ADDIS ABABA UNIVERSITY COLLEGE OF HEALTH SCIENCE SCHOOL OF MEDICINE

DEPARTMENT OF MEDICAL LABORATORY SCIENCES

ASSESSMENT OF BLOOD AND BLOOD COMPONENTS UTILIZATION IN BLACK LION SPECIALIZED HOSPITAL, ADDIS ABABA, ETHIOPIA

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By

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List of Abbreviations

ACHS	Australian Council on Health care Standards
BTS	Blood Transfusion Services
BSCH	British Committee for Standards in Haematology
CAF	Cryo Precipitated Antihemophilic Factor
CPB	Cardio Pulmonary Bypass
ELISA	Enzyme Linked Immuno Sorbent Assay
EQUAS	External Quality Assurance
EHCB	Effective Health Care Bulletin
FFP	Fresh Frozen Plasma
FNHTR	Febrile None-Hemolytic Transfusion Reaction
HIT	Heparin Induced Thrombocytopenia
ITP	Immune Thrombocytopenic Purpura
HIV	Human Immunodeficiency Virus
HLA	Human Leukocyte Antigen
PRC	Packed Red Blood Cell
PTP	Post Transfusion Purpura
RBC	Red Blood Cell
RDP	Random Donor Platelet
SDP	Single Donor Apheresis Platelet
TACO	Transfusion Associated Circulatory Overload
TA-GVHD	Transfusion Associated Graft Versus Host Disease
TRALI	Transfusion Related Acute Lung Injury
TTI	Transfusion Transmitted Infections
TTP	Thrombotic Thrombocytopenic Purpura

Abstract

Background: Assessment of blood and blood components utilization is an important tool to reduce inappropriate transfusions and helps to show the frequency of blood and blood component utilization, recipient status by pre- and post- transfusion assessments in addition improved and not improved after transfusion. However in Ethiopia the regular audit and assessment of the transfusion practice is not well studied.

Objective: To assess utilization of blood and blood components for transfusion at Black Lion Specialized Hospital, Addis Ababa Ethiopia.

Methods: A one year (September 2009 to August 2010) hospital based retrospective study was conducted to analyze the pattern of blood component utilization in Black Lion Specialized Hospital blood transfusion service effected from October 2010 to January 2011.There were about 4,570 transfusion episodes and 10,836 units of blood were transfused. Using estimation of single population proportion formula and systematic random sampling we selected 373 subjects and collected information from the existing blood bank log book on ABO and RH blood group, amount of transfusion episodes, and type of blood administered. In addition, data on sex, age, profession, level of education and department of the health worker, type of blood component, and amount of unit administered, prevalence of unexpected reaction, pre- and post transfusion examinations including improvement status. Data was analyzed for descriptive statistics, univariate and multivariate analysis using SPSS version 15.0 software (SPSS INC Chicago IL, USA).

Results: - Of 361 transfused study subjects 856 units of blood were transfused with the mean of 2.37 units. Of the transfused 188(52.1%) were Females. The most widely used blood and blood component type in this study was whole blood 307 (85%) and the combination of two blood products were given to 27(7.5%). Plasma was transfused only for single patient (0.3%). There were no transfusion reactions after transfusion. Out of the total none improved cases, 45(66.2%) were those transfused with whole blood transfusion. The proportion of improvement after transfusion according to service ranged from 69.0% to 100%. When 95% CI for the adjusted odds ratios were calculated among these variables, significant associations were found between the overall improvement statuses of the patient with their profession of the health worker ordered the transfusion and type of blood and blood product administered.

Conclusion: - The overall utilization of blood and blood components were similar to other developing countries. However, transfusion of blood components was very low and there were high rate of whole blood transfusion. The prevalence rate of patient improvement status after transfusion was high.

1. Introduction

Blood transfusion practice is the administration of blood component or plasma derivatives to the patient according to the current requirements of national guidelines and laws. Errors in the practice of transfusion medicine have given rise to serious and sometimes fatal consequences for patients. The need for a better blood component transfusion service in the health system has become increasingly obvious in recent years. A lot of progresses have been achieved in utilizing blood component transfusion services to provide guidance for appropriate transfusion and therapeutic actions in the developed world (1). In the contrary, blood component transfusion services in many developing countries are in their infancy at best. Thus, blood transfusion service is not properly guided and monitored by context related evidences. The introduction of blood component treatment has had a major impact on the practice of transfusion, providing a larger number of therapeutic units from a single donation of blood. Specific replacement treatment for the patient's needs is provided and the safety and efficiency of blood transfusion is thereby enhanced (2, 3).

Each unit of whole blood can be separated in to several components that can be transfused in to patients depending on their medical requirements. Successful transfusion therapy depends on providing each patient who needs a transfusion with the right blood component, at the right time, and for the right reason. Red blood cells (RBC) are indicated for increasing the oxygen carrying capacity in anemic patients. In addition, it increases intravascular volume and improve platelet function, particularly in uremic patients. Considerations in ordering RBC transfusion include cause of anemia and degree of anemia as measured by hemoglobin or hematocrit. One unit of RBC can be expected to result in a hemoglobin increase of 1 g/dl or hematocrit increase of 3% in a typical adult. One unit of RBC can replace a blood loss of 500 ml (4).

Platelets are indicated for the prevention or control of bleeding due to thrombocytopenia or platelet dysfunction. Platelets may be provided as pooled whole-blood derived platelet concentrates ("random donor" platelets) and as apheresis platelet concentrates ("single donor" platelets). For most patients these products are equally effective. Apheresis platelets are indicated for patients with immune refractoriness when crossmatched or Human Leukocyte

Antigen (HLA) matched platelets have better post-transfusion survival. Considerations in ordering platelet transfusions includes current platelet count, cause of thromobocytopenia, underlying disease, etc… Transfusion of one platelet pool and one unit of apheresis platelets will typically increase the platelet count of an adult by 20,000 – 40,000/μL. A post-transfusion platelet count should be obtained 10 minutes to 1 hour after transfusion for best assessment of transfusion effectiveness. Platelet transfusion is contraindicated in thrombotic thrombocytopenic purpura (TTP) and heparin-induced thrombocytopenia (HIT). Serious adverse events have occurred with platelet transfusion in these settings. Platelet transfusion is relatively contraindicated in immune thrombocytopenic purpura (ITP) or post-transfusion purpura (PTP) because the survival of transfused platelets is extremely brief. Blood components, especially platelet concentrates, due to their short shelf-life, are frequently in limited supply and their appropriate use is required to ensure their availability for patients who really need them (4,6).

Plasma is provided as Fresh Frozen Plasma (FFP) or Liquid Plasma ("single donor" plasma). FFP is plasma within 24 hours of thawing. After 24 hours, thawed plasma may be relabeled as liquid plasma and stored at 4°C for up to 5 days. Liquid Plasma has essentially the same coagulation factor content as FFP and may be used interchangeably for most patients. Plasma may be transfused for replacement of any plasma protein deficiency, usually coagulation factor deficiency. Plasma transfusion is mostly indicated for coagulation factor deficiency. Concentrates are available for Factor VIII and Factor IX, and are preferable to plasma in patients with these deficiencies and dilutional coagulopathy due to massive transfusion. A dose of 10 ml/kg will typically provide sufficient coagulation factors to achieve hemostasis. Factor levels in donor plasma are variable, but can be assumed to be approximately 1 IU/ml (3-6).

Cryoprecipitate or cryoprecipitated antihemophilic factor (CAF or "cryo") is a concentrate of Factor VIII, von Willebrand's factor, fibrinogen, and Factor XIII. It is not a significant source of other coagulation factors and cannot be used as an alternative to plasma. Each unit contains a minimum of 80 IU of Factor VIII and typically 250 mg of fibrinogen. It is generally indicated for Factor VIII deficiency, Von Willebrand's disease, hypofibrinogenemia, Factor

XIII deficiency, etc… For Factor VIII replacement, the dose can be calculated assuming 80 IU per bag. For fibrinogen replacement, the dose can be calculated assuming 250 mg per bag. For other indications, cryoprecipitate is usually given as 1 unit per 10 kg, or a pool of 10 units for an adult (4, 5).

The transfusion of blood and blood components plays a fundamental role in the management of various pathologies and is, sometimes, a life-saving treatment. It is, however, an expensive and limited resource. Over the last 20 years there has been a progressive increase in demands for this product, mainly as a result of the advances in oncohematological therapies and the increase in major surgery. The achievement of self-sufficiency in blood and its derivatives, a goal destined to be affected also by changes in the demographic characteristics of the population, is a priority for all health care systems (1, 6).

On the other hand, the risk of disease transmission associated with incompatibility resulting from non red cell antigens like plasma product or HLA, non- infectious transfusion diseases like volume overload and iron overload, are resulted from non targeted transfusion of whole blood. To avoid or minimize such risks, transfusing the appropriate specific blood component by keeping the dosage is mandatory.

To achieve the foregoing goal, each step in the process of blood transfusion, starting from the physician who orders a transfusion to the actual administration of the ordered components, should be validated. A well-organized blood transfusion service (BTS), with quality systems in all areas, is a prerequisite for safe and effective use of blood and blood products (1). Thus, evaluation of the utilization of blood components is an important tool to reduce inappropriate transfusions and utilization of the blood products. The aim of this study is, therefore, to retrospectively assess the utilization of blood and blood components at Black Lion Specialized Hospital in Addis Ababa, Ethiopia.

1.1. Statement of the problem

The decision to transfuse, like any other therapeutic decision, should be based on the risks, benefits, and alternatives of treatment. Unfortunately, data regarding the indications for transfusion are frequently not available and recipients run the risk of both over transfusion and under transfusion. The goal of assessing blood utilization is to ensure effective use of limited blood resources. Appropriate blood transfusion can be a life-saving intervention and it is used to supply of blood and blood products that is safe, accessible at reasonable cost and adequate to meet national needs and the appropriate clinical use of the products. However, like all treatments, it may result in acute or delayed complications and carries the risk of transfusion-transmissible infections, including HIV, hepatitis viruses, syphilis, malaria and trypanasomiasis (5).

Inappropriate utilization of blood component results in wastage, high cost, and immunological and non-immunological reaction; immediate and delayed immunological reactions, non-immune mediated reactions and transfusion transmitted infections. Appropriate transfusion by following the guidelines and having the required pre- or post-transfusion assessments are helpful.

Following inappropriate utilization of blood and blood products the following transfusion related complications may resulte, such as immediate hemolytic transfusion reaction, immune-mediated platelet destruction, febrile non-hemolytic reaction, anaphylactoid/anaphylactic reactions, and delayed transfusion reactions like transfusion-related acute lung injury (TRALI), delayed hemolytic reaction includes post transfusion purpura (PTP), transfusion-associated graft-versus-host disease (TA-GVHD), transfusion-associated circulatory overload (TACO), and metabolic complications may accompany large-volume transfusions. The blood component support is more challenging practice, so a thorough understanding of various blood components and indications for each is critical when making the decision for transfusion (3, 5).

1.2. Literature Review

Many studies were conducted in different countries on the utilization of blood and blood components. A retrospective audit of 200 transfusion episodes was performed in five hospitals in London involving the use of platelets or fresh frozen plasma. In 61.5% of cases the reason for using the components was not stated. Inadequate documentation of the use of blood components occurred in 66% of cases. An accepted clinical indication for the use of components was evident in only 36% of the total; inappropriate use of FFP was particularly apparent (7).

In a similar study on the appropriate use of blood products in adult patients in a Venezuelan general hospital, it was shown that seven hundred patients who had an average of 2.45 transfusions were studied. Prevalence of appropriate use was 51.3% for all departments. Prevalence by departments was: 72% for medicine, 36% for surgery, 56% for emergency, and 47% for obstetrics. Using the department of medicine as a reference group, it was found that the department of surgery, emergency and obstetrics had a higher risk of in appropriate use of transfusions, The study revealed that, the prevalence of appropriate use of blood product was 51% with packed red blood cell and fresh frozen plasma with the lowest prevalence of appropriate use (8).

In another study done on Canadian general teaching hospital as part of a quality assurance program, a retrospective audit of transfusion practices for packed red blood cells, fresh frozen plasma and albumin was undertaken with predetermined criteria. Of 520 transfusion episodes with 1218 units of packed red blood cells given to 297 patients 88% were considered appropriate; of 106 episodes with 405 units of fresh frozen plasma given to 83 patients 90% were deemed appropriate; and of 187 episodes with 320 units of albumin given to 99 patients 64% were considered appropriate (9).

A study in the United States of America showed that RBC unit expiration rates, RBC unit wastage rates and to examine hospital blood bank practices associated with more desirable (lower) rates. Red blood cell unit expiration rates were 0.1% or less at the 90th percentile and

above, 0.3% to 0.9% at the 50th percentile, and 3.5% or greater at the 10th percentile and below. Red blood cell unit wastage rates were 0.1% or less at the 90th percentile and above, 0.1% to 0.4% at the 50th percentile, and 0.7% or greater at the 10th percentile and below (10).

Blood management is most successful when multidisciplinary, proactive programs are in place so that; these strategies can be individualized to specific patients. Although the alternatives can be used individually with success, they are most effective when used together in a blood management strategy that is individualized to a specific patient. From the studies in the various parts of the world, the blood requirement in any modern city is remarkably consistent at about 40 units per 1,000 of the population per year, for example Denver and Sydney manage to supply 43 units per 1,000 of the population per year. Blood requirement in the Southeast Asia region is 15 million units against a collection of 9.3 million (4, 11).

Three different hospitals retrospective surveys were carried out in Wales public hospitals using medical records from 1 January to 31 August 2000. Out of the total 1147 transfused patients, 33% (136/414) of platelet, 37% (248/669) of FFP and 62% (37/60) of cryoprecipitate transfusions were assessed as inappropriate. By hospital type, 29% (75/259) of platelet transfusions were inappropriate at tertiary referral hospitals, 51% (40/78) at major urban hospitals, and 27% (21/79) at major rural hospitals. For FFP, 36% (112/313), 37% (80/216) and 39% (55/140) were inappropriate for referral, urban and rural hospitals, respectively. Cryoprecipitate was used almost exclusively at tertiary referral hospitals (12).

On the other hand, prospective monitoring of request forms has been shown to reduce rates of inappropriate transfusions significantly. This was demonstrated by a study conducted in Australia, Royal Melbourne Hospital (a tertiary teaching hospital) where rates of inappropriate transfusion episodes of red cells fell from 16% to 3%; platelets, 13% to 2.5%; and FFP, 31% to 15%. Almost all inappropriate FFP transfusion episodes post-intervention were due to failure to demonstrate prolongation of prothrombin or activated partial thromboplastin times more than 1.5 times the control value (13).

Inappropriate use of FFP as high as 73% and 69% have been reported from Singapore (14) and Malaysia (15), respectively. The study from an Acute General Hospital in Singapore which was conducted from October to December 2001 demonstrated out of the 932 units of FFP used during the study period for 359 transfusion episodes, only 98 (27%) episodes were seemed appropriate. The commonest reasons for inappropriate use were: FFP used in the setting of inadequately prolonged coagulation profiles, or absence of bleeding, or surgical interventions (14). Similarly, a retrospective analysis of blood bank request forms and work sheets during a 6-month period (January-June 1998) revealed that out of the 931 episodes of FFP transfusions only 31 % were for appropriate indications. The average FFP requirement when used for appropriate indication was about 4 units per episode, whereas for inappropriate indication it was 2.5 units per episode. Unlike the report from Singapore, there were differences among specialties. Inappropriate use in terms of the number of units was highest by the surgical services (68%) and orthopaedics (64%), while the Department of Pediatrics had the lowest incidence of inappropriate use (40%). When Pediatrics was used as the benchmark, the incidence of inappropriate use by other departments was significantly higher. Inappropriate usage were mainly related to the use of FFP for volume support in trauma, massive bleeding and burns, routine requests without identified indication in cardiac bypass surgery, and prophylactic use in the preoperative period. As for FFP usage in common clinical indications, there was a high incidence of inappropriate use in burns (82%), preoperative period (73%), cardiac surgery (68%), massive bleeding (62%) and trauma (60%) (15).

On the contrary, lower rates of inappropriate use of FFP have been documented in Italy (16). In this study, inappropriate requests for plasma decreased from 27% to 22.7% over a three years period (2003-2005). In addition, it was possible to classify the inappropriate requests for plasma on the basis of homogeneous, regionally defined criteria. The most frequent inappropriate indication (60.7% of the total) was the use of plasma in the case of hemorrhage in patients with a normal PT and/or PTT or unavailable results (16).

A study carried out in Ohio Medical College Hospital between April and July 1982, showed that out of the 364 units of fresh frozen plasma used 33% of the units were utilized for blood pressure support, 34% for clotting support, 14% for the combined reasons of blood pressure

and clotting support, 11% of the units were used during therapeutic pheresis, and the remaining 7% were used for unidentified reasons. Thirty nine percent of the FFP were given with red blood cells (17).

In another retrospective audit done at 5 hospitals in Iran, Gorgan city 1592 units of FFP issued to 346 patients from March 2006 to March 2007 showed that, there is a high rate of inappropriate FFP usage (53% of transfusion episodes). Most 'inappropriate' FFP usage occurred when there was active bleeding, with normal (or unmeasured) coagulation tests (30% of transfusion episodes). In only 66% of FFP-transfused patients were coagulation variable measured at any point in the hospital episode (18).

In a retrospective analysis of 3 years data (July 2005- July 2008), in India the relevant data regarding clinical details of patients and laboratory investigations were analyzed. During the study period, 26,400 whole blood units, 87750 packed RBC units and 105291 units of components (platelet concentrate, platelet rich plasma, and fresh frozen plasma) were transfused to patients. Ninety adverse events were reported; 24 of which occurred with the whole blood, 62 with PRBC, 03 with FFP and 01 with platelet concentrates (19). Another study from the same country revealed a wastage rate of 5.42% for different components. The orthopedics department was the one with maximum usage of whole blood in comparison to other departments and pediatrics used the least whole blood (20).

Over the years there is a decline in the inappropriate use of whole blood. Five years data from India (April 2003 to March 2008), involving 15,759 patients undergoing different types of surgeries was analyzed. The patients received a total of 37,142 units of whole blood, red cell concentrate, fresh frozen plasma (FFP), platelets and cryoprecipitate. The whole blood utilization reduced significantly during the five years. Among the specialties, the maximum awareness regarding blood component use was observed in the cancer surgeons. In 2003 – 2004 nobody asked for cryoprecipitate but from 2006 onwards there was demand for this component also. There was no significant change in component ordered per case. On average orthopedic surgeries used 2.14, gynecologist 2.07, cancer surgeons 3.7 and general surgeons 2.4 units/case. During five years significant increase was observed in utilization of blood

components for various surgeries. Over the years, whole blood and single unit demands significantly reduced and RCC, Platelets, FFP were used more frequently. This study helped to change the attitude of clinicians about blood component use for surgery and improve judicious use of blood (21).

In a similar study in Gujrat, India done from January 2008 to June 2008, 2242 units of FFP were used in 1,050 transfusion episodes to 788 patients. The inappropriate requests were 968 (43.18%) while FFP was used appropriately in 56.83% cases. The department of Medicine and plastic surgery were the departments with maximum number of inappropriate requests (22).

A six-month retrospective platelet audit was carried out from May to October 2005 by department of transfusion medicine, in Chandigarh, India to assess its preparation, appropriate utilization and wastage. Adult and pediatric hemato-oncology was the main user specialties utilizing 39.9 and 87.6% of the RDPs and SDPs prepared. Of the patients receiving RDPs, 95% were transfused ABO and Rh (D) group specific platelets whereas 100% SDPs transfusion were of groups' specific platelets. The result revealed that 88% of prophylactic platelet transfusions were appropriate as per the recommended BCSH guidelines. However, 12% of the prophylactic platelets were transfused inappropriately in a cardiopulmonary bypass (CPB) surgery with normal platelet counts and no evidence of bleeding related to platelets. Out of the 5,444 RDPs prepared, 1, 585 (29.11%) units were not utilized. Regular audit of blood and blood component is a must so that necessary remedial measures can be taken to maximize appropriate and judicious utilization of each component (23).

Taken together the aforementioned studies demonstrated that inappropriate utilization of blood and its components are very high while several studies revealed adverse reactions and transfusion related risks which indicate the need for improvement of many aspects of transfusion practices.

Adverse transfusion events occurring in India were retrospectively analyzed over 4 years (June 2004 to June 2008). Data was retrieved from transfusion reaction workup files and from patient records. During the study period a total 19,853 whole blood units, 17,038 packed red

cell units and 33,726 other component units (platelet concentrates, platelet rich plasma and FFP) were transfused to 22,412 patients. A total of 283 adverse transfusion events were reported, all were of immediate type. The incidence of adverse transfusion events ranged from 0.45% to 0.81% to and the commonest was allergic reaction followed by Febrile None-Hemolytic Transfusion Reaction (FNHTR). Among the acute hemolytic reactions, majority were due to improper storage and faulty administration. There were 2 instances of immune hemolytic transfusion reactions and 3 cases of transfusion associated cardiac overload. Acute reactions due to contaminated products were identified in 4 patients. However no delayed reactions were reported (24).

One year clinical audit of the use of blood and blood components in Nigeria to evaluate all blood and blood component transfusions over a period of one year from January to December 2004 was done. A total of 682 transfusion episodes were reviewed and analyzed. The commonest indication for use blood/blood component was severe anemia in 38% of cases. Twenty nine percent of transfusions for moderate anemia, and 36% of fresh frozen plasma transfusions were found to be unnecessary. Inappropriate transfusion is most marked in the setting of platelet transfusion with 81% of platelet transfusion being inappropriate (25).

A survey to establish the status of blood availability and safety in the African Region was conducted in 2004 and 2006. The requirement of blood for a population of over 773 million people is estimated at about 8 million units (10/1000 population), but currently a total of 3 191,784 units (about 41.5% of the demand) is being realized. The regional target for 80% voluntary non-remunerated blood donation has been attained by 19 of the 46 countries, four countries may be said to be in transition, but 21 are yet to collect 50% of their total blood supply from VNRBDs. The collection ratio per 1000 population is still at 4.15 ranging from 0.39 to 34.77. The total number of units of blood collected from the 44 countries during 2006 is 3,191,808 excluding the two countries, Equatorial Guinea and Liberia. The total population living in these 44 countries is 769,717,000 which represent 99.5% of the population in the WHO African region. The average annual blood collection rate in the Region in 2006 is 4.15 units per 1000 population, ranging from 0.39/1000 in Ethiopia to 34.77/1000 in Mauritius. Five countries have reached the level of more than 10 units/1000 of the population (26).

In Africa only forty countries have developed guidelines on appropriate clinical use of blood. On average, 74% of the total units of blood are still transfused as whole blood. Blood safety, however, remains a challenge to many countries in sub-Saharan Africa due to unstable economies, civil strife, natural and manmade disasters, and failure to translate government commitment to practical interventions that would lead to further improvement. Moreover, the African Region has the highest rates of infectious diseases transmissible through blood transfusion, high HIV prevalence (about 60% of the world's total prevalence). It has a prevalence of more than 8% of the hepatitis B surface antigen (HBsAg) and a prevalence of HCV as high as 2.5% to 10% in some areas (27-30)

Africa has the highest maternal mortality in the world with ratios estimated at an average of 1000 per 100,000 live births and accounted for 247,000 of the 500,000 maternal deaths in the world in 2000; 16 up to 40% of maternal deaths are attributable to hemorrhage. Malaria has an even higher death toll in Africa. Of the estimated annual one million deaths due to malaria in the world, 90% occur in Africa south of the Sahara. Mortality due to severe malarial anemia is considerable in the region (31,32).

Ethiopia has a population of around 74.7 million; its overall health status is poor even when compared to other low Human Development Index HDI countries. Iron deficiency is seen in 85% of children aged under five and in 50% of women of child-bearing age. The national requirement for blood is for between 80,000-120,000 units per year. Collection levels supply only 43% of this. Most of these units are transfused without being separated in to components, only very few of the blood collected are separated by aphaeresis procedure (33,34).

1.3. Rationale of the study

All the 46 member states in the WHO African Region are signatories and commit themselves in promoting the establishment of a safe, efficient, cost effective and sustainable nationally-coordinated blood transfusion service. Despite the fact that Ethiopia is on accelerating the improvement of its blood transfusion service, little is known about the utilization of blood and blood component transfusion services in health facilities. The plans to alleviate the health delivery system cannot be achieved without adequate focus on improving quality of blood transfusion service. As the transfusion practice is largely dependent on regular audit and assessment of the transfusion procedure, there is a need to assure provision of blood products according to the guideline.

Transfusion practice is a challenging process and most of the episodes are given as whole blood for the aim of preventing transfusion related complications and economical reasons, it needs to be separated in to different blood components, rather than administering in to a single patient. The judicious use of these blood components will provide optimal clinical benefit to patients and optimal utilization of the available resources of donor blood.

However, in most of developing countries including Ethiopia; blood is mostly transfused without being separated in to components, despite there is very low volunteer blood donation habit and very high risk of transfusion acquired infections. While the hospital is the only referral center for hematological malignancies and all kinds of cancers as well as handling large numbers of surgeries, studies addressing its blood and blood components utilization are very limited. To our knowledge, there are no published reports.

Thus, this study is intended to provide evidences about the utilization of blood and blood components; as pattern of transfusion, wastage rate, expiry rate and most commonly used blood component. This study can also serve as bottom line information for other similar studies.

2. Study Objective

2.1. General Objective

- To assess utilization of blood and blood components for transfusion at Black Lion Specialized Hospital, Addis Ababa, Ethiopia.

2.2. Specific objective

- To evaluate the pattern of blood and blood components utilization at Black Lion Specialized Hospital
- To evaluate the selected hematological profile before and after blood and blood component transfusion at Black Lion Specialized Hospital

2.3. Hypothesis

- Blood component utilization is similar to that reported for other developing countries.

3. Material and Methods

3.1 Study design

A hospital based retrospective study was used to assess the utilization of blood and blood component.

3.2. Study sites

The study was conducted in Addis Ababa which is the capital city of Ethiopia. Addis Ababa has a population size of 2,738,248 million with annual growth rate of 2.1 (35). Currently, there are ten public hospitals in Addis Ababa under the Regional Health Bureau, the Federal Ministry of Health and Addis Ababa University. This study was conducted at Black Lion specialized teaching hospital which is one of the university hospitals in Ethiopia and the largest last level referral hospital.

3.3. Study period

The study was conducted between October 2010 and January 2011 on data of patients transfused from September 2009 to August 2010.

3.4. Population

3.4.1. Source population

- All patients in Black Lion Specialized Hospital who have received transfusion

3.4.2. Study population

Patients who received at least one unite of blood and blood component transfusion at black lion specialized hospital from September 2009 to August 2010 and selected by systematic random sampling technique.

3.4.3. Sample size

The required sample size is determined by using estimation of single population proportion formula considering the following assumptions:

- Proportion of 50% (is taken due to absence of reliable previous study that show blood and blood component utilization)
  - ♦ Level of significance = 0.05
  - ♦ Marginal of error (d) = 5%
  - ♦ Non-response rate = 5%
  - ♦ sample size = n

The formula for calculating the sample size (n) is:

$$n = \frac{(Z_{\alpha/2})^2 P(1-P)}{d^2}; \qquad n = \frac{1.96^2 \times 0.5 \times 0.5}{0.05^2} \qquad n=384$$

- Finite population correction factor $\frac{n \times N}{n + N} = \frac{384 \times 4570}{384 + 4570} = 354.24 \simeq 355$
- When the 5 % of non response rate is considered $17.75 \simeq 18$
- With the above assumption, the calculated sample size found to be $355 + 18 = 373$

3.4.4. Sampling Procedure

- A list of patients registered at Black Lion Specialized Hospital registration book were used as a sampling frame in which we found 4,750 subjects were transfused during the study time period and to select study subjects' systematic random sampling was used.

  $K = N/n = 4{,}570/373 = 12.25$

  $K = 12$

  So, from the first 12 was selected by lottery method and individual samples were selected every 12^{th} interval.

The blood bank laboratory was observed using structured observation checklist (annex III).

3.4.5. Inclusion and exclusion criteria

3.4.4.1 Inclusion criteria

All the transfusions recorded in hospital log book and patient card at least containing the following information were taken as study subjects:

- Patient hospital ID,
- Age,
- Sex,
- Type and amount of blood component transfused,
- ABO and Rh blood group ,
- Type and amount of blood component transfused,
- Post-transfusion status of the patient, and
- The health professional who ordered the transfusion and department.

3.4.4.2 Exclusion criteria

All the transfusions recorded in hospital log book and patient card not containing the following information were excluded:

- ABO and Rh blood group,
- Amount of unit give,
- Type of blood and blood product administered, and
- Department ordered

3.5. Study variables

3.5.1. Dependent Variable

- Blood and blood component utilization

3.5.2. Independent Variable

- Socio demographic information (Sex, Age, etc…)
- Hematological profiles
- The department ordered the transfusion
- Type of blood component transfused
- The amount of units administered

3.6. Measurement and Data collection

3.6.1. Data Collection Procedure

Four staff nurses and one medical laboratory technologist together with the principal investigator were involved in data collection. One of the staff nurse together with principal investigator acted as supervisor. Both the data collectors and supervisor were trained for two days with the objective of uniformity of the data collection instrument and with basic skill of extracting the data both from the blood bank log book as well as from patient's follow up card. Before the actual data collection, a pre-test of the instruments and the procedure was conducted and corrective measures were taken.

The structured pre-tested questionnaire (annex II) was used to extract information from the patient's card and blood bank log book like sex age, pre transfusion and post transfusion examination of the patient, the presence or absence of unexpected transfusion reaction, profession and level of education of the health worker who ordered the transfusion, department, type and unit transfused. The criteria set by the College of American Pathologists in 1994 were used as the standards the transfusion service (annex IV).

Data were also collected retrospectively on the number of transfusions performed in the Hospital and the number of blood component containing units that were transfused patients. The number of units that were expired (outdated) prior to being utilized, and the number that were wasted due to mishandling and the type of blood component transfused in relation to departments were also recorded.

3.6.2. Data Quality Control

Supervision was made by the supervisor together with the principal investigator. Pre-testing of the survey instruments, training of data collectors, and checking all the questionnaires for errors, completeness and logical consistency at the end of each day, and giving prompt feedback at the spot during the data collection process were the methods employed to ensure the quality of data.

3.7. Data Analysis and Interpretation

Data collected through a standardized questionnaire were entered into Excel spread sheet and transported into and analyzed by SPSS Version 15.0 software (SPSS INC, Chicago, IL, USA). Proportions, percentages and tables were used for description of the data as appropriate.

Descriptive statistics, student's t test, association, bivariate and multivariate logistic regression models were also used to examine the effect of selected variables on blood and blood component transfusion services by using Odds Ratio (OR) with a 95% Confidence Interval (CI). P-Value less than 0.05 were taken as statistically significant and Odds Ratio and Adjusted Odds Ratio and the 95% CI are also considered. Variables that were found with a statistically significant association ($p<0.05$) at univariate logistic analysis were entered and analyzed by multiple logistic regression analysis.

3.8. Operational Definition

- **Transfusion episode:** each transfusion event in which a patient was transfused**.**
- **Wasted Unit:** a blood component unit that was discarded prior to its expiration date due to undesired change in physical appearance (gross red blood cell contamination, lipemia, clot or gas formation), bag rupture or leakage during component preparation, loss of swirling or mishandling during storage (deviation from prescribed temperature range).
- **Expired Unit:** a blood component unit that was discarded because its maximum allowable storage time has reached.

- **Transfusion Service** — the personnel and physical plant devoted to all aspects of transfusion within the institution, including those within laboratory facilities that participated in this study.
- **Post-transfusion improvement** — it is defined by the physician and registered on the patient card.
- **Post-transfusion no improvement** — it is defined by the physician and registered on the patient card.

3.9. Ethical Considerations

Before the start of the data collection process ethical clearance was secured from Research Ethical Committee of Addis Ababa University Department of Medical Laboratory Sciences and the Institutional Review Board (IRB) of Addis Ababa University School of Medicine. Permission was also obtained from the study hospital (Black Lion Specialized Hospital). Full explanation about the purpose of the study was made to persons in charge of the health facility and the practicing health workers interviewed. The respondents were informed of their right to refuse or agree to be part of the study, or discontinue their participation whenever they feel the need. Confidentiality of the data was maintained during data collection.

4. Result

4.1. Demographic description

From the total 373 study subjects 361(96.8%) of the data were complete. Of the 361 transfused patients 188(52.1%) were females. The median age of the study subject was 35 years, 96 (26.6 %) being in the age group 21-30 years. In this study 131 (36.3%) of the blood transfused was blood group O and 328 (90.9%) of the blood was Rh positive. About 267(74%) of the patients were given 2 units of blood. About 258 (71.5%) of the blood transfusion was authorized by specialists (Table 1).

The total number of expired rate during the study time period was 1.1% collected from the from the blood bank laboratory data.

Table 1- Demographic characteristics of the study subjects transfused with blood and blood components at Black Lion Specialized Hospital; Addis Ababa, Ethiopia, September 2009 to August 2010.

Variable	Frequency	Percent (%)
Sex		
Male	173	47.9%
Female	188	52.1%
Age group		
<20	39	10.8%
21-30	96	26.6%
31-40	69	19.1%
41-50	62	17.2%
51-60	55	15.2%
>60	40	11.1%
ABO blood group		
A	123	34.1%
B	19	5.3%
AB	88	24.4%
O	131	36.3%
Rh blood grouping		
Rh +	328	90.9%
Rh-	33	9.1%
Persons authorized to administer blood in general		
BSC Nurses	34	9.4%
General Practitioners (GP)	69	19.1%
Specialists	258	71.5%
No of unit transfused		
One	15	4.2%
Two	267	74.0%
Three	41	11.4%
Four	6	1.7%
Greater than four units	32	8.9%

4.2. Type of blood and blood component transfused

The most widely used blood and blood component type was whole blood 307 (85%) and the combination of two blood products were given to 27(7.5%). Plasma was transfused only for single patient (0.3%). There were no transfusion reactions (Table 2).

Table 2. Type of blood and blood component transfused at Black Lion Specialized Hospital, Addis Ababa, Ethiopia, September 2009 to August 2010

Variable	Number	Percentage (%)
Whole blood only	307	85%
Plasma only	1	0.3%
Platelet only	4	1.1%
Packed Red Blood Cells only	20	5.5%
Two types of components[1]	27	7.5%
More than two components[2]	2	0.6%

[1] – Two types of blood and blood component are transfused for a single patient (whole blood & plasma, whole blood & platelet, whole blood & PRC, and platelet & PRC)

[2]- More than two types of blood and blood component are transfused at the same time for a single patient (whole blood, Plasma & platelet and whole blood, plasma & PRC)

4.3. Departmental consumption of blood products

Analysis of blood and blood component transfusion pattern by the department level showed that, majority of the transfusion was performed by surgical department 130 (36.0%) and the lowest 6 (1.7%) by the urology department (Table 3).

Among the transfusions within each department, in the medical ward 69(61.0%) were whole blood and no plasma was used. Moreover, about 96.15% of transfusion in surgery, 94.0% in Emergency ward, and 97.3% in gynecology, and 100% in urology were whole blood. Platelet was used 4(3.5%) by Medical ward only. More than one blood component was administered to a single individual by all the departments except urology department (Table 3).

Table 3: Distribution of blood and blood component utilization by departments at Black Lion Specialized Hospital stratified by type of blood product; Addis Ababa, Ethiopia, September 2009 to August 2010

Variable	Number	Percentage (%)
Medical		
Whole blood	69	61.0%
Plasma	0	0.0%
Platelet	4	3.5%
PRC[1]	18	15.9%
Combination of 2 blood products[2]	21	18.6%
More than two blood products[3]	1	0.01%
Total	113	100%
Surgery		
Whole blood	125	96.15%
Plasma	0	0.0%
Platelet	0	0.0%
PRC[1]	1	0.77%
Combination of 2 blood products[2]	4	1.54%
More than two blood products[3]	0	0.0%
Total	130	100%
Emergency		
Whole blood	64	94.0%
Plasma	1	1.5%
Platelet	0	0.0%
PRC[1]	1	1.5%
Combination of 2 blood products[2]	1	1.5%
More than two blood products[3]	1	1.5%
Total	68	100%
Gynecology		
Whole blood	43	97.73%
Plasma	0	0.0%
Platelet	0	0.0%
PRC[1]	0	0.0%
Combination of 2 blood products[2]	1	2.27%
More than two blood products[3]	0	0.0%
Total	44	100%
Urology		
Whole blood	6	100%
Plasma	0	0.0%
Platelet	0	0.0%
PRC[1]	0	0.0%
Combination of 2 blood products[2]	0	0.0%
More than two blood products[3]	0	0.0%
Total	6	100%

[1] PRC: Packed Red Cell

[2] When two type of blood products transfused for a single patient (whole blood & plasma, whole blood & platelet, whole blood & PRC, and platelet & PRC)

[3] More than two blood products transfused (whole blood, plasma & platelet and whole blood, plasma & PRC)

4.4. Pre transfusion and post transfusion selected hematological parameters

Out of the total 361 study subjects, post transfusion hematological parameters data was available for hemoglobin 358(99.1%), hematocrit 359 (99.4%), RBC count 337(93.4%) and total white blood cell count 193(53.5%). Data on the platelet count was available for only platelet transfused patients. Student t test shows there was clinically significant association between hemoglobin, hematocrit, red blood cell and white blood cells analysis at pre and post transfusion assessments (Table 4).

Table 4: Selected hematological parameters before and after blood and blood component transfusion at Black Lion Specialized Hospital; Addis Ababa, Ethiopia, September 2009 to August 2010

Variable	Pre-transfusion No	Post -transfusion no	Mean difference	No of paired	CI (95%)	P-value
Hemoglobin (g/dl)						
<7g/dl	57	48	-0.066	56	(-0.834- -0.468)	**0.000***
7-10g/dl	61	85	-1.180	61	(-1.376- -0.985)	**0.000***
>10g/dl	243	225	0.232	241	(0.169-0.295)	**0.000***
Total	361	358		358		
Hematocrit (%)						
<36%	175	199	-0.195	174	(-0.255- -0.136)	**0.000***
37%-54%	183	156	0.297	182	(0.223-0.370)	**0.000***
>55%	3	4.	1.333	3	(-0.100- 2.768)	0.057
Total	361	359		359		
Red blood cell count(10^{12}/L)						
<3.6 x 10^{12}/L	132	149	-0.236	123	(-0.315- -0.156)	**0.000***
3.6-6.0 x 10^{12}/L	200	178	0.219	192	(0.150-0.288)	**0.000***
>6 x 10^{12}/L	17	10	1.000	14	(0.680-1.320)	**0.000**
Total	349	337		239		
White blood cell count (10^{6}/L)						
<3 x 10^{9}/L	17	15	0.145	103	(0.025-0.266)	**0.018***
3-10.2 x 10^{9}/L	185	126	-0.090	100	(-0.170- -0.009)	**0.028***
>10.2 x 10^{9}/L	88	52	0.547	64	(0.399- -0.694)	**0.000***
Total	290	193		267		

* $p < 0.05$ (Clinically significant association)

4.5. Hemoglobin concentration levels among patients transfused with packed red cell only

Packed red cells (PRC) were transfused to 20(5.5%) patients; 6(30.0%) of them having a pre-transfusion hemoglobin (Hb) levels below 7g/dl, 10(50.0%) of them had pre-transfusion Hb levels between 7 and 10g/dl, 4(20.0%) had above 10g/dl (cut off values for severe, moderate and mild types of anemias respectively) (Table 5).

4.6. Platelet Count among patients transfused with Platelet only

twenty-one (95.5%) patients transfused with platelet had platelet count below 150 X 10^9/l and the remaining 5% had greater than 450 X 10^9/l (Table 5).

Table 5: Hemoglobin and platelet profile of patients before and after PRC and Platelet transfusion; Addis Ababa, Ethiopia, September 2009 to August 2010.

Hematological profile	**Before transfusion n(%)**	**After transfusion n(%)**
Hb value (g/dl)		
<7g/dl	6 (30.0%)	3(15.0%)
7-10g/dl	10(50.0%)	8(40.0%)
>10g/dl	4(20.0%)	9(45.0%)
Total	**20(100%)**	**20(100%)**
Platelet count(10^9/L)		
< 150 X 10^9/L	21(95.0%)	2(16.7%)
200 – 450 X 10^9/L	0(0.0%)	9(75.0%)
> 450 X 10^9/L	1(5.0%)	1(8.3%)
Total	**22(100%)**	**12(100%)**

4.7. Patient's response after transfusion

Of the total 361 transfusion episodes during the study time period 2 had no status report available and 291(81.1%) of the patient 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. From the total transfusion, 305 (84.5%) of the transfusion were whole blood. Out of them 45(14.8%) did not show improvement and the remaining two have no improvement status described on the patient card (Table 6).

Table 6: Patient improvement status at Black Lion Specialized Hospital stratified by type of blood components transfused; Addis Ababa, Ethiopia, September 2009 to August 2010.

Type of blood product	Patient status	
	Improved	**Not improved**
Whole blood	260(85.2%)	45(14.8%)
Plasma	1(100%)	0(0.0%)
Platelet	2(50%)	2(50%)
PRC	14(70%)	6(30%)
Whole blood & plasma	2(50%)	2(50%)
Whole blood & platelet	2(28.6%)	5(71.4%)
Whole blood & PRC	3(50%)	3(50%)
Platelet & PRC	5(50%)	5(50%)
Whole blood, Plasma & platelet	1(100%)	0(0.0%)
Whole blood, plasma & PRC	1(100%)	0(0.0%)
Total	**291(81.1%)**	**68(18.9%)**

The proportion of improvement after transfusion according to departments ranged from 69.0% to 100%. In view of that, the proportion of patients who showed improvement after transfusion for Medical, Surgery, Emergency, Gynecology and Urology were 69%, 80%, 92.6%, 93.2% and 100% respectively (Table 7).

Table 7: Patient improvement status at Black Lion Specialized Hospital stratified by services, Addis Ababa, Ethiopia, September 2009 to August 2010.

Departments	Patient status		
	Improved	Not improved	Total
Medical Ward	78(69.0%)	35(31.0%)	113
Surgery	105(80.8%)	25(19.2%)	130
Emergency	63(92.6%)	5(7.4%)	68
Gynecology	41(93.2%)	3(6.8%)	44
Urology	6(100.0%)	0(0.0%)	6
Total	**293(81.2%)**	**68(18.8%)**	**361**

4.8. Factors affecting patient improvement status on the transfusion service

In univarate analysis, overall patient improvement status on the transfusion service showed statistically significant association with profession of the health personnel who ordered the transfusion (p=0.007), type of blood product administered (p=0.042), department the transfusion was effected (p=0.036) and the number of units administered (p=0.017).

However, when 95% CI for the adjusted odds ratios were calculated among these variables, significant associations were found between the overall improvement statuses of the patient with their profession of the health worker who ordered the transfusion and the type of blood and blood product administered.

Those study subjects, who was ordered to be transfused by the General Practitioner, were 2 times more likely to show improvement than those who were transfused by specialists and BSc nurses (AOR= 2.278; CI 1.093-5.831).

Clients who were transfused with blood components showed different improvement status when compared with those transfused with whole blood only. Those transfused with packed red blood cell are 2 times more likely to improve (AOR=2.852; CI 1.018-7.994), those transfused with whole blood and plasma were 10 times more likely to improve (AOR=10.265; CI 1.254-18.371), those transfused with whole blood and platelet were 15 times more likely to improve (AOR=15.312; CI 2.789-32.971), those transfused with whole blood and PRC were 7 times more likely to improve (AOR=7.080; 1.316-38.073), and those transfused with platelet and packed red blood cell were 6 times more likely to improve than those transfused with whole blood (AOR=6.883; CI 1.816-26.097). However, there was no significant difference in overall improvement by difference in sex, age group, educational level, department and number of unit administered (Table 8).

Table 8: Determinants of patient improvement at Black Lion Specialized Hospital; Addis Ababa, Ethiopia, September 2009 to August 2010.

Variable	Dependent Variable		OR (95% CI)	P-value	Adjusted OR (95% CI)	P. value.
	Imp[1]. (fre.)[2]	Not imp[3].(fre.)				
Sex						
Male	136	37	1		1	
Female	157	31	0.726(0.427-1.233)	0.236	0.966(0.514-1.85)	0.913
Age Group						
<20	30	9	1		1	
21-30	78	18	0.833(0.284-2.441)	0.740	0.999(0.364-2.764)	0.998
31-40	60	9	1.083(0.428-2.743)	0.866	0.502(0.160-1.573)	0.237
41-50	47	14	1.667(0.586-4.737)	0.338	1.697(0.590-4.880)	0.327
51-60	45	10	0.857(0.323-2.277)	0.757	1.090(0.361-3.268)	0.879
>60	32	8	1.125(0.400-3.165)	0.823	0.899(0.272-2.974)	0.862
Profession						
Specialist	204	53	1		1	
GP[4]	65	4	4.222(1.472-12.112)	**0.007***	2.278(1.093-5.831)	**0.018***
BSC[3] Nurse	24	10	0.624(0.281-1.384)	0.246	0.592(0.094-3.727)	0.376
Educational level						
Specialization	243	53	1		1	
MD[5] (GP[4])	28	12	0.275(0.036-2.112)	0.432	0.869(0.077-9.827)	0.910
BSC[3]	17	1	0.147(0.011-1.979)	0.148	2.647(0.752-9.323)	0.130
Others	5	2	0.137(0.016-1.152)	0.067	4.640(0.516-4.176)	0.171
Type of blood product						
Whole blood	260	45	1		1	
Plasma	1	0	0.258(0.070-0.949)	**0.042***	0.000(0.000)	1.000
Platelet	2	2	0.429(0.129-1.428)	0.168	5.913(0.769-7.501)	0.088
PRC[6]	14	6	0.172(0.214-1.251)	0.022	2.852(1.018-7.994)	**0.042***
Whole blood & plasma	2	2	0.115(0.031-0.422)	**0.001***	10.265(1.254-18.371)	**0.030***
Whole blood & Platelet	2	5	0.086(0.008-0.967)	**0.047***	15.213(2.789-32.971)	**0.002***
Whole blood & PRC[6]	3	3	5.778(1.131-29.527)	**0.035***	7.080(1.316-38.073)	**0.023***
Platelet & PRC[6]	5	5	0.172(0.048-0.617)	**0.007***	6.883(1.816-26.097)	**0.005***
Three type of blood product	2	0	0.000(.000)	0.999	0.000(0.000)	0.999
Department						
Surgery	105	25	1		1	
Medical ward	78	35	0.531(0.294-0.958)	**0.036***	1.434(0.731-2.815)	0.294
Emergency	63	5	3(1.093-8.234)	**0.035***	0.358(0.119-1.078)	0.047
Gynecology	41	3	3.254(0.932-11.366)	0.064	0.315(0.086-1.152)	0.081
Urology	6	0	0.0(0.00)		0.000(0.000)	0.999
Number of unit						
One	13	2	1		1	
Two	226	41	0.848(0.184-3.898)	0.832	1.272(0.232-6.982)	0.782
Three	33	8	0.635(0.119-3.395)	0.595	1.563(0.245-9.975)	0.637
Four	6	0	0.000(0.000)	0.999	0.000(0.000)	0.999
>four	15	17	0.136(0.026-0.702)	**0.017***	5.595(0.882-35.486)	0.068

Note: fre. means frequency; [1] improved after transfusion [2] not improved after transfusion [3] BSC Nurse Nurse who have Bachelor of Science, [4] MD (GP[5]) Medical doctors (General Practitioner) not have specialization, [6] PRC Packed Red blood Cell

5. Discussions

In this retrospective study, we aimed to investigate the utilization of blood and blood components at Black Lion Specialized Hospital, Addis Ababa, Ethiopia. It showed that a total of 361 transfusions episodes and 856 units of blood were transfused with the mean of 2.37 units of blood transfused per patient at Black Lion Specialized Hospital from September 2009 to August 2010. Comparative result was also found in Venezuelan general university hospital (8) by studying 700 patients who showed an average of 2.45 transfusions. A similar study at a on Canadian general teaching hospital (9) revealed a total of 813 transfusion episodes with 1943 units resulting an average of 2.39 units were administered.

The current study showed that whole blood transfusion rate was 307 (85%), 20(5.5%) of PRC, and 34(9.5%) of other components (plasma, platelet, combination of two and more than two types of blood components). In contrast to our finding a study in India showed they utilized 28.1% whole blood, 24.1% PRC and 47.8% of other components (platelet, plasma and FFP) transfused (21). In another five years audit in India (22) showed whole blood and single unit utilization reduced and the utilization of blood component increased.

When the departmental consumption of whole blood and blood components was analyzed, 61.06% of the total transfusions in medical ward were as whole blood and no plasma was ordered. Whereas, 96.15% of the transfusions in surgery, 94.11% in emergency ward 94.11%, 97.73% in gynecology and 100% in urology departments were with whole blood.

The possible explanation this could be lack of awareness on blood component usage, even if it is advantageous both immunologically and economically. The use of blood components instead of giving whole blood is beneficial. This can be achieved by making sure that strict adherence to transfusion guidelines, provision of refreshment courses and training by creating maximum awareness and changing the attitude of clinicians about blood component use and improves judicious use of blood. This creates consciousness about the use advantage of administering blood component instead of whole blood transfusion.

This study highlighted that post transfusion platelet counts was not available for 45.5% of patients having platelet transfusions. Alike our finding, a retrospective study on the use of platelet and fresh frozen plasma done in London (9) showed inadequate documentation of the use of blood component occurred in 66% of the cases.

Our justification for the above result is we observed only post transfusion platelet analysis only but in the study done in London they investigated the whole documentations required after transfusion. In addition they also observed documentations related to the use of all types of blood components administer in their setting not only limited to platelet transfusion.

This study showed that the prevalence of expiration rate were 1.1%. In contrast in a study done in the United States of America (10), the prevalence of expiration rate was less than 0.1%. The reason for the high expiration rate in the hospital resulted from the management of blood and blood components the principle of first in first out by cheking all the nessesary laboratory investigations like ABO and Rh blood grouping and cross matching techniques. Since other investigations required were done in the Ethiopian red cross society blood bank.

The present study showed that, when 95% CI for the adjusted odds ratios were calculated, significant associations were found between the overall improvement statuses of the patient with the profession of the health worker who ordered the transfusion and type of blood and blood product administered. Those clients, who were ordered to be transfused by General Practitioner), were 2 times more likely to show improvement than those who were ordered to be transfused by specialists and BSc nurses (AOR= 2.278; CI 1.093-5.831). In addition, clients who were transfused with blood components showed significant improvement when compared with those transfused with whole blood ranging from two times (AOR=2.852; CI 1.018-7.994) in packed red cell to fifteen times more likely in whole blood and platelet (AOR=15.312; CI 2.789-32.971. However, there was not a significant difference in overall improvement by difference in sex, age group, educational level, department and number of unit administered.

This can be partially expressed that specialized physicians handle critical patients according to the hospital referral system as a result their improvement status is very low when compared with General Practitioner (GP) this might contribute to their improvement. When the blood component transfusion compared with whole blood it showed up to fifteen times more improvement than those transfused with whole blood. This indicates that administration of separated blood product for a specific reason is more efficient to treat and economical as well, especially for countries like Ethiopia with very low annual blood collection rate.

6. Strength and Limitation of the Study

6.1. Strengths of the study

- Although there are studies which focused on examining the utilization of blood and blood components elsewhere, to our knowledge this is the first study in Ethiopia that specifically assess the utilization of blood and blood components.

6.2. Limitations of the study

- The study had limitations like service access, budget constraints, and the habit of keeping patient record, etc… which may limit generalizability of our findings.
- The exact reasons for transfusion and required clinical investigations were barely available it limits us from categorizing as appropriate and inappropriate transfusion.
- Exact cause of transfusion reactions after transfusion could not be determined.
- Data on post transfusion assessment were barely available.

7. Conclusion and Recommendation

7.1. Conclusions

Based on the findings of this retrospective study we conclude that, the overall utilization of blood and blood component was comparable to other developing countries. However, blood components usage was very low. This may affects negatively in attaining the objectives of effective utilization of blood and blood components. The presence of high expiry rate and whole blood administration were the major problems found in providing economical transfusion service. The overall prevalence rate of non-improvement status after transfusion was 18.8%. The study also showed that, there were no post transfusion reactions during the study time period. Post transfusion clinical examination and hematological profiles were barely available; this does not allowed us from conducting transfusion audit.

7.2. Recommendations

According to our findings, we would like to recommend the following points that we believed will help to improve the transfusion practices. Further research on the blood component transfusion including appropriate collection, transportation, storage and registration of blood products and documentation of all the important patient information on the patient card by attaching laboratory and other data including post transfusion assessments are important. High expiry rate can be improved by strengthening hospital transfusion team. This helps to promote safe and effective transfusion practice supporting the implementation of transfusion-related education and training, performing regular transfusion audit, and preparation and implementation of protocols and guidelines based on national and local evidence of best practice. Trainings on blood component usage for those engaged in the service is mandatory to use this precious product economically. Our transfusion indication should focus on blood components rather than whole blood as it benefits the patient and economical as well. Finally regular auditing of blood and blood component utilization could improve the transfusion service and it alleviates an increased demand for blood and blood components.

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Addis Ababa University School of Medicine Department of Medical Laboratory Sciences

Annex I: English Version Questionnaire Consent

Informed Consent Form

Questionnaire for data collection on assessment of blood and blood component utilization in Black Lions Specialized Hospital

Identification: _____

Type of Faculty _____ Name of faculty _____

Institution code _____

Hello, how are you? My name is _____ I am currently a student of Addis Ababa University, Department of Medical Laboratory Sciences, going to conduct a survey. I would like to interview you few questions about the utilization of blood and blood components in the hospital and identify factors that affect appropriate utilization of blood and blood components which will be important to improve the utilization. Your cooperation and willingness in the interview will be very helpful in identifying problems related to the issue. Your name will not be written in the form and assure you all the information you give will be kept strictly confidential. Your participation is voluntary and you are not obliged to answer any questions that you do not want to answer. If you are not comfortable with the interview please feel free to stop at any time you like. With your permission, I will use a tape recorder to ensure accuracy of the data collection.

Do I have your permission to continue? Yes ☐ No ☐

If yes, continue to the next page for the interview

Interviewers name _____ Signature _____

Date of interview _____ Time started _____Time finished _____

Supervisors name _____ Signature _____

I thank you for your cooperation.

Annex II: Patient Data Extraction form

Addis Ababa University School of Medicine, Department of Medical Laboratory Science

Patient Data Extraction form for data collection on the assessment of blood and blood component transfusion service at Black lion specialized Hospital, Addis Ababa Ethiopia.

101	patient card number:_____	Patient code: _____
102	Sex of the patient	1. Male 2. Female
103	Age of the patient	
104	Profession of the health worker	1, Nurse 2, Physician 3, Specialist (specify) 4, Other (specify)
105	Level of education	1. BSC 2. MSc 3. MD 4. Specialization 5. Other
106	Department	1, Medical ward 2. Surgery 3, Emergency 4. Gynecology 5, Other (specify)
107	Diagnosis or findings of the patient	Lab. Result: Hb:_____ Hct_____ Blood Group &Rh_____ CBC;_____ Others:_____
		Clinical exam.

108	The type of blood or blood component transfused	1, Whole blood 2, Plasma 3, Platelet 4, Packed red blood cell 5, Other (specify)
109	How many unit of blood/blood component ordered	1. One unit 2. Two unit 3. Three unit 4. Four unit 5. > 4 unit
110	Post transfusion examination of the patient	Lab. Result: Hb:_____ Hct_____ CBC;_____ Others:_____
		Clinical exam.
	Patient improvement status after transfusion	1. Improved 2. Not improved 3. If other
111	Does the patient have unexpected transfusion reaction	1. Yes 2. No 3. Don't know

Annex III: Observation Checklist for Blood Bank

Addis Ababa University School of Medicine, Department of Medical Laboratory Science

Observation checklist for data collection on the assessment of blood and blood component transfusion service at Black lion specialized Hospital, Addis Ababa Ethiopia.

General Information		
301	Sex of the health worker	1. Male 2. Female
302	Profession of the health worker	1. Nurse 2. Med Lab technologist 3. Physician 4. Health officer 5. Other
303	Level of education	1. Diploma 2. BSC 3. MSc 4. MD 5. Other
304	Does the blood bank have policies and procedures • to ensure that blood related equipment identification, calibration, maintenance, and monitoring of equipment conforms to these standards and other specified requirements	1. Yes 2. No 3. Don't know
	• to ensure that documents are identified, reviewed, approved, and retained and that records are created, stored, and archived in accordance with record retention policies?	1. Yes 2. No 3. Don't know
305	Do storage devices have the capacity and design to ensure that the proper temperature is maintained?	1. Yes 2. No 3. Don't know
306	For storage of blood products, is temperature continuously monitored with temperature	1. Yes 2. No 3. Don't know

	recorded every 4 hours?	
307	Do requests for blood, components, tissue, and derivatives and records accompanying blood samples from the patient contain sufficient information to uniquely identify the patient, including two independent identifiers? Using the following criteria? a. Patient first and last name	1. Yes 2. No 3. Don't know
	b. Medical record number or date of birth	1. Yes 2. No 3. Don't know
	c. Date and time of sample draw and Phlebotomist's signature	1. Yes 2. No 3. Don't know
308	Do elements of recipient consent for transfusion include all of the following, at a minimum? a. A description of the risks, benefits, and treatment alternatives	1. Yes 2. No 3. Don't know
	b, The opportunity to ask questions	1. Yes 2. No 3. Don't know
	c, The right to accept or refuse transfusion	1. Yes 2. No 3. Don't know
310	Do the blood bank registration book include all the following information a. Patient name	1. Yes 2. No 3. Don't know
	b. Hospital Card no	1. Yes 2. No 3. Don't know
	c. Blood group, Rh and Cross Matching	1. Yes 2. No 3. Don't know

	result d. Type of blood component and amount of unit received	1. Yes 2. No 3. Don't know			
	e. Condition of the blood unit when received (clotted, expired, wasted, etc…)	1. Yes 2. No 3. Don't know			
309	Have you register	1.Yes	1. No	2. Not applicable	No of unit
	a. Expired unit				
	b. Wasted unit				
	c. Reactive unit				

Annex IV: The criteria used to assess the transfusion

TRANSFUSIONS <u>NOT MEETING</u> THE FOLLOWING CRITERIA MUST BE REVIEWED BY A MEDICAL STAFF MEMBER OR THE APPROPRIATE PEER REVIEW COMMITTEE

NOTE: *These criteria are extracted from the American Association of Blood Banks (AABB) "Guidelines for Blood Utilization Review" published 2001. The criteria are for auditing blood component administration and must not be misinterpreted as standards of care. These criteria reflect a consensus as to the generally accepted rationale for the use of blood components based published clinical trials, consensus statements, and guidelines produced by national organizations. Review criteria do not necessarily constitute indications, or triggers, for transfusion. Clinical situations may dictate transfusion practices that differ from the review*

1. Red Blood Cells (RBCs). RBCs are transfused to improve oxygen-carrying capacity	a. Symptomatic anemia in a normovolemic patient, regardless of hemoglobin concentration. b. Evidence of inadequate oxygen delivery or ongoing hemorrhage (e.g., more than (>)15 percent of blood volume). c. Hemoglobin less than (<)8 gram per deciliter (g per dL). d. Preoperative hemoglobin <9 g per dL and operative procedures or clinical situations associated with major, predictable blood loss. e. Hemoglobin <8 g per dL in a patient on a chronic transfusion regime.

2. Platelets. Platelet transfusion is appropriate to prevent or control bleeding associated with deficiencies in platelet number and function.	a. Platelet count <10,000 per microliter (μL) in a non-bleeding patient with failure of platelet production. b. Platelet count <50,000/μl and impending surgery or invasive procedure or in a patient experiencing hemorrhage. c. Diffuse microvascular bleeding following cardiopulmonary bypass, or during use of an intra-aortic balloon pump with no significantly abnormal coagulation parameters. d. Diffuse microvascular bleeding in a patient who has lost more than one volume in whom platelet count results are not yet available. e. Bleeding in a patient with a qualitative platelet defect, regardless of platelet count.
3. Plasma. Fresh Frozen Plasma (FFP) is administered to correct bleeding due to single or, much more commonly, multiple coagulation factor abnormalities when specific therapy is unavailable.	a. Prothrombin time (PT) or partial prothrombin time (PTT) >1.5 times the mean of the reference range in a non-bleeding patient scheduled for or undergoing surgery or an invasive procedure. b. Diffuse microvascular bleeding in a patient given more than one blood volume and coagulation test results not yet available. c. Microangiopathic hemolytic anemia

	(e.g., thrombotic thrombocytopenic purpura) being treated with plasma exchange. d. Emergency reversal of coumadin anticoagulation. e. Deficiency of specific factors of the coagulation system when virus-inactivated concentrates are not available.
4. Cryoprecipitated Antihemophilic Factor (AHF). Cryoprecipitated AHF is administered for prevention or treatment of bleeding due to hypofibrinogenia (most commonly), dysfibrinogenemia, Von Willebrand disease (in some circumstances), and (very rarely) Factor VIII deficiency.	a. Fibrinogen <80 to 100 minigram per deciliter (mg/dL). b. Diffuse microvascular bleeding and fibrinogen <100 to 120 mg/dL. c. Von Willebrand disease or hemophilia unresponsive to 1-deamino-8-D-arginine vasopressin (DDAVP) and no appropriate factor concentrate available. d. Uremic bleeding (if DDAVP is ineffective or after tachyphylaxis). e. Factor XIII deficiency.
5. Special Components. Modified components that provide benefit for selected patient populations	a. <u>Leukocyte-Reduced Components.</u> (1) Prevention of recurrent febrile nonhemolytic transfusion reactions. (2) Prevention of Human Leukocyte Antigen (HLA) alloantibody formation in select patients. (3) Prevention of cyt0megalovirus (CMV)

	transmission in selected patients. b. Cytomegalovirus Risk Reduction. (1) CMV-seronegative recipients of allogenic progenitor cell transplants. (2) Intrauterine transfusions. (3) CMV-seronegative pregnant women. (4) Low birth weight infants (<1200). (5) Exchange transfusions in newborns. (6) Patients with congenital immunodeficiencies. (7) CMV-seronegative patients with HIV infection. (8) CMV-seronegative recipients of a solid organ transplant from a seronegative donor. (9) CMV-seronegative patients undergoing chemotherapy that results in a severe neutropenia. c. Irradiated Blood Components (1) Intrauterine transfusion. (2) Infants who received intrauterine transfusions. (3) Patients with congenital immunodeficiencies. (4) Patients undergoing progenitor cell transplantation, either autologous or

	allogenic. (5) Patients receiving HLA-matched cellular components. (6) Patients receiving directed units from blood relatives. (7) Patients with Hodgkin's disease. d. Washed Blood Components (1) History of anaphylactic reaction to blood components. (2) Immunoglobulin A (IgA) deficiency with documented IgA antibodies. (3) Neonatal alloimmune thrombocytopenia or hemolytic disease of the newborn when the mother is the donor for the fetus or newborn infant.

Annex V: Amharic Version Questionnaire Consent

በአዲስ አበባ ዩኒቨርስቲ ህክምና ት/ቤትየህክምና ላቦራቶሪ ሳይንስ ዲፓርትመንት

በ ጥቁር አንበሳ ሆስቲታል የደም ውጤቶች ልገሳ የአገልግሎት ጥራት ለማጥናት የተዘጋጀ መ□□ቅ::

መለያ መረ□:

የጤና ድርጅቶች ስም _____ የጤና ድርጅቱ ኮድ _____

የሚሰጥ አጠበቅ ስምምነት

የተከበሩ ተሳታፊ

ዕንደምን አሉ ስሜ.....ይባላል፡፡ በአዲስ አበባ ዩንቨርስቲ ህክምና ፋክልቲ የህክምና ላቦራቶሪ ሳይንስ ትምህርት ቤት ***ተማሪ ስሆን*** ጥናታዊ ዳሰሳ ሚጃ ***ለመሰብሰብ ነው የመጠውት፡፡ በሆስ□□ሉ ውስጥ ስላለው የደም አሰጣጥ ሒደት የተወሰኑ ጥያቄዎች ልጠይቀዎት ነው ስላሉት ችግሮች እና ነሱንም በመ□ታትና ጥራት ያለው አገልግሎት ለመስጠት የሚረዳንን መረጃ ለመሰብሰብ ነው የመጣሁት፡፡ በደም አሰጣጥ*** አገልግሎት ጥራት ላይ ተፅዕኖ የሚ ፈጠሩ ችግሮችን ዙርያ ቃለ መ ጠይቅ ***ላደርግሎት*** ሲሆን ዓላማውም አገልግሎት ጥራት ላይ ተጽዕኖ የሜጠሩ ችግሮችን ትከከለኛ የሆነ ሚጃ በማቅረብ □አገልግሎቱን ጥራት ለማሻሻል ስልቶችን ለመቀየስ የሚቅም ሚጃ ማቅረብ ነው፡

በዚህ ጥናት □ስዓ የእርሶ መሳተፍ በአገልግሎት ጥራት ላይ ተጽዕኖ የሜጠሩ ችግሮችን በማሻየቱ ዙርያ ከፍተኛ አስተዋፅዖ ስላለው በዚህ ጥናት ላይ አንዲሳተፉ በትህትና እንጠይቃለን፡፡ ማንኛውም ዓይንት ጥሩም ሆነ መጥፎ አስተያየት እንቀበላለን በ***መጠይቁ ላይ ስም□ም ሆነ የእርስዎን ማንነት*** የሚልፅ ***ማንኛውም ዓይነት መረ□ አይጠቀስም፡፡ በማንኛ□ም ሰ□ት ቃለ መጠይቁን ማቋረጥ ሲፈልጉ ቃለመጠይቁን ለማቋረጥ ይችላሉ፡፡ ስለሆነም በቅድሚያ ስለሚያደርጉልን ትብብር ምስጋናችን*** አያቀረብን የሚሠጡንን ሚጃ በትክክል ለመለዳድ እንደንችል የደምፅ መቅረጫ አነደንጠቀም ይፍቀዱልን፡፡

በዚህ ቃለመዓ□ቅ ላ□ ለመሳተፍ ይፈልጋሉን ? **□ፈልጋለሁ** ☐ **አልፈልግም** ☐

ቃለ*ማ*ጠይቅ ያደረገው **ሰው** ስም..... ***ፊርማ***.....

ቃለ*ማ*ጠይቅ የተደረገበት ቀን..... የተጀመረበት ሰዓት..... ያለቀበት ሰዓት.....

መልሱ አዎ ከሆነ ለ*ማ*ጠይቅ **ወደሚቀጥለው** □□ □እንለ□

መጠይቁን የሞላው ሰው ስም..... ***ፊርማ***.....

መጠይቁን የተሞላበት ቀን..... የተጀመረበት ሰዓት..... ያለቀበትሰዓት.....

መጠይቁን ያርጋገጠው ተቆጣጣሪ **ሰው ስም**..... ***ፊርማ***.....

ስላደረጉልን ትብብር እናመሰግናለን

Annex VII: Declaration

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

Name: Melaku Tamene (BSc)

Signature _____

Place: Addis Ababa University School of Medicine Department of Medical laboratory Sciences, Ethiopia

Date of submission: _____

This thesis has been submitted with my approval as University advisor.

Name: Aster Tsegaye (MSc, PhD) Signature _____

Asaye Birhanu (BSC, MSc) Signature _____

Bineyam Taye (BSc, MPH) Signature _____