Addis Ababa University

College of Health Sciences

Department of Medical Laboratory Sciences

Assessment of Blood Transfusion Utilization , Patient Outcome andassociated factors at St. Paul Hospital Millennium Medical College Addis Ababa, Ethiopia.

By: AssefaAbebe (BSc)

Adivisors:

Aster Tsegaye (MSc, PhD)

AfeworkHagos (MD, Hematologist)

MikiyasNegash (MSc, PhD candidate)

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This is to certify that the thesis prepared by AssefaAbebe entitled:

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Advisor_____ Signature _____ Date _____

Advisor_____ Signature _____ Date _____

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Chairman of the Department or Graduate Program Coordinator

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Abbreviations

%T	Transfusion probability
C|T ratio	Cross-match Transfusion ratio
CRC	Concentrated Red Cells
FNHTR	febrile non hemolytic transfusion reaction
PRBC	Packed Red Blood Cells
SPHMMC	St. Paul Hospital Millennium Medical College
SPSS	Statistical package for the social science
TACO	Transfusion associated circulatory overload
TAS	Transfusion associated sepsis
THA	Total hip arthroplast
TI	Transfusion index
TKA	Total knee arthroplastics
TRALI	Transfusion related acute lung injury
TTI	Transfusion transmitted infection

Abstract

Background: Assessment of blood utilization is an important way to minimize unnecessary use of blood and blood components for transfusions so as to effectively manage such scarce resources. However, in Ethiopia the regular assessment of transfusion practice is not performed consistently. Regular audits are necessary to ensure blood and blood products are appropriate and clinical.

Objective: To assess blood transfusion utilization , patient outcome and assocaited factors from july 2020 to september 2020 at St, Paul's Hospital Millennium Medical College.

Methods: the utilization of blood, patient outcomes and associated factors were assessed in this Hospital based cross sectional study at St. Paul Hospital Millennium Medical College from July to September 2020. A standardized data extraction checklist was used to extract data from patient file and from blood bank log book. Transfusion indices werecalculated. Data was entered and analyzed using SPSS version 23. Dependent variable frequencies, percentage, mean and range were calculated. The association between patient improvement and independent variables was examined using bivariate and multivariable logistic regression analysis. P-value less than 0.05 were considered as statistically significant and Odds ratios with 95% confidence interval were used to determine strength of the association.

Result: A total of 352 participants were included in the study. The majority of the patients were female 218 (61.9%). The median and interquartile range [IQR] age of study participant was 30 [20-43] years. For 352 study subjects, 1060 unit of blood components were transfused with the mean of 3.01units per patient. From 1242 cross matched units, 85.3% wereutilized, the rest 14.7% were returned to laboratory stock.Anemia was the commonest indication for transfusion and concentrated red cell was the major component transfused. The study revealed the number of units cross matched/transfused (C|T) ratio of 1.17, Transfusion probability (%T) of 61.3%, and Transfusion index (TI) of 1.84. Only 177(50.3%) of the patients showed improvement. Patients in the age group 1 to 10 years were more than 6 times more likely to improve than those aged under one year'sAOR and 95% CI =6.037[1.205-30.251], p=0.029.

Conclusion: The study demonstrated an encouraging rate of transfusion utilization in which 85.3% of cross matched blood is utilized. Transfusion indices,C/T, %T and TI, values were within the acceptable standard. The high rate of non-improvement warrants further investigation.

Key words *Blood components, Transfusion practices, Transfusion indices, patient outcome.*

1. Introduction

1.1 Background

Blood transfusion is an important part of day to day clinical practice. Blood and blood products provide unique and life- saving therapeutic benefits to patients. However, due to misuse or overuse of blood and blood products, it is not always possible for the blood product to reach the patient at the right time so as to ensure effective and quality of blood to be available when required [1,2].In Ethiopia, the Federal Ministry of Health focuses on increasing the blood transfusion services. But health facilities have limited information about the appropriate usage of blood and blood component [3]. Blood and components are often ordered without seriously checking the patient condition rather on the basis of anticipated or low hemoglobin concentration. This leads to overuse of blood and unnecessary exposure of the patient to antibody and antigen which increase morbidity and mortality rate of patients. Moreover, the unused blood after cross match remain reserved which cause the needy patient not to be transfused immediately in life threatening situation [2, 4].

Blood transfusion is usually life- saving, but there are occasions they cause degree of morbidity and mortality; some of these deaths are caused by poor laboratory practice. On the other hand it is because of blood or components that have been selected or issued incorrectly, that there is a high risk of transfusion-transmitted infection (TTI). An insufficient blood supply has also a negative impact on health services. Blood and blood products are used for a number of cases but the main reasons are to correct anemia, to replace blood lost by bleeding, during surgery or trauma, as well as to replace other constituents of blood such as coagulation factors [4].

In a well-managed laboratory blood bank, the intake and issue of blood are equally balanced by keeping records throughout the whole process of blood transfusion practice, from the recruitment of the donor to the time when the blood or component is transfused into the patient. These records help to calculate how much blood and components are needed in blood bank each day, week, month, and year. Therefore, an accurate assessment of how much blood are likely needed is required by keeping an inventory regularly; otherwise adequate health services cannot be maintained effectively [5].

Transfusion reaction is any transfusion-related adverse event that occurs during or after the transfusion of blood and blood components to the patient. It is one of the challenges of blood transfusion practices [6].

Thus, appropriate use of blood components and transfusion safety practices when monitored properly will help to ultimately improve the quality of life of patients. Studies assessing blood component utilization and patients' clinical outcome, and associated factor could contribute to such efforts. This is a gap the study is trying to address in one of the largest teaching hospitals in the country.

1.2.Statement of the problem

Blood transfusions are usually life-saving, but there are occasions when they cause different degrees of morbidity and even mortality in the world, especially in Africa. Some of the deaths are caused by poor transfusion practice such as blood and components has been selected or issued incorrectly. There is a growing interest in many countries in the development of systems to promote appropriate blood transfusion and to improve the quality, safety and efficiency of treatment with blood products in patient management [7].

Indications for blood and blood component prior to transfusion are uncertain in that mostly decision to transfusion is by low hemoglobin level. However, when deciding to transfuse an individual patient, it is good practice to consider the overall clinical condition of patient rather than hemoglobin level alone [1, 7].

On the other hand, transfusion reaction,which is one of the major challenges of blood transfusion practice, if not properly handled could put the life of the patient endanger. Any transfusion-related adverse event can occur during or after the transfusion of blood or blood components. An estimated 1-2 per centof transfused patients may show transfusion reaction. The reactions are mainly categorized as febrile, allergic, hemolytic reaction. Hemolytic reactions are the most sever type. Immediate transfusion reactions occur within 24 hours post transfusion. These include acute intravascular hemolysis, bacterial contamination, fluid over load, anaphylactic reaction, transfusion related acute lung injury (TRALI), transfusion associated circulatory overload (TACO), febrile non hemolytic transfusion reaction (FNHTR), transfusion associated sepsis (TAS). Delayed complications of transfusion occur 5 to 10 days post transfusion like post transfusion purpura, Graft versus host diseases, iron overload, platelet refractoriness [6].

Ethiopia is one of the developing countries in Africa with a huge demand for safe blood and blood products in health institutions. However, due lack of clear blood services strategy in emergency situation, the blood bank services encountered a serious challenge to reach to the expected standard, to provide safe and adequate blood and blood product to all patients in need of transfusion as treatment [3]. A study at the largest tertiary care Hospital of the country has shown that whole blood was the most frequently transfused component with potential threat to the patients who could have been treated with the appropriate component [8]. Transfusing the right type of component needed to the right patient at the right time is achieved by appropriate

clinical use of blood. Thus, this researchwas conducted to assess blood transfusion utilization, patient outcomes and associated factor at St Paul Hospital Millennium Medical College (SPHMMC). The result helps the national blood bank and the hospital to establish mechanism for monitoring, utilization of blood and blood products.

1.3 Significance of the study

The findings of this study enable to put appropriate strategy in St Paul Hospital for control of blood usage and monitoring of transfusion related complications.

It also helps to monitor the Clinical use of blood in the hospital, and the blood transfusion practices.Itgives clue for health planners and decision makers as to prospective observation and intervention action to be taken.

The study will be useful to the hospital to establish some protective measures against inappropriate use of blood, such as overuse of blood, also the study provided information about patient status after transfusion. This must be beneficial and improve patient condition as a goal of health care system otherwise increase the risk to exposure of patient to antigen, TTIs and transfusion reaction. This reduces the morbidity and mortality rate of patients.

At the national blood bank level, it helps to quantify the amount of required blood and component to supply the health institution.

2. Literature Review

Regularly assessing transfusion practices is an important way to identify gaps and minimize unnecessary use of blood and blood components for transfusion so as to effectively manage such scarce resources. A study on the impact of Blood transfusions and transfusion practices on long-term outcome following Hepatic pancreatic biliary surgery was conducted at Johns Hopkins hospital from 2009-2013. A total of 175 (39.6 %) patients received at least 1 unit of packed red blood cells (PRBC) in the perioperative period either intra operatively (n=74, 16.7 %), postoperatively (n=56, 12.7 %), or both (n=45, 10.2 %). A total of 597 units of PRBC were transfused over the study period. The majority of the patients received one or two units (n=107, 61.1 %) of PRBC. Over 1/3rdof the transfused patients received 3 or more units of PRBC (n=68, 38.9 %). The study identified that blood transfusions were more common during pancreas (n=118, 67.4 %) as compared to liver (n=57, 32.6 %) resections (P=0.04) [9].

Across-sectional pilot study regarding blood utilization in 27 hospitals in North California was conducted. The result showed that the percentage of hospitals with component-specific transfusion trigger were fairly consistent.Red blood cells (61.5%), Platelets (65.4%), Plasma (57.7%), and Cryoprecipitate (46.2%) were in use in the hospitals [10].

A retrospective study was conducted at the University of Pittsburgh medical center. The study investigated blood utilization after primary total joint arthroplasty in large hospital on 3750 primary total knee arthroplastics (TKAs) and 2070 primary total hip arthroplastic (THAs) patients over a 15 month period. The study aimed to determine the number of RBC transfused per patient. The result indicated that on postoperative period 19.3% TKA patients and 38.5% THA patients received RBC transfusion. Transfusion rates following TKA varied widely between surgeons (TKA 4.8-63.8%,THA 4.3-86.8%).Transfused TKA patients received an average of 1.65±0.03 RBCs; whereas transfused THA patients received an average of 1.97±0.14 RBCs. The lowest transfusion rate was 4.8% for a surgeon who performed 104 Primary TKA per year. This surgeon transfused an average of 1.24 per transfusion event. And also patients who received allogeneic transfusion were more likely to be discharged to recovery. TKA patients discharged to facility accounted 37.7% than TKA patient who were not transfused (24.6%.p<0.001).The result was similar for primary THA patients 31.7% sent to recovery facility and 68.3% were sent home [11].

A descriptive study on transfusion reaction, prevention, diagnosis and treatment at university of Pittsburgh institution of transfusion medicine indicated that allergic transfusion which occurs within 4hours of transfusion was frequently associated with platelet transfusion (302 per 100,000platelet unit). The study demonstrated allergic reaction prevalence(per 100 000unit transfused) were 111.2, anaphylactic reaction 8, acute hemolytic reaction 2.5-7.9, delayed hemolytic 40, and delayed serological transfusion reaction 48.9-75.7. Moreover,hypotensive transfusion reaction was 1.8-9, Septic transfusion reaction 0.03-3.3, transfusion-associated circulatory overload 10.9 and transfusion-related acute lung injury 0.4-1.0. The incidence of anaphylactic reaction was 8 per 100,000; the incidence of delayed hemolytic transfusion reaction was one per 2500 transfusions, but rise to 11% in patients with sickle-cell disease [12].

To evaluate the effect of procedure related to blood transfusion on operative outcomes, a study was conducted at university of Kentucky and Lexington veteran affairs medical center. The result revealed that from 470,404 patients, 32,953 (7%) received at least one blood transfusion within 72 hours of operation. The percent of transfused patients who died or developed serious morbidity was 11.3% and 55.4%, respectively. High risk patients did not have a significant risk from blood transfusion but low risk patients have between an 8-10 fold excess risks of adverse outcomes when they receive a blood transfusion [13].

A retrospective cross-sectional analysis was conducted on all inpatients on Blood transfusion utilization and recipient survival at Hospital das Clinic in São Paulo, Brazil in 2004. The study aimed to describe blood utilization according to clinical diagnosis and to determine the factors associated with survival of blood recipients. The result showed that 30,779 patients were admitted to the Hospital Clinic, of which 3,835 (12.4%) were transfused. These patients had 10,479 transfusions episodes, consisting of 39,561 transfused components; 16,748(42%) red cells, 15,828 (40%) platelets and 6,190 (16%) plasma. Mortality during hospitalization was dramatically different for patients whose admissions included transfusion or not (24% vs. 4%). After 1 year, 56% of transfusion recipients were alive. Factors associated with mortality following transfusion showed that the most significant factors in descending order were hospital ward type, increasing age, increasing number of components transfused, and type of components received [14].

Retrospective cross -sectional descriptive study was done in hospital in Multan Pakistan on adverse transfusion reactions. The result revealed that from 6050 blood transfusions 23 (0.38%) develops adverse transfusion reactions. Febrile non hemolytic transfusion reaction was the commonest adverse event. It was followed by allergic reaction and anaphylactic reaction from components; whole blood accounted 73.91% and pack red blood cells 26.09% transfusion implicated reaction. On the other hand, no reaction occurred in fresh frozen plasma and platelet transfusion. The distribution of different blood groups who had adverse transfusion reactions were as follow; 10 (43.47%) O-positive, 10 (43.47%) B-positive and 03 (13.04%) A- Positive [15].

A retrospective pilot study was conducted on utilization of blood and components in a tertiary care hospital in India. The total number of whole blood and its products issued from the blood bank in 1 year (1st February 2007 to 31st January 2008) was 8,549 units. The result showed that, the blood units supplied for the calculated monthly average were 712 units. Whole blood was the most utilized product; followed by packed red blood cells (PRBC). The maximum need was to the surgical wards. The patients of trauma followed by malignancy and surgery required whole blood mostly. Anemia was the most common indication for blood products [16].

A prospective study was undertaken for a period of 18 months in the department of transfusion medicine at a tertiary care teaching hospital. Blood utilization indices [Cross-match/Transfusion Ratio (C/T Ratio), Transfusion Probability (%T) and Transfusion Index (TI)] were computed. The result indicated that the complete blood utilization indices of the hospital were C/T ratio of 5.95, %T of 67.7% and TI = 0.87, respectively. Blood transfusion indices of the study were optimal but comparatively higher as most of the cross matched blood was not utilized [17].

The use of whole blood is a routine transfusion practice in Africa. Availability of blood transfusion in sub-Sahara Africa countries is limited since less than 5 units of blood were donated per 1000 population far below the recommended requirement of 20 units/1000 per year.Young children are the main users of blood for transfusion in these SSA regions, largely due to severe anemia secondary to infection and sickle cell anemia. Outcomes for children with severe anemia are poor, even in those receiving transfusion. In the 2016 report, data indicate that median percentage of whole blood use for transfusion was 85% [18].

A retrospective analysis of blood transfusion recipient data, covering all blood and blood components transfused and recorded over a 12-month period study was conducted in four major hospitals, all located in Harare. The study described the demographic characteristics of blood transfusion recipients and patterns of blood and blood component use. The result indicated that most of the 1,793 transfusion recipients studied were female (63.2%) and in the reproductive age group, i.e. 15-49 years (65.3%).The majority of these recipients (n=1,642; 91.6%) received a red blood cell transfusion. The median time spent in hospital was 8 days (range, 0-214) and in-hospital mortality was 15.4%, the effect was dose related. Specifically, patients who received 1–2 units of PRBC were over 1.5 times more likely to die whereas those receiving 3 units or more were 2.5 times more likely to die. Similarly, the risk of recurrence was nearly three times higher among patients receiving 3 units of blood or more. In addition, patients transfused under a restrictive hemoglobin trigger tended to have a lower risk [19].

In Ethiopia, a study was conducted in TikurAnbessa Hospital, a tertiary care teaching Hospital, by Tamene et al. They assessed 361 transfused patients on the utilization of blood components and patient outcome. The study revealed that 85% of the patients were transfused with whole blood while combination of two components was transfused to 27 patients (7.5%). Interestingly, of the patients who did not clinically improve, 66.2%were those who were transfused with whole blood [8].

Regularly updated information on blood and components utilization is useful for identifying gaps and addressing them so as to ensure rational use of blood and blood components. The current study aimed at providing such information in a tertiary care teaching hospital.

3. Objective

3.1 General Objective

- To assess blood transfusion utilization, patient outcome and associated factors in SPHMMC, Addis Ababa, from July to September 2020

3.2 Specific objectives

- To determine Transfusion indices (C|T Ratio, %T, and transfusion index (TI)
- To describe patient outcome and associated factorsin SPHMMC, Addis Ababa

4. Material and Methods

4.1 Study area

This study was conducted at St. Paul Hospital Millennium Medical College. St. Paul Hospital is the second largest Public hospital in Ethiopia, which is located in Addis Ababa, built by late Emperor Haile Selassie in 1968. In 2007, St. Paul's hospital added medical college which is called St. Paul Hospital Millennium Medical College. The college has more than 2800 clinical, academic, administrative and supportive staffs that provide medical services to the patient. The college has inpatient capacity of more than 700 beds and serves an average of 1200 outpatient and emergency clients daily. The college receives referrals from all over the country and governed by a board under Ethiopian Federal Ministry of Health. [www.sphmmc.edu.et].

4.2 Study Design and Period

This Hospital based prospective study was conducted to assess blood utilization, patient outcome and associated factors at St. Paul Hospital Millennium Medical College from July to September 2020.

4.3 Population

4.3.1 Source Population

- The source populations were all patients who were transfused blood and blood components in SPHMMC from July to Sep 2020.

4.3.2 Study Population

- Patients who were transfused blood and blood components in SPHMMC and who fulfill the eligibility criteria in the study period.

4.4 Inclusion and Exclusion Criteria

4.4.1 Inclusion Criteria

- All transfused patient of all age groups who were volunteering to participate in this study

4.4.2 Exclusion Criteria

- Transfused patients with incomplete data, lost file

4.5Study Variable

4.5.1 Dependent Variable

- Frequency of blood component type utilized
- Patient improvement(outcome)

4.5.2 Independent Variable

- Age
- Sex
- Blood group and RH
- Number of unit
- Type of blood product
- Department

4.6 Measurement and Data Collection

4.6.1 Sample Size Determination

The required sample size (n) was estimated by using the single population proportion formula.

$$n = \frac{(Z\alpha/2)2\ P\ (1 - P)}{d\ 2}$$

n = sample size

Z = 95% confident interval corresponds to 1.96

P = rate of blood component transfusion =50%=0.5

D = margin of error= 5%=0.05

$$n = \frac{1.962 \times 0.5(1-0.5)}{(0.05)2} = 384$$

4.6.2 Sampling and data collection method

Data was collected by using convenient sampling technique and structured checklist was used to collect data for each patient before and after transfusion from July to Sep 2020. Patients were followed for certain period of time. Data on type and amount of blood cross matched,

The department from which the request was issued, who ordered the transfusion were checked and noted from the laboratory blood bank log book daily. Patient Pre -transfusion and post-transfusion complete blood count result were collected either from patient record or from laboratory.

4.7 Data Collection

A standardized data extraction checklist was used to extract data from patient file and from blood bank log book. All relevant information and possible factors were noted such as number of unit transfused, type of components, who ordered blood, length of stay after transfusion, and the occurrences of transfusion reaction. The checklist is developed in English language and was collected by trained Laboratory technologist and nurses.

4.8 Quality Assurance

To ensure reliable data collection

- Training was given on data collection for Laboratory technologistsand nurses
- The data collection, application, accuracy was supervised by principal investigator.
- Filled data extraction format was collected after checking for consistency and completeness
- Twenty percent of entered data was double checked against the data extraction format

4.9 Data Analysis

Data entry and analysis was performed using SPSS (Statistical Package for the Social Science) version 23 statistical software. Descriptive statistics was used to summarize socio-demographic characteristics. Dependent variable frequencies, percentage, mean, range and proportionswere calculated. The association between patient improvement and its independent variable was examined using bivariate and multivariable logistic regression analysis. P-value less than 0.05 were considered as statistically significant and Odds ratios with 95% confidence interval were used to determine strength of the association. Descriptive summary was presented in table. Transfusion indices were calculated to indicate significant blood usage practice. C/T ratio= less than or equal to 2.5 was considered significant blood usage. T% value of 30% and above was

considered efficient blood usage. TI value of 0.5 or more was considered significant blood utilization.

4.10 Ethical Considerations

The study was approved by the ethical review committee of the Department of Medical Laboratory Sciences, College of Health Sciences Addis Ababa University. To undertake the study, ethical clearance and permission was also obtained from the study hospital (SPHMMC) to look at patient files. Also patient was sign consent form.To ensure confidentiality, participants' data was linked to code numbers. Hard copies were protected by locking and electronic files by using pass word.

4.11 Operational definition

- **Patient outcome**: a patient is said to be clinically improved, when he or she has stable vital sign, improve hematological parameter (mainly an increase of Hemoglobin by 3gm/dl per unit of transfusion), and increase cardiac output and tissue oxygenation. The clinical information is obtained from patient's charts.

- **C|T Ratio**=the number of units cross matched/number of units transfused. Ideally, thisratio should be 1.A ratio of 2.5 and below is considered indicative of significant blood usage as described by Boral and Henry 1975 [20].
- **Transfusion probability [%T]**=number of patients transfused/number of patients cross matched×100.A value of 30% and above was considered indicative of efficient blood usage [21].
- **Transfusion index[TI]**=number of units transfused/number of patients cross matched. A value of 0.5 or more was indicative of significant blood utilization [21].

5. Results

5.1. Demographic characteristics of the study participants

A total of 352 participants were included in the study. The majority of the patients were female 218 (61.9).The median and interquartile range [IQR] age of study participant was 30 [20-43] years.As shown in Table 1, the majority of transfused patients were in the age group 21-30 years, 93 (26.4%), followed by the age group 31-40 (66, 18.8%) and >50 years (61, 17.3%). Infants accounted the next majority where 56 of the transfused patients were under one years of age (15.9%).

Table1. Demographic characteristics of patients transfused blood and components at St Paul Hospital Millennium Medical College, July to September, 2020.

Characteristics	Number	Percentage
Gender		
Male	134	38.1
Female	218	61.9
Total	352	100.0
Age Group		
≤1	56	15.9
2-10	15	4.3
11-20	26	7.4
21-30	93	26.4
31-40	66	18.8
41-50	35	9.9
>50	61	17.3
Total	352	100.0

5.2. Transfusion utilization, ordering clinician, department and type of blood transfused

For 352 study subjects,1060 unit of blood components were transfused with the mean of 3.01units per patient.The department that ordered blood transfusion mostly was Gynecology, Maternity, and Labor 102(29.0%). Secondly,Surgery including one maxillofacial surgery 60(17.1%) andEmergency 59(16.8%) and thirdlyNeonate, Pediatric, adult ICU 53(15.1%) were among the most utilizers.

In this study blood group O+ 129(36.6%), blood group A+ 90(25.6%) and B+90(25.6%), blood group AB+ 24(6.8%), other negative 19(5.4%) blood type were transfused. Most of blood were ordered by Intern171 (48.6%) and Resident 156(44.3%), the least was by specialist 20 (5.7%)and general practitioner 5(1.4%) [Table2].

Most of the indication of transfusion was anemia 217(61.7%), followed by thrombocytopenia and coagulopathy 56(16%) and blood loss and PPH 52(14.7%), the rest was pancytopenia and other cancer 27(7.6%) [Figure1].

Table2. Transfusion prescribing clinician, department and types of blood transfused at St Paul Hospital Millennium Medical College, July to September, 2020.

Characteristics	Number	Percentage
Department		
Surgery	60	17.1
Medical	35	9.9
Gynecology, Maternity, Labor	102	29.0
Emergency	59	16.8
Neonatal ,Pedi, Adult ICU	53	15.1
Oncology	15	4.3
Pediatric	19	5.4
Covid-19 isolation	9	2.6
Professional who order blood		
Specialist	20	5.7
Resident	156	44.3
Intern	171	48.6
General practitioner	5	1.4
Blood Type*		
A+	90	25.6
B+	90	25.6
AB+	24	6.8
O+	129	36.6
Other Rh-negative Type	19	5.4

**4A-; 3B-; 2AB-; 10 O-*

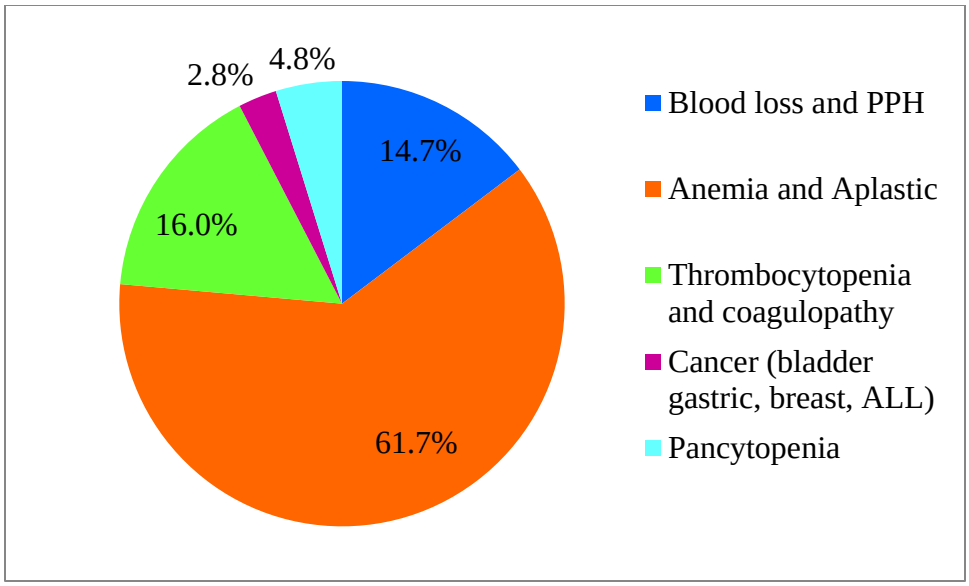

Figure1. Indications of transfusion at SPHMMC hospital July to September, 2020

5.3. Transfusion indices (C|T Ratio, %T, and transfusion index (TI)

The current study demonstratedthat from 1242 cross matched units, 1060 (85.3%) units were transfused, the rest 182(14.7%)were unutilized [Table 3]. As shown in the figure when categorized by departments, pediatrics (35/36, 97.2%)utilized the highestof the cross-matched blood followed by gynecology, maternity and labor ward (389/402, 96.8%), while Oncology utilized the lowest where only 28 out of the 47 cross-matched blood was transfused (59.6%) [Table3].

Table3. Number of patients and Blood unit cross matched, transfused and improvement status by specific departments at SPHMMC hospital, July to September, 2020

Department	**Number of Units**		**Number of Patients**		**Improvement Status**	
	Cross matched	**Transfused**	**Cross matched**	**Transfused**	**Improved**	**Not Improved**
Surgical	207	159(76.8%)	109	60(55.0%)	33(55%)	27(45%)
Medical	111	96(86.5%)	66	35(53.0%)	15 (43%)	20(57%)
Gynecology, Maternity Labor	402	389(96.8%)	190	102(53.7%)	51(50%)	51(50%)
Emergency	268	207(77.2%)	79	59(74.7%)	35(59.3%)	24(40.7%)
Neonatal, Pedi, Adult ICU	136	120(88.2%)	68	53(77.9%)	22(41.5%)	31(58.5%)
Oncology	47	28(59.6%)	22	15(68.2%)	8(53.3%)	7(46,7%)
Pediatrics	36	35(97.2%)	24	19(79.2%)	6(31.8%)	13(68.2%)
Covid-19	35	26(74.3%)	16	9(56.3%)	4(44.4%)	5(55.6%)
Total	1242	1060(85.3%)	574	352(61.3%)	177(50.3)	175(49.7%)

Table 4 displays the overall transfusion indices of the hospitalduring the three months study period. These indices were calculated based on the data displayed in Table 3. Thestudy revealed the number of units cross matched/transfused (C|T) ratio of1.17,Transfusion probability, that is, number of patients transfused out of the number of patients cross matched×100(%T) of 61.3,andTransfusion index, meaning the number of units transfused out of the number of patients cross matched(TI) of 1.84 respectively [Table 4]. The highest CT ratio of 1.67 was detected in Oncology department while the highest transfusion probability was recorded in Pediatrics (79.2%) followed by ICU (77.9%) and Emergency (74.7%). The least was detected in Medical (53.0%) and Gynecology, Maternity and Labor (53.7%) [Table4].

Table 4: Transfusion Indices with specific department at SPHMMC hospital, July to September, 2020

Department	**C/T Ratio**	**% T**	**TI**
Surgical	1.30	55.0	1.46
Medical	1.15	53.0	1,45
Gynecology, Maternity, Labor	1.03	53.7	2.04
Emergency	1.29	74.7	2.62
Neonatal, Pediatrics Adult, ICU	1.13	77.9	1.76
Oncology	1.67	68.2	1.27
Pediatrics	1.07	79.2	1.45
Covid-19 isolation	1.34	56.3	1.63
Total	1.17	61.3	1.84

***C|T Ratio** = the number of units cross matched/number of units transfused; **Transfusion probability [%T]** = number of patients transfused/number of patients cross matched×100; **Transfusion index [TI]** = number of units transfused/number of patients cross matched.*

5.4 Patient improvement status by blood component transfused

Table 5 shows the type of blood components transfused during the three months study period. Accordingly, most of the patients were transfused with CRC 119(33.8%) followed by whole blood 68(19.3%) and both whole blood and CRC 54(15.3%) [Table 5]

Of the total 352 transfusion events during the three months study period, 177(50.3%) of the patientsshowed improvement. From the total patients who showed improvement, 118 (66.7%) were transfused with a single blood component (Whole blood, CRC, Plasma, Platelet), the rest 59 (33.3%) were among those transfused with two to four different type of Components [Table 5].

Table5.Patient improvement status at SPHMMC hospital by the type of blood and components transfused July to September 2020.

Type of blood and components	Number of patients Transfused	Patient improved	Patient not Improved
Whole blood	68(19.3%)	41(60.3%)	27(39.7%)
CRC	119(33.8%)	62(52.1%)	57(47.9%)
Plasma	13(3.7%)	3(23.1%)	10(76.9%)
Platelet	26(7.4%)	12(46.2%)	14(53.8%)
WB and CRC	54(15.3%)	27(50%)	27(50%)
WB and Plasma	1(0.3%)	0(0%)	1(100%)
WB and Platelet	2(0.6%)	1(50%)	1(50%)
CRC and Plasma	9(2.6%)	4(44.4%)	5(55.6%)
CRC and Platelet	19(5.4%)	11(57.9%)	8(42.1%)
WB,CRC and Plasma	4(1.1%)	2(50%)	2(50%)
WB,CRC and Platelet	10(2.8%)	5(50%)	5(50%)
CRC, Plasma and Platelet	8(2.3%)	2(25%)	6(75%)
Plasma and Platelet	7(2.0%)	3(42.9%)	4(57.1%)
WB,CRC, Plasma and Platelet	7(2.0%)	1(14.3%)	6(85.7%)
WB, Plasma and Platelet	5(1.4%)	3(60%)	2(40%)
Total	352(100%)	177(50.3%)	175(49.7%)

5.5. Transfusion outcome and associated factors

Table 6 shows binary and multivariable logistic regression analysis of factors associated with patient improvement. As shown in the table,age being in the age group 1-10 years and 21-50 years were more likely to show improvement than those under one years of age. On the other hand, those transfused with both plasma or plasma and platelet were less likely to improve. Regarding indication for transfusion, those with pancytopenia were less likely to improve compared to those who had anemia,Sex, ordering professional, department type, or amount of unit transfused showed no significant association with improvement. In the multivariable logistic regression model, those which showed p value less than 0.20 were entered thus after controlling for sex, department, component types, and indication for transfusion, being in the age group 1 to 10 years were more than 6 times more likely to improve than those aged under one years of age AOR and 95% CI =6.037[1.205-30.251], p=0.029.

Table6. Determinants of patient improvement at SPHMMC hospital July to September, 2020

Variable	Improved	Not Improved	P-Value	COR[95%CI]	AOR[95%CI]
Sex					
Male	59(44%)	75(56%)		1	1
Female	118(54.1%)	100(45.9%)	0.066	1.50[0.973-2.312]	1.468[0.836-2.577]
Age Group (years)					
<1	20(35.7%)	36(64.3%)		1	1
1-10	10(66.7%)	5(33.3%)	0.037*	3.60[1.079-12.008]	6.037[1.205-30.251]*
11-20	11(42.3%)	15(57.7%)	0.567	1.32[0.510-3.416]	0.936[0.190-4.616]
21-30	49(52.7%)	44(47.3%)	0.046*	2.00[1.014-3.963]	1.142[0.223-5.851]
31-40	41(62.1%)	25(37.9%)	0.004*	2.95[1.410-6.181]	1.757[0.345-8.953]
41-50	20(57.1%)	15(42.9%)	0.047*	2.40[1.011-5.696]	1.473[0.269-8.069]
>50	26(42.6%)	35(57.4%)	0.445	1.34[0.634-2.819]	0.763[0.150-3.888]
Profession who ordered Transfusion					
Specialist	11(55.0%)	9(45.0%)		1	
Resident	78(50.0%)	78(50.0%)	0.674	0.818[0.321-2.084]	
Intern + GP*	88(50.0)	88(50.0%)	0.672	0.818[0.323-2.072]	
Department					
Surgery	33(55.0%)	27(45.0%)		1	1
Medical	15(42.9%)	20(57.1%)	0.255	0.614[0.265-1.422]	0.649[0.262-1.611]
Gynecology, Maternity, Labor	54(52.9%)	48(47.1%)	0.800	0.920[0.485-1.746]	0.809[0.370-1.768]
Emergency	35(59.3%)	24(40.7%)	0.634	1.193[0.577-2.468]	1.388[0.615-3.135]
ICU (Neonatal, Pedi, Adult)	22(41.5%)	31(58.5%)	0.153	0.581[0.275-1.225]	0.758[0.159-3.604]
Oncology	8(53.3%)	7(46.7%)	0.908	0.935[0.301-2.908]	1.078[0.293-3.967]
Pediatrics	6(31.6%	13(68.4%)	0.081	0.378[0.127-1.127]	0.201[0.032-1,244]

COVID 19 Isolation	4(44.4%)	5(55.6%)	0.556	0.655[0.160-2.680]	1.175[0.2475.911]
Blood Component					
Whole blood	41(60.3%)	27(39.7%)		1	1
CRC	62(52.1%)	57(47.9%)	0.279	0.716[0.391-1.311]	0.848[0.435-1.655]
Plasma & Plasma+PLT	6(30.0%)	14(&0.0%)	0.021*	0.282[0.097-0.825]	0.317[0.088-1.143]
Platelet	12(46.2%)	14(53.8%)	0.219	0.564[0.227-1.404]	0.784[0.200-3.076]
WB+CRC	27(50%)	27(50%)	0.256	0.658[0.320-1.355]	0.646[0.302-1.381]
WB+Plasma& WB+PLT &WB+Plasma+PLT	4(50%)	4(50.0%)	0.577	0.658[0.152-2.860]	0.885[0.183-4.285]
CRC+plasma & CRC+ platelet & CRC, plasma, platelet	17(47.2%)	19(52.8%)	0.203	0.589[0.261-1.331]	0.826[0.320-2.131]
WB+CRC+plasma&WB +CRC+platelet&WB+CR C+plasma+PLT	8(38.1%)	13(61.9%)	0.078	0.405[0.148-1.108]	0.529[0.179-1.567]
Amount of unit used					
One unit	65(48.9%)	68(51.1%)		1	
Two units	51(54.8%)	42(45.2%)	0.377	1.270[0.747-2.161]	
Three units	17(41.5%)	24(58.5%)	0.407	0.741[0.365-1.505]	
Four units	15(57.7%)	11(42.3%)	0.412	1.427[0.610-3.335]	
Five units	10(62.5%)	6(37.5%)	0.307	1.744[0.599-5.072]	
Above Five units	19(44.2%)	24(55.8%)	0.593	0.828[0.415-1.653]	
Indication of transfusion					
Blood loss, PPH	28(53.8%)	24(46.2%)		1	1
Anemia ,Aplastic	114(52.5%)	103(47.5%)	0.865	0.949[0.517-1.740]	0.997[0.516-1.925]
Thrombocytopenia, Coagulopathy	24(42.9%)	32(57.1%)	0.254	0.643[0.301-1.374]	1.126[0.367-3.458]
Cancer [bladder, gastric, breast. ALL	7(70.0%)	3(30.0%)	0.352	2.00[0.465-8.597]	3.225[0.647-16.083]
Pancytopenia	4(23.5%)	13(76.5%)	0.036*	0.264[0.076-0.917]	0.313[0.079-1.245]

**5 General practitioners ordered transfusion (one patient showed improvement)*

6.Discussions

Blood transfusion is an important part of day to day clinical practice. Blood and blood products provide unique and life- saving therapeutic benefits to patients, however due to misuse or overuse of blood and blood products, it is not always possible for the blood product to reach the patient at the right time and effective and of quality to be available when required [1]. This study aimed to assess blood transfusion utilization, patient outcome and associated factors in SPHMMC, Addis Ababa, from July to September 2020. A total of 1060 unit of blood components were transfused to 352 patients of all age groups with a mean of 3.01units per patient. Most of the patients were transfused with CRC 119(33.8%) followed by whole blood 68(19.3%) and both whole blood and CRC 54(15.3%).The average number of units per patient was higher when comparing to the study conducted at BLH which included 361 patients and showed a mean of 2.37 units per patient[8]. Unlike the current finding, whole blood was the commonest utilized product followed by packed red blood cells according to a study from a tertiary care hospital in India [16] as well as the study from the Black Lion Hospital [8]. Also like in the present study, the study from both areas indicated a highest transfusion need in surgical department [8, 16]. Anemia was the most common indication for blood products both in the current and the Indian study [16].

The current study demonstrated that the overall ratio of units cross matched versus transfused (C/T), Transfusion probability (%T), and number of units transfused per number of patients cross matched (TI) were considered to be optimal blood usage as compared with the standard [20,21]. The majority of cross matched blood (85.3%) was utilized by the patients leaving 14, 7% of cross matched blood unutilized.Boral Henry was the first to use cross match to transfusion ratio for evaluating transfusion practice. Ideally this ratio should be 1.0,but a ratio of 2.5 and below was suggested to be indicative of efficient blood usage. In consistent to this recommendation,the overall C|T ratio of 1.17 observed in the present study is considered to be efficient blood usage [20].

Mead etal suggested the probability of transfusion (%T) indicates efficient use of blood, in that a value of 30% and above has been suggested to be suitable and signifies the appropriateness of number of unit cross matched. In this regard the result of this study showed an overall %T of 61.3%, which was indicative of efficient utilization compared to unit cross matched [21].

Concerning transfusion index (TI), a value of 0.5 or more is indicative of efficient blood usage and signifies the appropriateness of number of units transfused so that the present study revealed that the

TI was 1.84.The study from university of Gondar hospital by studying 286 patents showed C|T ratio of 2.3, %T of 47% and TI of 0.77[5]In another study from a tertiary care teaching hospital in India demonstrated that C|T ratio of 5.95, %T of 67.7% and of 0.87 [9]. Although a C/T ratio of 2.5 and below is considered indicative of significant blood usage as described by Boral and Henry 1975 [20], the study from Gondar evidences the need to cross match double amountof units for a single transfusion while the study from India revealed their hospital needs more than 5 times more crossmatches than the current study.The probability of transfusion in the study from Gondar is much lower than both the current and the Indian study [5, 9]. Hence, the blood transfusion utilization at St Paul Hospital is close to the standard. The majority of blood component used was CRC 119(33.8%) due to the fact that most of the indication of transfusion was anemia 217(61.7%). A study on blood utilization in 27 hospitals in North California also revealed the most common transfused component to be Red blood cells (61.5%), followed by platelets [10]. This was also confirmed by a study in Brazil which demonstrated that 42% red cells, followed by plasma to be the common [14]. The finding at St Pal's hospital is in sharp contrast to what has been reported some years back at TikurAnbessa specialized hospital where the majority of the patients (85%) were transfused with whole blood [8]. This shows the improvement in the utilization of specific component for transfusion.

Most of blood type used in this study was O+ 129 (36.6%) which is consistent with the previous report from TikurAnbessa hospital which reported 36.3% O+ transfusion [8]. This is in line with the frequency of group O+ as the most predominant type in Ethiopia.

Improvement of patients define in this study was a better clinical outcomes such as stability of patient, improve of vital sign, absence of clinical sign and symptom, a better changes in hematological parameter mainly hemoglobin after transfusion as extracted from the patient file.

The improvement status in the current study, 177(50.3%), is much loser compared to the study from TASH which reported about 77% improvement status [8]. The difference between the two studies might have probably resulted from the definition of improvement status as their study is retrospective document evaluation and some information might have missed from patient cards. The current study in the multivariable logistic regression analysis identified being in the age group 1 to 10 years were more than 6 times more likely to improve than those aged under one years of age after controlling for sex, department type, component types, and indication for transfusion. Unlike the current study component types and the prescribing physician such as being general practitioner was significantly

associated with improvement in the study by Tamene et al at TikurAnbesssa Hospital [8]. Since they did not include children and infants in their study the finding of better improvement in the age group 1 to 10 years in the current study cannot be compared with theirs.

7. Strength and Limitation

This study was partly conducted during the COVID era and 352 out of the planned 384 participants were eligible to be included in the study. However, a response rate of 91.7% is acceptable and primary data is used in the study. The study is restricted in one teaching hospital and may not be generalizable.

8. Conclusion and Recommendation

8.1. Conclusion

The current study demonstrated an encouraging rate of transfusion utilization in which 85.3% of cross matched blood is utilized. The study also showed optimum transfusion indices as demonstrated by C/T, %T and TI values which are within the acceptable standard. Anemia was the commonest indication for transfusion and CRC was the major component transfused. Slightly over half of the patients showed improvement. Age being in the age group 1 to 10 years old was significantly associated with improvement after transfusion.

8.2. Recommendation

- The hospital needs to properly plan for the type of component mostly needed and communicate same to the National Blood Blank
- Conduct regular auditing about usage of blood and patients follow up after transfusion for transfusion reactions.
- The hospital usage of components was encouraging in that transfusion indices suggested significant blood usage.
- The high non improvement rate needs further investigation as almost half of the patients did not improve after transfusion.
- The national blood bank to increase the number of components preparation in that the majority of patients transfused in the hospital was CRC.

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Annex1: Data Extraction Questionnaire (checklist)

Extracted and fill from patient file about Socio-demographic and other relevant risk factors on blood utilization and patient outcomes at SPHMMC hospital.

Serial number _____ -ID.NO _____ -Date _____

1. Patient Gender; Male ☐ Female ☐

2. Patient Age _____

3. Indication of transfusion _____

4.Department of Patient admitted- _____

5. Who Ordered blood transfusion _____

6. Blood group of patient _____

7. Type of blood and components transfused. WBC ☐ CRC ☐ PLASMA ☐ PLATLETE ☐

Cryoprecipitate ☐

8. Amount of blood unit transfused; 1unit ☐ 2unit ☐ 3unit ☐ -above ☐

9. Hematological parameter before transfusion; WBC _____ -RBC _____ Hemoglobin _____

10. Hematological parameter after transfusion; WBC _____ RBC _____ Hemoglobin _____

11. Patient condition Pre transfusion Stable _____ Unstable _____

12. Patient condition posttransfusion .Stable _____ Unstable _____

13. Patient develops transfusion reaction; yes ☐ No ☐

If yes mention type of reaction _____

14. No of days patient stays hospital after transfusion- _____

15. Patient improves after transfusion; Yes ☐ -No ☐

Declaration

I, the undersigned, declare that this M.Sc. thesis is my original work, has not been presented for a degree in this or any other university and that all sources of materials used for the thesis have been duly acknowledged.

M.Sc. candidate: **AssefaAbebe (B.Sc.)**

Signature: _____

Date of submission: _____

This thesis has been submitted with our approval as advisors.

Advisor: **Aster Tsegaye (MSc, PhD)**

Signature: _____

Date: _____

Place: Addis Ababa, Ethiopia.

Advisor: AfeworkHagos (MD, Hematologist)

Signature: _____

Date: _____

Place: Addis Ababa, Ethiopia

Advisor: MikiyasNegash (MSc, PhD candidate)

Signature: _____

Date: _____

Place: Addis Ababa, Ethiopia