossmatch test is prioritized, bypassing the queue for crossmatch tests at the serology department. Based on the results of the interviews, obtained several categories of emergencies according to the distribution. "If the hemoglobin level is below 7 or the platelet level is below 50,000, we usually process it immediately. The Operating Room patient for sure. For example, someone takes blood from the Operating Room, and someone takes blood from the ward, we still prioritize those from the Operating Room. Emergency Room

too. In the ER, especially if it is confirmed immediately or if there is a note in the blood request, we will process it immediately because those from the ER, as soon as they know the laboratory results, will immediately confirm it too. That's a maximum of 30 min later the blood can come out for emergency cases like that." (Interview 04, distribution)

If the blood stock for the patient is not available at the Blood Transfusion Unit, the patient's family is recommended to find a donor or take blood at the PMI. The donor process starts with inputting donor data to SIMETRIS, checking hemoglobin and blood type, history taking, checking blood pressure, inputting data to the AFTAP computer, and taking blood. The blood that has been taken will then be processed in the component and testing department. One blood bag will be separated from the blood components, namely PRC, TC, and plasma, then the plasma will be frozen for the manufacture of FFP. After the process of separating blood components is complete, all blood components will be taken to the release department. At the same time, the EDTA sample received from the AFTAP department will be processed at the IMLTD department for screening for Hepatitis B, Hepatitis C, HIV, and syphilis. The release department will assess the feasibility and volume of the blood product as well as assess the results of the screening from the IMLTD department before determining whether the blood product can be removed. If the blood comes from a voluntary donor, then the blood product will go into the stock refrigerator, while if it is a replacement donor, the release department will look for the patient's blood components' requests first before putting the blood product into the patient's stock refrigerator. The large number of donors at the same time is a factor that prolongs the TAT of blood supply, as in the following interview: "Yes, we also work according to this flow. If it's crowded here, it must be delayed, the blood centrifugation is delayed, the result is delayed, so it takes a long time to get to the release. Depending on the intensity of the work, it's a lot or not." (Interview 05, release)

Blood requests

The blood components requests sent to the Blood Transfusion Unit are requests for blood components from a clinician that must be accompanied by the completeness of the patient's identity, doctor, and indication of transfusion. Indications of transfusion and hemoglobin information that are not filled in the blood components requests cause the Blood Transfusion Unit not to prioritize the blood request, therefore the Blood Transfusion Unit must wait for confirmation from the ward regarding when the transfusion will be performed. The wrong check on the requested blood component also causes the Blood Transfusion Unit to confirm it first to the inpatient ward before processing the blood. This can lead to a prolongation of the TAT of blood supply at the Blood Transfusion Unit. "Sometimes the blood request has a wrong tick, someone ask for PRP, it's a bit unusual. Usually, the blood request is often wrong, so later we confirm to the ward, what they want to ask is PRC or really PRP." (Interview 04, distribution)

Dr. Sardjito General Hospital is currently developing a blood request through a work order system, which is expected to speed up the process of requesting blood from the Blood Transfusion Unit. The obstacle that is still being faced is that the staff in the ward still sends blood components requests and samples to the Blood Transfusion Unit even though the blood request has been inputted in the work order, thus causing duplication of blood requests. There is still a weakness in this work order system, namely the absence of

notifications in the SIMETRIS system, causing the Blood Transfusion Unit to still have to wait for information from the ward if the ward has entered work orders and the amount of blood stock that is ready to be collected can only appear on the work order if it has been crossmatched, there are still many doctors/nurses who ask for blood stocks by telephone or come directly to the Blood Transfusion Unit.

Instruments/tools

The type of tool and maintenance of the tool will affect the process and the results carried out, which means the knowledge of the tools used and routine tool maintenance is needed, considering that the tools have the potential to be damaged. All departments at the Blood Transfusion Unit have instruments/tools, each of which has specifications and a routine maintenance schedule, either by the equipment vendor or from the IPSRS (*Instalasi Pemeliharaan Sarana Rumah Sakit*/Hospital Facility Maintenance Installation). Overall routine maintenance has been going well, whether daily, weekly, or monthly. The equipment vendors and the IPSRS are also easy to contact, and they can deal with damaged equipment immediately.

There are only a few cases of severe equipment damage that cause service interruptions, for example as described in the following quote: "Once. It happened recently. So the damage to the device is more than 24 h, resulting in blood cannot be released. All pending. We are trying too, usually we have rapid test backups, but that time is running out too. Usually if there is damage to the device for more than 24 h, we use a rapid test." (Interview 02, components and testing)

In addition to specific equipment, problematic telephone, computers, and the SIMETRIS network system can also hinder work at the Blood Transfusion Unit, resulting in delays in blood supply. Only 1 computer was placed in the distribution department, while the computer was used to input requests for entry and input blood output from the Blood Transfusion Unit, causing distribution officers to not work in parallel.

Samples

The patient's blood sample is sent to the EDTA tube together with the blood components requests, which will be used by the Blood Transfusion Unit for crossmatch and blood type examination. The input process at SIMETRIS will be carried out by the distribution department after checking the condition of the sample and checking the blood type. There are several problems with the sample that can prolong the blood supply process. "Sample without identity, identity on sample and request does not match, sample does not use EDTA tube, sample lysis, etc. If there is this problem then the sample and request are returned, not inputted first." (Interview 06, distribution)

With the transition from a manual blood request letter to a work order, it can be used to propose an installation of pneumatic tube system for transporting patient samples from the ward to the Blood Transfusion Unit. Therefore, the samples do not need to be taken to the Blood Transfusion Unit, which will shorten the service time for blood requests.

Blood products

To meet the need for blood stock, every morning the release department will look for blood products that are not used through the SIMETRIS system or telephone for confirmation to the ward. If the stock of blood and blood that cannot be used are inadequate (<10/blood type, except for AB <5/blood type),

the Blood Transfusion Unit will ask the PMI Kotagede and the PMI Sleman to drop ± 20 bags/blood type. In addition to routine stock, the Blood Transfusion Unit is also required to provide an emergency stock of at least 10 bags/blood type. The cause of the delay in providing blood products in the release department is if the family already has a donor, but after checking the request letter has run out and there is no new one, or the request letter has not yet been delivered from the ward, therefore it must be confirmed and wait again.

The release department is the department for the latest blood check at the Blood Transfusion Unit. If a problematic blood product is found, it must be re-checked which can have an impact on the time of supplying blood products, such as the following interview: "Yes, determining whether blood is worthy or not. If it's not appropriate, we won't accept it, hold on, then we'll usually trace where the error is. If it's from AFTAP, we'll fix it again, we'll keep track of it, later if we need to re-screen, we'll re-screen, we ask the IMLTD (*infeksi menular lewat transfusi darah*/ infection transmitted by blood transfusion) department to re-screen using a hose, so we don't use the sample tube." (Interview 05, release).

Reactive blood products from the results of the transfusion-transmitted infections examination will be re-screened using a blood bag tube, if the results remain reactive, the blood will be discarded and the donor status in AFTAP is blocked, for further scheduling of donor consultations at the Blood Transfusion Unit. Apart from asking for blood droppings from the PMI, another way to fulfill blood needs at the Blood Transfusion Unit is by conducting Mobile Unit activities. This method is quite effective in meeting the need for blood stock at the Blood Transfusion Unit, as explained in the following interview: "Yes, it must be Mobile Unit. With the previous Mobile Unit, it has helped to reduce the dropping. At least we must get 30 bags of blood. Yesterday we got about 26 bags of blood in the Nursing Study Program. If we have a large Mobile Unit, we can get 100 bags of blood." (Interview 05, release)

DISCUSSION

The Blood Transfusion Unit is a unit that is responsible to ensure the availability of blood for patients in need. The importance of blood availability at the Blood Transfusion Unit requires always maintaining the amount and quality of available blood to meet the need for blood transfusions. As a unit engaged in the service sector, service quality is a measure of how well the level of service provided is able to meet customer expectations.[14] The intended customer is a clinician who expects a timely blood supply. An effective problem-solving strategy involves carrying out planned activities, which can be summarized in three main steps: responding to and receiving complaints, resolving complaints, and sending feedback to customers.[10]

There was a shortage of 23 technical personnel for blood transfusion at the Blood Transfusion Unit of Dr. Sardjito General Hospital based on the workload analysis carried out. Workload analysis is a management technique that is carried out systematically to obtain information about the level of effectiveness and efficiency of an organization's work based on the volume of work. One way to calculate HR requirements is to use workload analysis with the health workload analysis method.[15]

The procurement of employees is a crucial, difficult, and complex issue, because it is used to find and place competent, compatible, and effective people. The procurement of employees requires serious attention, and is based on job analysis, job descriptions, job

specifications, and job evaluations.[16]

The lacking of officers cause the distribution of the number of officers in each department to be not ideal which is not possible to divide the officers per shift with the appropriate number and causes one department to be filled by officers from the other departments. The most workload at the Blood Transfusion Unit is on the night shift, while the duty officer is only 1 person per division which will slow down the workflow and the TAT for blood supply. With the condition of the number of human resources that is not yet ideal, the flexibility of the Blood Transfusion Unit officers is needed to be able to meet the patient's requests. Flexibility is related to the organization's ability to adapt to change.[17]

In the method factor, the thing that causes the length of the TAT for blood supply is the communication system that has not been integrated between the Blood Transfusion Unit and the ward. The ward expects the blood to be processed immediately after the blood components requests are received at the Blood Transfusion Unit, while the Blood Transfusion Unit expects confirmation of the timing of the use of blood from the ward before the blood is processed. The large number of donors at the same time is also a factor that prolongs the TAT of blood supply. Because the process of supplying blood is a flow that is interconnected between parts, delays in one part will have an effect on other parts as well. Quality patient care can only be provided if there is a combination of various disciplines working together in a unified team.[18]

The data input process in SIMETRIS which is accumulated is also a separate obstacle at the Blood Transfusion Unit. Ideally, the data input process is carried out every time the inspection is finished, but the data input process at the Blood Transfusion Unit waits for the officers to be free, especially if there is an emergency request. In conditions of emergency blood demand, the crossmatch test takes precedence, passing through the queue for the crossmatch tests at the serology department, which then the data input process will be carried out simultaneously for several patients after the officers have completed all the crossmatch examinations.

Regarding material factors, the completeness and accuracy of filling out the blood components requests, especially indications for transfusion, information on hemoglobin, and requested blood components, the Blood Transfusion Unit still has to confirm first to the inpatient ward before processing blood. The incompleteness of filling in the blood components requests is similar to the study of Ramanathan, Shaiji, and Usha which is one of the most common causes (19 cases) of prolongation of the TAT 1-5 min for emergency blood supply.[6]

The implementation of the work order system, which is expected to speed up the process of requesting blood to the Blood Transfusion Unit, has not been implemented by all wards, and there are still duplication of manual blood requests and work orders. The absence of notifications in the SIMETRIS system causes the Blood Transfusion Unit to still has to wait for information from the ward if the ward has entered a work order and the amount of blood stock that is ready to be collected can only appear on the work order if a compatible crossmatch test has been carried out, and there are still many doctors/nurses who asked for blood stock by telephone or came directly to the Blood Transfusion Unit.

All the departments at the Blood Transfusion Unit have instruments/tools, each of which already has a routine maintenance schedule on a daily, weekly, or monthly basis, either by the equipment vendor or from the IPSRS. The equipment vendors and the IPSRS

are also easy to contact, and they can deal with equipment damage immediately. The problems with telephone, computers, and the SIMETRIS network system can also hamper the work at the Blood Transfusion Unit which results in delays in supplying blood. In the study of Sharma, Arora, and Malhotra, instrument failure was the second most common cause (10 cases) of 11-15 min of TAT prolongation for emergency blood supply.[2] The prolongation of the TAT for the supply of blood could also be due to the fact that there is only 1 computer in the distribution department which is used to input requests for incoming and outgoing blood from the Blood Transfusion Unit which leads to the distribution officers cannot work in parallel.

The patient's blood sample is sent to the EDTA tube together with the blood components requests, which will be used by the Blood Transfusion Unit for crossmatch and blood type examination. If there are problematic samples, such as samples without identity, the identity on the sample and the blood request does not match, the sample does not use the EDTA tube, or the sample is lysed, then the sample and blood request will be returned to the ward first, which will extend the TAT of blood supply at the Blood Transfusion Unit. Various problems in the sample were also found in the study of Ramanathan, Shaiji, and Usha, causing a TAT prolongation of ≥ 20 min for blood supply in emergency conditions.[6]

The availability of safe blood in hospitals is one of the Hospital Minimum Service Standards, which means that every hospital must have a 24-h safe blood stock at the Hospital Blood Bank or Hospital Blood Transfusion Unit.[19] If the stock of blood and blood that cannot be used is insufficient, then the Blood Transfusion Unit will ask the PMI Kotagede and the PMI Sleman to drop ± 20 bags/group of blood. If the patient's family already has a donor, but after checking the letter of request for blood has run out and there is no new one, or the letter of request for blood has not been delivered from the ward, then the Blood Transfusion Unit must first confirm to the ward before being able to provide blood for the patient. In the case of problematic blood product conditions, such as barcode discrepancy and reactive transfusion-transmitted infections screening results, the Blood Transfusion Unit must also re-check which can have an impact on the time of supplying blood products.

The Comprehensive Blood Transfusion Unit management is needed to address the various causes of the problem of prolonging the blood supply TAT. According to Rusdiana, the management function has task characteristics, namely planning, organizing, mobilizing, and controlling, which can be interpreted as a systematic process carried out by superiors in an agency to achieve goals. During the implementation of management functions, employees will raise their personal expectations of agency policies. Whether or not employees' expectations with the agency are in accordance with the agency's expectations will be reflected through employee perceptions of the management function that it will shape the expected performance.[20] It is in line with the study conducted by Kalkavan and Katrinli which states that the optimal performance of employees is influenced by employee perceptions of their responsibilities.[21]

Based on the results of the analysis carried out in the study, it was found that several problems were the cause of the delay in providing PRC at the Blood Transfusion Unit Dr. Sardjito General Hospital. All problems cannot be solved at the same time because each problem has a different and complex cause. Problem identification and problem-solving priorities are necessary steps for

policy formulation in order that real and relevant problems can be identified and the most urgent and crucial problems will be addressed first.[22] In addition to proposing the addition of the number of officers to the HR of Dr.Sardjito Hospital, the Blood Transfusion Unit accelerated the implementation of automation and carried out regular Mobile Unit activities to meet the amount of blood stock.

The changes that will be made by the Blood Transfusion Unit is aiming to improve the service quality of the Blood Transfusion Unit as one of the work units in Dr. Sardjito General Hospital. The service quality is the result of a comparison between customer expectations (expected quality) and customer experience when experiencing a service (experienced quality). If the perceived service is as expected, then the service quality is perceived as good and satisfactory. Whether or not the quality of the service is good depends on the ability of service providers to meet the customer expectations.[23]

CONCLUSION

Turnaround time for the provision of PRC at the Blood Transfusion Unit of Dr. Sardjito General Hospital for the available blood stock group is 179.08 (67.2 – 396.27) min, the replacement blood donor group is 485.38 (126.43 – 910.68) min, the cito group is 121.29 (27.68 – 421.38) min. It is found that there is TAT prolongation of PRC provision in the Blood Transfusion Unit of Dr. Sardjito General Hospital. The factors that play roles in the prolongation of the TAT for the provision of PRC are: man (lack of technical personnel for blood transfusion, 1 person on duty per division on night shifts), method (unintegrated communication system between the Blood Transfusion Unit and wards, large number of donors at the same time), materials (incomplete and inaccurate filling of the blood components requests, the implementation of the work order system has not been carried out by all wards, no notification in the SIMETRIS system if the inpatient ward has input work orders, the number of patient blood stocks can only appear on the work order if a compatible crossmatch test has been carried out), machine (telephone, computers, and the SIMETRIS network system is problematic, only 1 computer is placed in the distribution department), measurement (samples are problematic), milleu (inadequate blood stock, the blood request letter has run out or the request letter for blood has not been delivered from the ward, the condition of the blood product is problematic).

Furthermore, it can be suggested to propose additional blood transfusion technical officers that it can reduce the shortage of officers at the Blood Transfusion Unit, automatisation of crossmatch examinations which the results can be automatically inputted into SIMETRIS, improvement of the SIMETRIS system which leads work order notifications appear on SIMETRIS and show the amount of blood stock available for patients, implementation of work orders simultaneously for all wards to avoid duplication of blood requests, the completeness and accuracy of filling out the blood requests and sending EDTA samples from the ward, installing a pneumatic tube system for transporting EDTA samples from the ward to the Blood Transfusion Unit, add 1 unit of computer in the distribution department in order to speed up the process of inputting requests for incoming and outgoing blood from the Blood Transfusion Unit, and implementation of routinely scheduled Mobile Unit activities to ensure the availability of blood stock at the Blood Transfusion Unit.

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