



ST. PAUL'S HOSPITAL MILLENNIUM MEDICAL COLLEGE

**ASSESSMENT OF OUTCOMES AND ASSOCIATED FACTORS OF
BLOOD AND BLOOD COMPONENTS TRANSFUSION IN THE
PEDIATRICS DEPARTMENT (0-14years) AT SPHMMC**

Investigator: Zelalem Dagnachew(pediatrics resident)

**Advisor: Dr.Mamude Dinkeye (MD, MPH, pediatrics Hematologist and
Oncologist)**

**Co advisor; Dr. Tadele Hailu(MD, pediatrics Hematologist and
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**Addis Ababa, Ethiopia
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**A thesis submitted to the department of pediatrics and child health presented
in partial fulfillment of the requirements for the certificate in pediatrics and
child health, st. paul hospital millennium medical college**

Addis Ababa, Ethiopia , February 2024

DECLARATION

I hereby declare that; this thesis report is my original work and has not presented for a degree by another person in this or any other university and all source material used for this thesis have been acknowledged.

Name: _____

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Date_____

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Name of Co-Advisor: _____

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Date_____

Summary

Introduction: The World Health Organization has designated blood components as essential medicines because blood transfusions can save lives and patients around the world.

When the blood transfusion is correctly done, it is expected to raise the hemoglobin concentration and achieve hemodynamic stability.

Objectives: To determine immediate outcomes of blood and blood component transfusion and associated factors in the pediatrics department (0-14 years) at SPHMMC.

Methods: patient outcomes and associated factors were assessed with Hospital based cross-sectional study at SPHMMC

Data collection was done by using a structured and pre-tested questionnaire' based on WHO transfusion guidelines from patient files and blood bank logbooks. Data was entered and analyzed using SPSS version 26.

The associations between patient improvement and independent variables were examined using bivariate and multivariate logistic regression analysis. A P-value less than 0.05 was considered statistically significant and Odds ratios with a 95% confidence interval determine the strength of the association.

Result: A total of 262 episodes of blood and blood components were transfused to 194 patients. The most widely used blood component transfused was PRBC 107(40.8%) followed by PLT and whole blood 63 (24.0%) and 47 (17.9%) respectively. There was an increase in post-transfusion Hgb with a mean Hgb increase of 2.75 g/dl. The result showed 142(73.2%) of participants had clinical improvement whereas 52(26.8%) did not improve clinically. Of those who did not improve clinically, most of them were whole blood transfused participants. From a total of 25 participants who received whole blood-only transfusion, 16 (64 %) did not show clinical improvement. Those transfused with PRBC only were 4 times more likely to improve than those transfused with whole blood only (AOR=4.948,95%CI=2.086-11.736).

Conclusion: Overall clinical improvement in this study is 73.2%. Of those who did not improve clinically, most of them were whole blood transfused participants. PRBC transfusions were found to have more likely clinical improvement than those transfused with whole blood.

Keywords: *Blood components, blood transfusion, Transfusion outcome, SPHMMC*

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Acronyms and Abbreviations

FFP	Fresh frozen Plasma
G.C	Gregorian calendar
HGB	Hemoglobin
HCT	Hematocrit
PRBC	Packed Red Blood Cell
PLT	Platelet
COR	Crudes odds ratio
AOR	Adjusted odds ratio
SPHMMC	St.Paul Hospital Millennium Medical College
WHO	World Health Organization

1. Introduction

1.1. Background

Blood is composed of plasma in which highly-specialized cells; red blood cells, white blood cells, and platelets are suspended.[1]

Red cell concentrate is prepared by allowing the blood to separate under gravity overnight in a refrigerator at a temperature of +2°C to +6°C or by centrifuging the blood pack in a special refrigerated centrifuge. Plasma is separated from whole blood and frozen at –25°C or colder within 6–8 hours of donation to preserve its labile coagulation factors (Factors V and VIII). FFP can be stored for at least one year or longer if low temperatures can be maintained. Platelets separated from plasma obtained from 4–6 donations of whole blood are often pooled to produce a therapeutic dose of platelets for an adult. [1]

Blood transfusion is a procedure in which whole blood or parts of blood are put into a patient's bloodstream through a vein to compensate for any type of blood loss or to treat anemia.[2]

Whole blood may be suitable for transfusion in many clinical situations, such as red cell replacement in acute blood loss where there is also hypovolemia. However, the separation of whole blood into its constituent components – red cells, platelets and plasma – is widely practiced for use when these specific components only are required.[1]

As Many findings indicated, blood transfusion in the clinical area has significant importance and its therapeutic benefit was achieved by taking and implementing evidence-based activities through continuous review and evaluation of demographic and clinical characteristics, clinical response of transfusion recipients, and appropriate clinical utilization of blood and blood products.[2]

When the blood transfusion is correctly done, it is expected to raise the hemoglobin concentration, achieve hemodynamic stability, and cause the recipient no harm in terms of transfusion-related infections or adverse events. The WHO Guidelines are essential to ensure the safe and rational use of blood, reduce unnecessary and unsafe transfusions and improve patient outcomes and safety.[3] Evidence suggests that restrictive rather than liberal hemoglobin thresholds for red blood cell (RBC) transfusions are efficacious and safe in both neonates and children. Restrictive use of platelet transfusions is also recommended.[4]

1.2. Statement of the problem

Data reported to WHO indicate significant differences in the age distribution of patients transfused. In high-income countries, the most frequently transfused patient group is aged over 60 years, which accounts for up to 76 % of all transfusions. In low-income countries, up to 54% of all transfusions are for children aged under 5 years, usually followed by females aged between 15 and 45 years.[5]

Studies conducted in hospitals in East and West Africa demonstrated that children receive 45–60% of all blood transfusions and that up to 30% of pediatric admissions are for the treatment of severe anemia.[1]

Whole blood transfusion is discouraged in most high-income countries. It is less effective in correcting anemia, exposes to volume overload and represents one of the risk factors associated with the mortality of transfused children.[6]

The Ethiopian red cross society blood banks and Government Hospital based blood transfusion services in Ethiopia rely on family and replacement donors, and because of resource constraints and lack of a clear blood services strategy, the blood transfusion services encountered a serious challenge to reach to the expected standard.[7]

Studies in Ethiopia showed that the predominant transfusion was whole blood and whole blood transfusion was associated with the worst clinical outcomes in adults. [2,10]

The Research done in 2018, on the utilization of blood and blood products among pediatric patients admitted to st. Paul's hospital millennium medical college showed, there is significant inappropriate usage of blood products. PRBCs and whole blood were inappropriately utilized.[8] No studies found on outcomes of blood and blood components transfusion in pediatrics in our country.

1.3. Rationale of the study

Significance of assessing, the clinical and laboratory outcome of blood and blood component transfusion in pediatrics helps to implement restrictive form of blood transfusion. so that it improves patient outcomes by managing a patient's own blood through diagnosis and etiology-specific treatment of anemia and preserving the patient's own blood by minimizing blood loss and bleeding while promoting patient safety and empowerment. It reduces the utilization of health care resources as well as expenditures, transfusion dependency, and the risks and complications of transfusion. [9]

Blood is inappropriately utilized from the 2018 study, on utilization of blood and blood products among pediatric patients admitted to SPHMMC. So knowing its outcome is also important for better understanding of potential negative consequences and it also helps to identify factors affecting clinical improvement. The data can also be used to design a national guideline on form of blood transfusion.

2. Literature review

A descriptive retrospective study done in the Pediatric wards of the University of Nigeria Teaching Hospital, Enugu, to determine the indications, practices and outcomes of transfusion on children.(published in 2013).[3]

Two hundred and thirty-eight transfusions were given amongst 95 patients, at a ratio of 2.5 transfusions per patient.in 12 months (January to December 2011). Since their objective was to review non-emergency blood transfusions given to patients on admission, the transfusions given at Emergency Room transfusions were not included in the review. There were 789 admissions in the pediatric wards and NICU and a total of 325 blood transfusions were given within the review period, given a prevalence of transfusion to be 41.2%. Out of the 325 transfusions given, 238 transfusions had complete data and were reviewed. The indicators of the transfusion were: malignancy (31.7%), sepsis (15.1%), sickle cell anemia (12.1%), malaria (10.0%), hyperbilirubinemia (10.0%), HIV/AIDS (8.3%), nephrotic syndrome (7.2%) and malnutrition (5.4%). Whole blood (56.4%) and sedimented cells (36.3%) were the main types of blood transfused. About 96.4% were transfused the appropriate volume of blood.

The mean Hemoglobin increase was 3.1g/dl and 12.8% of the recipients recorded a Hb increase of ≥ 5 g/dl. The mean duration of transfusion was 4.6 hours and 59.7% of the transfusions exceeded the recommended four hours. Pulse and respiratory rates returned to normal post-transfusion in 26.1 and 21.8% of the recipients respectively. In 10% of the transfusions, there were minor adverse events; chills/fever (5.1%), itching (3.4%), hypothermia (1.0%) and vomiting (0.5%). This study concluded Blood transfusion in this tertiary institution is not common and is mainly due to non-communicable diseases. The duration of most transfusions was unduly prolonged and transfusion-related adverse events are rare.

A prospective descriptive study was conducted in Three Hospitals in Gabon, Africa to assess the indication and Outcomes of Pediatrics Blood transfusion in 9 months period from 1 January to 30 September 2016, Published in 2020.[6]

Children between the ages of 1 month and 15 years, who were hospitalized and transfused, were included in the study. They included 287 children who represented 17.1% of all hospitalized children. The average age was 3.7 years. Blood cell counts were performed before and 48 hours after the transfusion. Hemoglobin was interpreted according to WHO criteria for anemia.[10] They also documented the blood type of each patient and the donor, blood volume transfused, duration of transfusion, adverse reactions if documented, diagnosis and clinical course. Packed red blood cells (PRBC) were administered to 99.3% of anemic patients. World Health Organization (WHO) defined severe anemia (hemoglobin (Hemoglobin) <7 g/dL) was the main indication (95.1%). The volume of PRBC transfusion was calculated by the formula $20 \text{ ml} \times \text{body weight in kg}$ in 82% (n=237) of the patients, by the formula $(\text{hemoglobin level targeted} - \text{measured hemoglobin}) \times 3 \times \text{weight in kg}$ in 12% (n=35) of the patients, and otherwise for 6% (n=15) of the patients.

The mean hemoglobin (Hb) level pre- transfusion being $5.1 \text{ g/dL} \pm 2.7 \text{ g/dL}$, and post-transfusion hemoglobin gain being $2.9 \text{ g/dL} \pm 1.2 \text{ g/dL}$. Malaria was present in 79% of transfused patients and 46.9% of children screened were homozygous for sickle cell disease. Platelet concentrate and fresh frozen plasma were each used in one patient.

The clinical course was favorable for 98.3% (n=282) of patients and was unfavorable for 5 patients (1.8%), of whom 3 (1%) were transferred to a higher-level structure and 2 died due to disease process (0.7%). Severe malaria in its anemic form was the diagnosis in each of these cases.

Whole blood is no longer distributed in this country although some facilities on the continent still use it. It is less effective in correcting anemia, exposes to volume overload and represents one of the risk factors associated with the mortality of transfused children. The blood volume to be transfused contributes to the effectiveness of the transfusion by targeting a post-transfusion hemoglobin level. No post-transfusion adverse reaction has been reported but documentation accuracy is unknown.

However, in most developing countries including Ethiopia, whole blood is most commonly transfused. A 1-year hospital-based retrospective audit was conducted to analyze the utilization of blood components and patient outcomes at the Black Lion Specialized Hospital blood transfusion service, published in 2016.[11]

The study was conducted between October 2010 and January 2011. Patients who received at least one transfusion at Black Lion Specialized Hospital from September 2009 to August 2010 were considered as study participants.

The sample size was calculated by using the estimation of the single population proportion formula and sample size was 373. A list of patients registered at Black Lion Specialized Hospital was used as a sampling frame in which we found 4,750 subjects who were transfused in the 1-year study time. Systematic random sampling was used to select study subjects. Retrospective data on blood and blood component recipients and usage of blood were recorded from the hospital blood bank log book. Details including gender, age, hematological profiles of the patient, the number of units that were expired (outdated) before utilization, type and amount of blood component transfused, the health professional who ordered the transfusion, the department from which the request was issued and patient improvement status were noted. Patient improvement in this study was defined as better clinical outcomes of patients such as the absence of clinical symptoms and/or reduced length of stay in the hospital, as determined by the physician attending the patient, as obtained from the patient file.

From the total 373 transfusion recipient records audited, 361 (96.8%) of the data were complete. The median age of the transfusion recipients was 35 years, of whom 96 (26.6%) were in the age group of 21–30 years (10% were less than 20 years). The most widely used blood and blood component type was whole blood 307 (85%). Of the total 361 transfusion events during the study time, 2 patients had no status report available and 291 (81.1%) of the patients showed improvement. Out of the total non-improved cases, 66.2% were those transfused with whole blood and 33.8% resulted from blood component transfusion.

A cross-sectional prospective study was conducted in 3 month period, from May 01 to July 30, 2021, on 616 individuals who requested blood transfusion at Yekatit-12 Hospital, Addis Ababa, Ethiopia. This study assess Blood Transfusion Utilization and Patient Outcomes, published in 2022.[2]

All transfused individuals of any age during the study period and fulfilling inclusion criteria were included. The data was collected by using a checklist that was developed following a thorough review of the literature from different sources and including information related to the socio-demographic condition and medical status. The checklist contains sections for assessing demographics, blood transfusion-related information, and associated factors. Records regarding the reason for transfusion, unit of blood requested, type of blood group requested, type of blood component requested, a unit of blood cross-matched, units of blood utilized after cross-match, and outcomes of recipients after transfusion were collected by reviewing the recipient's cards, and laboratory blood bank logbooks by using structured pretested check-list. Details including gender, age, a hematological profile of the patient, the number of units that were expired (outdated) before utilization, type and amount of blood components transfused, the health professional who ordered the transfusion, the department from which the request was issued and patient improvement status was noted. Transfused patients with the absence of clinical symptoms, with improvement in hematological profile after transfusion and/or reduced length of stay in the hospital were defined as showing better improvement.

The total number of patients who have transfused during the study period and fulfilled the inclusion criteria was 616. Out of 616 individuals requested for cross-match with a mean age of 43 years, 53.2% were males; 1498 blood units were transfused for 615 individuals with an overall average transfused blood unit of 2.43. In this study, the most utilized blood type was blood group O (47.6%), and the RH type was RH positive (83.6%). The most utilized blood component was the whole blood component which accounts for 55.9% in a medical ward, 65.5% in the surgical ward, 79.2% in an emergency ward, 63.4% in gynecology wards, and 84.7% in other wards. No documentation from pediatrics ward.

The overall prevalence rate of improvement status after transfusion was greater than 73.9 and the overall prevalence rate of non-improvement status after transfusion was 11.11%. The study also showed that there were no post-transfusion reactions during the study period.

3. Objective

3.1. General Objective;

To assess outcomes and associated factors of blood and blood component transfusions in pediatric patients admitted at SPHMMC

3.2. Specific objectives;

To assess immediate clinical outcomes of blood and blood component transfusions in the pediatrics department at this hospital

To determine laboratory outcomes of blood and blood component transfusions

To evaluate associated factors of blood and blood component transfusion outcomes

4. Methodology

4.1. Study area

This study was conducted in St. Paul's hospital millennium medical college pediatric department. St Paul's Millennium Medical College, as it is known today, was established through a decree of the Council of Ministers in 2010, although the medical school opened in 2007 and the hospital was established in 1968 G.C by the late Emperor Haile Selassie. It is governed by a board under the Federal Ministry of Health. The college has more than 2800 clinical, academic and administrative and support staffs that provide medical specialty services to patients who are referred from all over the country, teaching medicine and nursing students and doing basic and applied research. While the inpatient capacity is more than 700 beds, The College sees an average of 1200 emergency and outpatient clients daily. (<https://sphmmc.edu.et/about>)

4.2. Study design and period

Descriptive cross-sectional prospective study was conducted for the study period from September 1, 2023, to November 30, 2023 G.C. Data was collected from blood bank log book and patient charts. From the blood bank log book blood and blood product requests from the pediatric department were identified and card number of these patients collected. Patient card review was done following each transfusion episodes regarding diagnosis, indication for transfusion, type of blood product the amount of blood product that the patient took, duration of transfusion, clinical and laboratory outcomes.

4.3. Study population

All pediatric patients (0-14 years) admitted to St. Paul millennium medical collage who took any form of blood transfusion from 1 September 2023 to 30 November 2023

4.4. Inclusion criteria

All pediatric patients admitted to each pediatric unit who took any form of blood transfusion in the study period and has complete information.

4.5. Exclusion criteria

All neonates who took blood for exchange transfusion and incomplete information was not be included in the study

4.6. Sample Size Determination and Sampling Technique

Since the study is a prospective cross-sectional study. Using nonrandom Purposive sampling technique, all pediatric patients who were admitted to the pediatric department and transfused with any form of blood and blood component except neonates for whom exchange transfusion done, from September 2023 to November 2023, were included in the study.

4.7. Data collection

Data collection was done by using structured and pre-tested questionnaire. The questionnaire will include demographic variables, indications of transfusion, clinical and hematology outcomes. Two questionnaires were prepared, one for age above 4 month and the other for age below 4 month which is according to WHO pediatrics transfusion guidelines[4]. It was prepared in English and was modified based on the pretest results before the study period. Data was collected from blood bank logbook and chart review by trained data collectors (trained nurses) working in the pediatrics department. Relevant laboratory results were included pre and post-transfusion. The clinical outcomes were assessed by changes in vital sign and general condition of the patient (respiratory condition, pallor and bleeding tendencies) after transfusion. The primary investigator rechecked data collection forms to ensure their completeness and accuracy.

4.8. Dependent and independent variables

Dependent variable

Clinical outcome

Independent variable

Age

Sex

Hemoglobin level
Platelet count
Indication for transfusion
Underlying disease
Type of blood component transfused
Amount of blood transfused
Duration of transfusion
Pediatrics unit of transfusion

4.9. Data processing & analysis

After data collection, each data was checked for completeness manually. The data was entered into SPSS version 26 statistical package. Frequencies and percentages were calculated for all variables that are related to the objectives of the study. The extent of blood prescribed, utilized, and transfusion outcomes were checked. Descriptive statistics was used to describe the independent variable. The bivariate and multivariate analysis was done to see the association between dependent and independent variables using binary logistics regression. The level of statistical significance was set at a 95% confidence interval. A P-value of less than 0.05 was considered statistically clinically significant. Finally, the result presented by using tables and narrative forms.

4.10. Data Quality Assurance

The questionnaire was pretested and the pretest results were not included in the study. The data was collected using a questionnaire after orientation has given to all data collectors regarding the procedures to be followed during the data collection. In addition, the collected data was reviewed and checked for completeness and consistency daily.

4.11. Result Dissemination Plan

After completion, the results of the research will be presented to SPHMMC's Department of pediatrics and child health. The findings will be published in a relevant scientific journal and disseminated online so that they can be of use for other academic researchers and clinical practitioners. The data can also serve as a baseline for future studies.

4.12. Ethical Consideration

Ethical clearance was obtained from ethical committee of SPHMMC. Confidentiality of participants were ensured using codes rather than names

4.13. Operational definitions

- 1. Pediatric age;** means age less than 14 years of age
- 2. Blood components;** are PRBC, platelet, FFP.
- 4. Pediatric department:** includes Pediatric emergency, PICU, NICU, pediatric ward (general ward, hemato-oncology & surgical ward).
- 5. clinical improvement;** determined by better of improvement of patient's clinical condition such as the symptoms or vital signs, pallor, bleeding tendencies following transfusion as obtained from patient file. Average time of clinical outcome assessed 6 hours of post transfusion.
- 6. Laboratory improvement;** expected rise in HGB per volume of transfusion. The usually recommended Whole blood transfusion volume of 20 ml/kg and PRBC of 10ml/kg should raise the Hgb concentration by approximately 2.7 g/dl.

5.0. Result

5.1. Demographic characteristics of the study participants

From the total 290 pediatrics department transfusion requests recorded in the blood bank 262 (90 %) of transfusion episodes were having complete data and given to 194 individuals making a transfusion ratio of 1.4 transfusions per patient.

From the total of 194 participants included in the study, the majority of the patients were male 108 (55.7%). As shown in **table 1**, the median age of the transfusion recipients was 3 year, of whom 50(25.8%) were under 1 month of age followed by under five and 5 to 10 years of age 49 (25.3%) each. Most of transfusions were during the day time 122 (62.9%) and the remaining 72(37.1%) were transfused during the night time or duty hours.

5.2. Blood and blood component transfusion pattern in pediatrics unit

According to this study found the most widely used blood component transfused was PRBC 107(40.8%) followed by PLT and whole blood 63 (24.0%) and 47 (17.9%) respectively.

PRBC only was transfused for 72(37.1%) followed by PLT and whole blood only, 25(12.9%) each. Patients transfused with FFP alone in the study were 21 (10.8%).

Participants were also transfused with a combination of two blood and blood components, majority were PRBC with PLT consisting 20(10.3%). In addition 11(5.6%) participants' received more than two components of blood. **Table 2**

The pediatrics department that ordered blood transfusion mostly was PICU 49(25.3%). Secondly, NICU 45(23.2%), PHO ward 37(19.1%), pediatrics emergency 34 (17.5%) and pediatrics ward 26 (13.4%) were among the most utilizers. **Figure 1**

Table 1 : Demographic characteristics of patients transfused with blood and blood components at SPHMMC, September to November, 2023

Variables	Frequency	Percent
Time of transfusion		
Day time	122	62.9
Night or duty time	72	37.1
Total	194	100.0
Gender		
Male	108	55.7
Female	86	44.3
Total	194	100.0
Age		
Neonates/ <1 month	50	25.8
Infants/<1 year	32	16.5
Under 5 year	49	25.3
5- 10 year	49	25.3
Above 10 year	14	7.2
Total	194	100.0

Table 2: type of blood and blood components transfused September to November 2023 at SPHMMC, pediatrics department.

Type of blood component transfused	Frequency	Per cent	Transfusion episodes	frequency	percent
whole blood only	25	12.9	Whole blood	47	17.9%
PRBC only	72	37.1	PRBC	107	40.8%
PLT only	25	12.9	PLT	63	24.0%
FFP only	21	10.8	FFP	45	17.1%
whole blood ,PRBC	2	1.0	Total	262	100.0%
whole blood,PLT	4	2.1			
whole blood,FFP	8	4.1			
PRBC,PLT	20	10.3			
PRBC,FFP	3	1.5			
PLT,FFP	3	1.5			
whole blood,PRBC,PLT	3	1.5			
PRBC,PLT,FFP	5	2.6			
whole blood,PRBC,PLT,FFP	3	1.5			
Total	194	100.0			

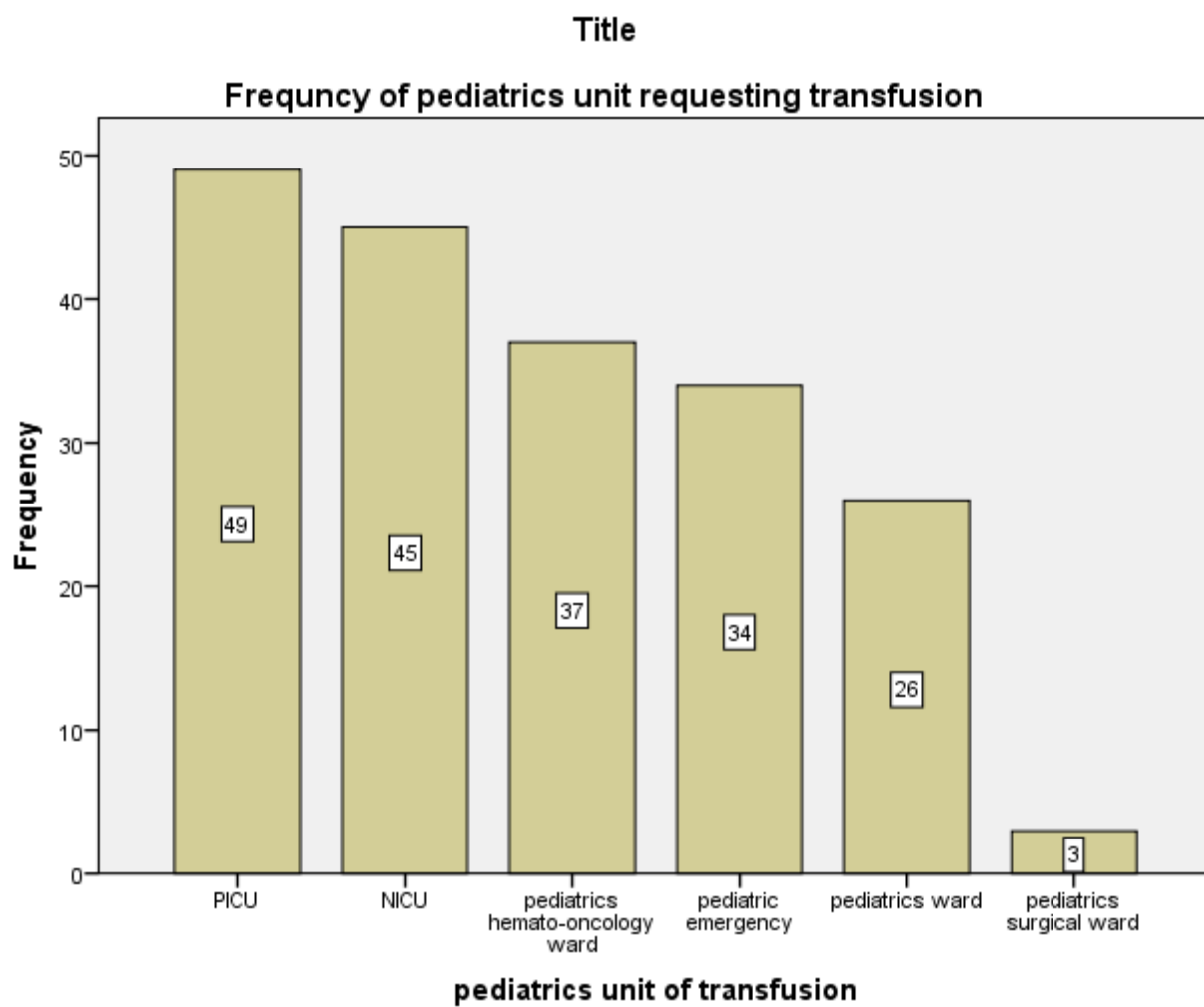


Figure 1: Frequency of pediatrics unit requested blood transfusion at SPHMMC, September to November 2023.

5.3. Selected Pre and Post-Transfusion hematologic parameters

This study was done according to WHO blood transfusion guideline and most of the transfusion 88.9 % were transfused based on the guideline's recommendation. Peripheral morphology was done for only 35(18.0%) of 194 participants before they received any forms of blood and blood components. The duration of transfusions was documented in all the cases. The mean duration of transfusion was 3 hours and there was no duration of transfusion exceeded the recommended 4 hours. There was no report of transfusion reaction detected in this study.

Severe anemia according to the WHO classification Hgb <7 g/dl was found in 43.6% (n=64) of transfused patients Hemoglobin levels below 5 g/dL were found in 11.6% (n=17) patients. Those transfused with liberal form of transfusion Hgb above 7g/dl were 83 (56.4%). In this study, the pre-transfusion and post-transfusion hematological parameter results (hemoglobin and PLT) of transfused individuals were measured. The current research indicated a significant change in post-transfusion blood cell parameters were seen compared with the laboratory results of the pre-transfused hematological findings of the individuals (P value < 0.05). (Table 4). There was an increase in post transfusion Hgb with a mean Hgb increase of **2.75 g/dl**. See (figure 2.)

Table 3 common diagnosis of transfused participants SPHMMC, pediatrics department, September to November 2023

underlying disease of patient	Frequency	Percent
Severe sepsis	57	29.4
Hematologic malignancy	34	17.5
Pancytopenia 2 to?	19	9.8
Hemolytic anemia (HDN, AIHA,HUS..)	16	8.2
Severe acute malnutrition	13	6.7
Hemorrhagic shock/blood loss	13	6.7
solid tumors	9	4.6
Anemia of prematurity	8	4.1
ITP	5	2.6

5.4 Clinical profile of participants

As this study found severe anemia/ thrombocytopenia secondary to severe sepsis 57 (29.4%), hematologic malignancy 34(17.5%) and pancytopenia 19 (9.8%) were the main diagnoses of the transfused participants (Table 3).

Over all clinical improvement of participants was assessed using improvement in vital signs clinical pallor, respiratory distress for those participants who took whole blood or PRBC and clinical improvement of participants who were transfused with platelet and FFP assessed with presence or absence of bleeding diathesis after completion transfusion. The result showed 142(73.2%) of participants had clinical improvement whereas 52(26.8%) did not improve clinically. .(table 5) Of those who did not improve clinically whole blood only transfusion accounts 16 out of 52 which makes 30.7 per cent.(table 6)

Table 4 Hematological Parameters Before and After Whole Blood and Blood Component Transfusion, SPHMMC, September to November 2023

Variable	Level	Pre transfusion	Post transfusion	p-value
Hemoglobin	Hgb level < 5g/dl	17 (11.6%)	2 (1.4%)	< 0.01
	Hgb level 5-7 g/dl	47 (32.0%)	16 (10.9%)	
	Hgb level 7.1-10	50 (34.0%)	69 (46.9%)	
	Hgb level above 10 g/dl	33 (22.4%)	60 (40.8%)	
	Total	147 (100%)	147 (100%)	
Platelet	Level			< 0.01
	Less than 10k	22 (35.5%)	13 (21.0%)	
	10-20k	18 (29.0%)	21 (33.9%)	
	21-50k	14 (22.6%)	13 (21.0%)	
	51-100k	6 (9.7%)	12 (19.4%)	
	Above 100k	2 (3.2%)	3 (4.8%)	
	Total	62 (100.0%)	62 (100.0%)	

Table 5: Clinical outcomes of participants at SPHMMC pediatrics department, September to November 2023

Clinical outcome	Frequency	Per cent
Improved	142	73.2
Not improved	52	26.8
Total	194	100.0

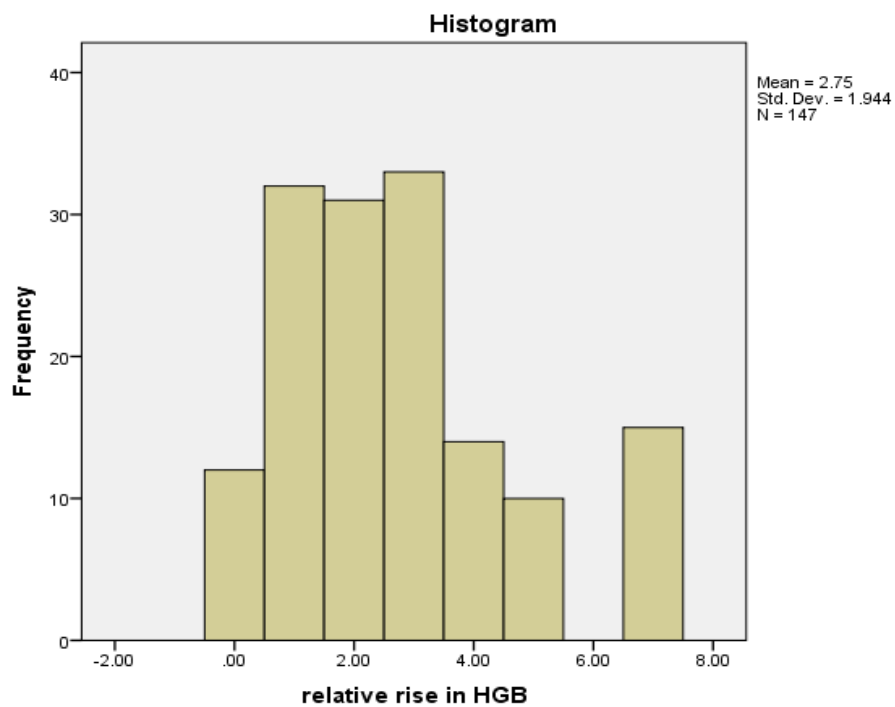


Figure 2: The relative rise in post-transfusion Haemoglobin in patients with different pre-transfusion haemoglobin

Table: 6 Patient clinical improvement status stratified by the type of blood and blood components transfused, SPHMMC

Type of blood and blood component	Improved	Not improved	Total
Whole blood only	9 36.0%	16 64.0%	25 100.0%
PRBC only	66 91.7%	6 8.3%	72 100.0%
PLT only	19 76.0%	6 24.0%	25 100.0%
FFP only	12 57.1%	9 42.9%	21 100.0%
Whole blood, PRBC	1 50.0%	1 50.0%	2 100.0%
Whole blood,PLT	2 50.0%	2 50.0%	4 100.0%
Whole blood,PRBC,PLT	2 66.7%	1 33.3%	3 100.0%
PRBC,PLT,FFP	5 100%	0 0.0%	5 100.0%

5.5 .Factors affecting patient improvement status following transfusion

In binomial logistic regression, the overall patient improvement status following transfusion showed statistically significant association with gender ($P=0.015$), type of blood and blood component transfusion ($P=0.000$), pediatrics unit ($P=0.005$), hematologic improvement($P=0.011$). However, when 95% CI for the adjusted odds ratios were calculated among these variables, by using multinomial logistic regression significant associations were found between the overall improvement status of the patients with type of blood component transfusion, pediatrics unit, and hematologic improvement.

Patients transfused with blood components showed significant improvement status when compared with those transfused with whole blood only. Those transfused with PRBC were 4 times more likely to improve than those transfused with whole blood(AOR=4.948,95%CI=2.086-11.736).

Patients transfused at PICU were 6 times more like to improve clinically than those transfused at pediatrics emergency (AOR= 6.784, 95% CI=1.773-25.948, P-value=0.005) and those transfused at NICU showed 4 times more improvement compared to pediatrics emergency(AOR=4.400,95% CI=1.133-17.093, P.value=0.032).

However, there was no significant difference in the overall improvement by difference in gender, age group, diagnosis of patient, level of Hgb before and after transfusion. (table 7).

Table 7 Determinants of patient improvement at SPHMMC, pediatrics unit, September to November 2023 (multinomial regression)

Variable	Imp	Not Imp	P-value	COR(95% CI)	AOR (95%CI)	P-value
Age						
Neonatal	26	24		1	1	
Infancy	15	17	0.651	1.228 (0.505-2.986)	3.115(0.297-32.630)	0.343
Under 5 year	26	23	0.916	0.958(0.435-2.110)	2.510(0.228-27.620)	0.452
5-10 year	25	24	0.922	1.040(0.473-2.288)	2.135(0.201-22.664)	0.529
Above 10 year	4	10	0.129	2.708(0.749-9.794)	3.638(0.298-44.361)	0.311
Sex						
Male	45	63		1	1	
Female	51	35	0.015	2.040(1.147-3.628)	0.787(0.401-1.544)	0.485
Blood and blood components						
Whole blood only	9	16		1	1	
PRBC only	66	6	0.000	0.051(0.016-0.165)	4.948(2.086-11.736)	0.000
PLT only	19	6	0.006	0.178(0.052-0.607)	1.155(0.513-2.598)	0.728
FFP only	12	9	0.155	0.422(0.128-1.385)	0.564(0.242-1.312)	0.184

Pediatrics unit						
p. emergency	31	3		1	1	
p.ward	19	7	0.074	3.807(0.877-16.526)	4.060(0.917-17.981)	0.065
PICU	30	19	0.005	6.544(1.753-24.427)	6.784(1.773-25.948)	0.005
NICU	32	13	0.037	4.198(1.089-16.178)	4.400(1.133-17.093)	0.032
PHO	29	8	0.148	2.851(0.689-11.796)	2.985(0.697-12.786)	0.141

Imp- clinically improved, Not-imp --- not clinically improved

6.0. Discussion

This cross sectional descriptive study aimed to assess blood and blood component transfusion , outcome and associated factors in SPHMMC, pediatrics department.A total of 262 episodes of

blood and blood component were transfused to 194 patients over 3 months period to all pediatrics age group including neonates. The median age of transfusion recipients was 3 year.

The median age of transfusion is similar to study done in paediatric settings of Gabon, Africa 2016, including clinical indications and subsequent outcomes.[6]

According to this study the most widely used blood component transfused was PRBC 107(40.8%) followed by PLT and whole blood 63 (24.0%) and 47 (17.9%) respectively. The finding is similar to study done on same institution with the aim of assessment of utilization of blood transfusion 5 years back[8]. When compared with study of Gabon, Africa, 2016, PRBC were administered to 99.3% of anemic patients. Whole blood is no longer distributed in this country[6]. But in Nigerian study, Whole blood (56.4%) and PRBC (36.3%) were the main types of blood transfused.[3] The higher utilization of component transfusion may be related to good clinical outcome.

In the current study, Severe anemia according to the WHO classification (Hgb < 7 g/dl) or transfused with restrictive form were 43.6% (n=64), whereas 83 (56.4%) of participants received blood in a liberal form (Hgb above 7g/dl). But, no statistical significance clinical outcome difference detected between liberal and restrictive form of transfusion in this study.

Hemoglobin levels below 5 g/dL were found in 11.6% (n=17) patients. There was an increase in post transfusion Hgb with a mean Hgb increase of **2.75 g/dl**.

Similar studies at three hospitals of Gabon Africa, WHO defined severe anemia (Hgb <7 g/dL) was the main indication (95.1%) with the mean Hgb level pre- transfusion being 5.1 g/dL $\pm$ 2.7 g/dL, and post-transfusion hemoglobin gain being **2.9 g/dL $\pm$ 1.2 g/dL**. [6]

Nigerian study showed Pre-transfusion hemoglobin concentrations of 15.2% of the transfused children were <5g/dl, 42.9% were within the range of 5g/dl to 7g/dl. The mean Hemoglobin concentration increase was **3.1g/dl**. [3]

The higher severe anemia in Gabon may be due to co-occurrence of, malaria and sickle cell disease (Malaria was present in 79% of transfused patients and 46.9% of children screened were homozygous for sickle cell disease).

WHO recommends that restrictive rather than liberal hemoglobin thresholds for red blood cell (RBC) transfusions are efficacious and safe in both neonates and children.[4]

Over all clinical improvement of participants was assessed using improvement in vital signs clinical pallor, respiratory distress for those participants who took whole blood or PRBC and clinical improvement of participants who were transfused with platelet and FFP assessed with presence or absence of bleeding diathesis after completion of transfusion. The result showed 142(73.2%) of participants had clinical improvement whereas 52(26.8%) did not improve clinically. Of those who did not improve clinically whole blood only transfusion accounts 16 out of 52 which makes 30.7 percent. Study in Gabon, Africa, the clinical course was favourable for 98.3% (n=282) of patients and was unfavourable for 5 patients (1.8%). The difference can be due to the underlying diseases of the two populations are different, severe sepsis and hematologic malignancies are common in the current study while malaria was the most common indication in the study done in Gabon.[6] Clinical outcomes of Nigerian study showed Pulse and respiratory rates returned to normal post transfusion in 26.1 and 21.8% of the recipients respectively, in this study underlying diagnosis of participants were similar to the current study.[3]

A 1-year hospital-based audit was conducted to analyses utilization of blood components and patient outcomes at the Black Lion Specialized Hospital between October 2010 and January 2011. Of the total 361 transfusion events 291 (81.1%) of the patients showed improvement. For patients who did not clinically improve, 45 (66.2%) were those transfused with whole blood.[11] similar study done at Yekatit 12 Hospital, out of a total of 616 transfusion episodes; 525 (85.2%) of the patients showed better improvement after transfusion.[2] But, in those studies their population includes both children and adults and cannot be generalized to children.

In the current study, Patients transfused with blood components showed significant improvement status when compared with those transfused with whole blood only. Those transfused with PRBC were 4 times more likely to improve than those transfused with whole blood which is in line with study on black lion, Ethiopia [11] and study in Gabon, Africa.[6]. The non improvement due to whole blood transfusion may be related to the higher risk of volume overload and low level of hematocrit concentration compared to PRBC transfusion.

Patients transfused at PICU were 6 times more like to improve clinically than those transfused at pediatrics emergency (AOR= 6.784, 95% CI=1.773-25.948, P-value=0.005) and those transfused at NICU showed 4 times more improvement compared to pediatrics

emergency(AOR=4.400,95% CI=1.133-17.093, P.value=0.032).This can be explained by most of component transfusions particularly PRBC was consumed by such units or can also be explained by other supportive cares given in the ICU setup like ventilation support but this needs further research.

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7.0. Limitation and strength of study

Since it is not multicenter study and non-random sampling technique it might not be fully representative. Assessment of platelet improvement in this study was difficult, since most of platelet transfusions were not according to recommendations due to inadequate availability of platelets in the setup.

Primary data is used in the study.

8.0. Conclusion and Recommendation

8.1. Conclusion

The study found that severe anemia/thrombocytopenia secondary to severe sepsis was the commonest indication for transfusion followed by hematologic malignancy. Peripheral morphology was done for only 35(18.0%) of 194 participants before they received any forms of blood and blood components.

Liberal form of transfusion was more common than restrictive form 83 (56.4%) and 64 (43.6%) of participants respectively. But, no statistically significant clinical outcome difference detected between liberal and restrictive form of transfusion in this study

There was an increase in post transfusion Hgb with a mean Hgb increase of 2.75 g/dl.

The result showed 142(73.2%) of participants had clinical improvement whereas 52(26.8%) did not improve clinically. Of those who did not improve clinically whole blood only transfusion accounts majority of cases. PRBC was the major component transfused and it is significantly associated with better clinical improvement compared with those transfused with whole blood. No report of transfusion reaction was detected in this study. Better clinical improvement was seen in those patients transfused at PICU and NICU compared to those transfused at pediatrics emergency.

8.2. Recommendation

Responsible bodies should focus on PRBC transfusion than whole blood transfusion since the clinical outcome of PRBC is better than whole blood.

Better clinical improvement in PICU and NICU needs further study.

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Questionnaire

This questionnaire is designed for the assessment of outcomes and associated factors of blood and blood component transfusion among pediatric patients admitted to SPHMMC from September 2023 to November 2023.

My name is Dr. Zelalem Dagnachew, pediatrics and child health resident at SPHMMC

Card No. -----Time of transfusion; day time-----night time-----

PART 1:Socio Demographic factors

1. Age.....

2. Sex M.....
 F.....

3. Weight.....

PART 2: Assessment of indications (based on WHO pediatrics blood transfusion Guideline) and outcomes of blood product transfusion

1. Pediatric unit ordered the transfusion

- A. Pediatric emergency
- B. Pediatric ward
- C. Pediatric ICU
- D. Neonatal ICU
- E. Pediatric surgical ward
- F. Pediatric hemato-oncology ward

2. Blood product transfused

- A. Whole blood
- B. PRBC
- C. Platelet
- D. FFP

3. Peripheral morphology prior to transfusion-----yes-----NO-----if yes, result-----

4.0. Indication for whole blood/PRBC (for age < 4 months)

- A. Hb < 7 g/dL with low reticulocyte count and signs of anemia
- B. Acute blood loss of ≥ 15 -20% of total blood volume
- C. Hb < 10 g/dL requiring O₂ (nasal cannula, CPAP <6cm, Fio₂<35%)
- D. Hb < 12 g/dL requiring O₂ (CPAP/MV with > 6-8 cm FIO₂> 35%)
- E. Hb < 15 g/dL with severe pulmonary or cyanotic heart disease/CHF/
- F. Inappropriate

✓ Indication for whole blood/PRBC (for age > 4 months)

- A. Hb < 7 g/dL with low reticulocyte count and signs of anemia
- B. Acute blood loss of ≥ 15 -20% of total blood volume
- C. Hb < 8 g/dL (with sign and symptoms of anemia and bone marrow failure)
- D. Hb < 13 g/dL with severe cardiopulmonary disease/ECMO
- E. Inappropriate

4.1 underlying disease (diagnosis) of the patient.....

4.2 HGB value prior to transfusion.....,after transfusion.....

4.3. Amount of whole blood/PRBC transfused

- A. 5-10ml/kg
- B. 10-15ml/kg
- C. 15-20ml/kg

4.4 Duration of transfusion of whole blood/PRBC.....hr

4.5 clinical condition prior to **PRBC/whole blood** transfusion

BP.....
PR.....
RR.....

SPO2.....

Respiratory distress; yes....NO.....

Pallor.....

Clinical condition after **PRBC/whole blood** transfusion

BP.....

PR.....

RR.....

SPO2.....

Respiratory distress; yes....NO.....

.pallor.....

4.6 Any transfusion reaction detected (specify if present and how was it managed.....

5. **Platelet transfusion indication?(< 4 months of age)**

A. Platelet <30,000

B. Platelet count < 50,000/ μ L (50 x 10⁹/L) with bleeding, or prior to minor surgery

C. Platelet count < 100,000/ μ L (100 x 10⁹/L) in a sick premature infant, or prior to major surgery

D. Qualitative platelet defect with bleeding

E. Inappropriate

✓ **Platelet transfusion indication(> 4 months of age)**

A. Platelet <10,000 due to hypo proliferative thrombocytopenia

B. Platelet count < 50,000/ μ L prior to an invasive procedure

C. Platelet count < 80,000/ μ L unexplained excessive bleeding during the procedure.

D. Inappropriate

5.1 Value of platelet before transfusion.....After transfusion.....

5.2 Underlying disease condition.....

5.3 The amount of platelet transfused

A.5-10 ml/kg

B.10-15 ml/kg

C.

>15 ml/kg for ITP

D. Inappropriate

5.4 Duration of transfusion of platelet.....

5.5 bleeding before transfusion.....yes....NO.....bleeding after
transfusion.....yes.....NO.....

6. If FFP transfused; what was the indication?

A. DIC

B. Coagulation factor deficiency (liver disease)

C. clinical evidence of coagulopathy with bleeding, laboratory results are
pending;

D. Inappropriate

6.1 The amount of FFP transfused

A.10-15ml/kg

B. Inappropriate..

6.2 bleeding before(YES/NO) FFP.....after FFP.....