

The use of blood components in diverse medical specialties in a tertiary health care institution

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Abstract

Introduction-

Blood is a crucial fluid that delivers waste and necessary compounds to cells, such as oxygen and minerals. It is composed of blood cells and plasma. Blood transfusion is the primary therapy in medical or surgical settings when there is no other option available. However, blood transfusions should be used with caution since they might cause transfusion reactions or the spread of transmissible infections such as HbsAg, HCV, HIV, Syphilis, and malaria. Clinicians should only perform blood transfusions when absolutely required. We plan to investigate the use of blood components in a blood bank at a tertiary health care facility.

Material and methods-

This is a retrospective cohort research in which statistics on blood requests and product use from January 2020 to December 2020 were gathered and evaluated at a tertiary care hospital's blood bank.

Results-

PRBCs are at the top of the list with 4130 units, primarily used in surgeries, accounting for 45.6% of total issuance. FFP is followed by 3160 units, which help in febrile diseases and operations, accounting for 34.9%. Platelets support oncological and infectious disorders with 1628 units (18%). Whole blood, which is essential in trauma and anaemia patients, totals 44 units (0.5%). Cryoprecipitates target particular difficulties with 94 units (1%). In comparison, PRBCs are the most commonly used, but whole blood is rarely used, underscoring the importance of tailoring blood component allocation to different medical demands.

Conclusion-

Efficient blood component allocation is critical, with PRBCs dominating utilisation. Tailored distribution maximises resource usage.

Continuous monitoring of component demand is essential for a balanced supply. To properly allocate resources and address various medical demands, emphasise education on optimal component utilisation.

Introduction

Blood transfusion is an essential component of contemporary medicine, providing life-saving help in a variety of clinical settings. In tertiary care settings such as hospitals, good blood product management is critical to ensuring patient safety and optimal outcomes. According to research, optimal blood product use has a considerable influence on patient morbidity and mortality¹. In India, where healthcare resources confront particular constraints, monitoring blood product utilisation patterns in tertiary hospitals is critical for resource allocation and patient care. According to research, incorrect transfusion methods can result in adverse outcomes and higher healthcare expenses². Despite recommendations, transfusion practices vary around the globe, underlining the need of local data in informing evidence-based transfusion policies³.

Furthermore, research has demonstrated the value of transfusion audits in identifying areas for improvement and improving transfusion practice⁴. However, little study has focused on blood product consumption patterns in Indian tertiary care settings. This study intends to close this gap by examining the use of blood products at a tertiary healthcare institution in India, giving insight on transfusion procedures and directing future actions for better patient outcomes.

Material and methods

Materials and Methods:

The study was carried out at a tertiary health care centre in India, from January to December 2022. Data on blood product consumption was gathered from several departments inside the hospital. This includes details about the distribution of packed red blood cells (PRBCs), fresh frozen plasma (FFP), platelets, whole blood, and cryoprecipitates. Furthermore, documents outlining the use of blood products for various illnesses and medical situations were gathered.

The obtained data was rigorously compiled and examined to discover how blood products were distributed among departments and medical situations. The use rates for each blood component were computed as a proportion of total supply. Comparative studies were carried out to determine trends and variances in blood product consumption, with a particular focus on differences between departments and medical conditions.

As this was a retrospective data collected from records and no patient identification parameters were included in the study, there was no need for ethical approval for this study. Statistical analyses were performed using SPSS version 21 to derive meaningful insights from the data.

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Results-

Blood component need and issuing rates-

Comparing necessary and supplied blood components showed rates of usage. PRBCs had the greatest usage rate, around 81.39%, followed by FFP at 90.29%. RDP demonstrated 95.98% efficiency. However, Whole Blood had a lower usage rate of around 29.33%. Cryoprecipitates exhibited a usage rate of around 81.74%. (table 1) These percentages show how efficiently blood components are distributed in relation to their needs, with RDP being the most efficient and Whole Blood being the least efficient.

Sr no	Blood Component	Whole blood	PRBC	FFP	RDP	CRYO ISSUE	Total
1	Component required	150	5078	3500	1703	115	10546
2	Component issue	44	4130	3160	1628	94	9056

Table 1. Table showing blood component need and issuing rates in our study.

Month wise distribution of blood components- The analysis of monthly blood component issuance indicates changing consumption patterns. PRBC issuance has been pretty consistent throughout the year, ranging from 310 to 375 units. FFP issuance swings, peaking in May (300 units) and falling in April (230 units). Platelets vary minimally, averaging 130-165 units per month. Whole blood issuance ranges between 3 and 5 units every month. Cryoprecipitate issuance is stable, at roughly 7-9 units per month.(figure 1) Overall, monthly issuance follows dynamic demand patterns, underscoring the significance of flexible inventory management to effectively satisfy shifting demands throughout the year.

WHOLE BLOOD, PRBC, FFP, RDP and CRYO

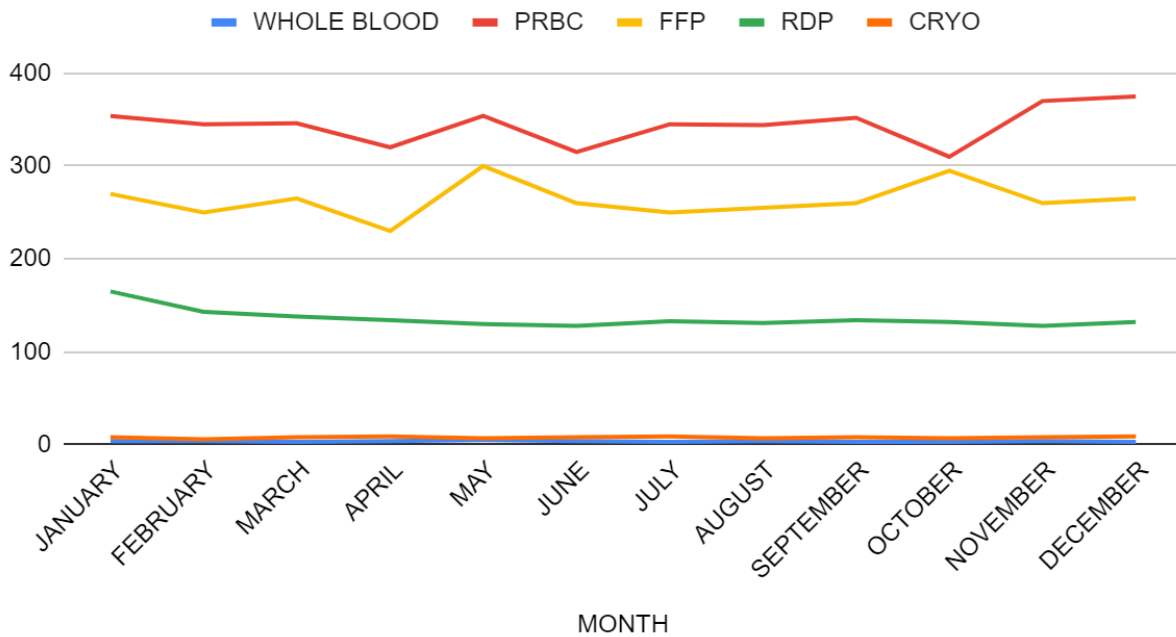


Figure 1- Line chart showing month wise distribution of blood components in our study.

Blood group distribution-

PRBC consumption varies by blood type, with A+ve and B+ve having the greatest utilisation rates at 1062 and 1026 units, respectively. O+ve and AB+ve follow, using 760 and 693 units, respectively. Among negative blood types, A-ve had the highest use (155 units), followed by O-ve (152 units) and B-ve (142 units). AB-ve has the lowest usage of all groups, at 140 units. These consumption patterns highlight the critical need of matching blood types to patient needs for effective transfusion treatment.

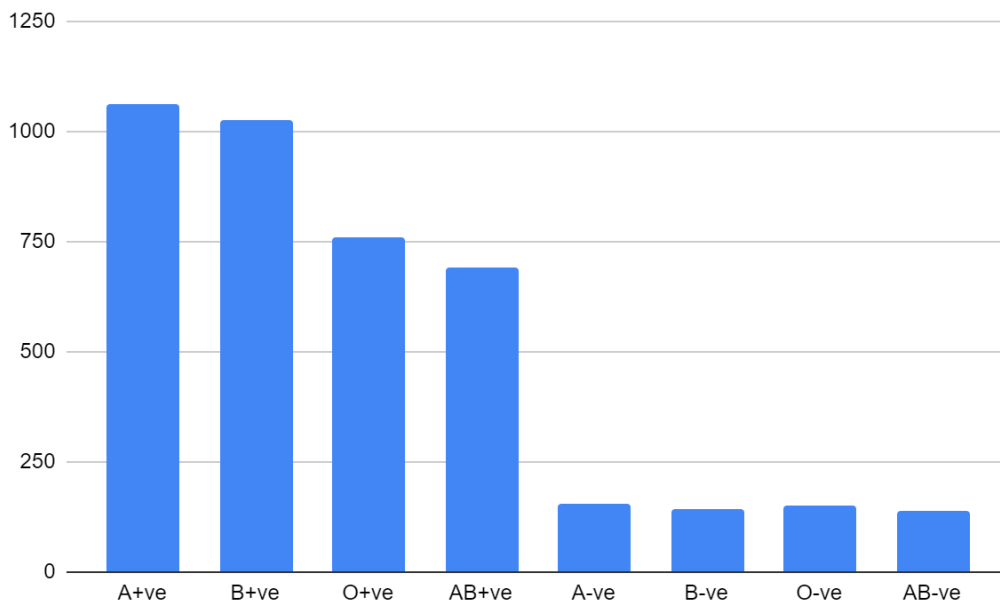


Figure 2- Blood group distributions in our study

Department specific usage of blood components-

Results:

Blood component issuance across departments shows varying use percentages. The Medicine Department issued the most units (2066), accounting for 22.8% of the total issuance. The CABG department has high use rates for FFP (35.5%) and PRBCs (49.6%). Pediatrics distributed PRBCs (36.7%) and FFP (53.1%). Gynecology demonstrated balanced

usage, with 57.6% FFP and 28.7% PRBCs. Other departments used a variety of blood products, with platelets (36.5%) and PRBCs (36.5%) being particularly popular Table 2.

	WB ISSUE	PRBC ISSUE	FFP ISSUE	PLT ISSUE	CRYO ISSUE	TOTAL ISSUE
PEADIATRIC	0	444	642	121	0	1207
MEDICINE	9	924	782	323	28	2066
SURGERY	2	306	194	31	0	533
GYNAC DEPT	9	697	340	163	0	1209
ORTHO	1	154	29	53	0	237
CABG DEPT	8	873	625	228	28	1762
OTHER	15	732	548	709	38	2042
TOTAL	44	4130	3160	1628	94	9056

Table 2- Table showing department wise distribution of usage of blood components.

Fresh frozen plasma utilization with indications-

The use of fresh frozen plasma (FFP) varies according to sickness and condition. Surgery-related diseases with normal or moderately increased coagulation profiles had the highest consumption (848 units), accounting for 26.9% of total FFP usage. Febrile sickness and diffuse intravascular coagulation with sepsis both demonstrated high consumption, accounting for 18.0% and 16.2% of total FFP utilization, respectively.(Figure 3) Other illnesses, such as bleeding episodes, upper gastrointestinal bleeds, and therapeutic plasma exchange, also contributed to FFP use, demonstrating its wide range of therapeutic uses in the treatment of coagulation-related disorders.

utilized Fresh frozen plasma(units)

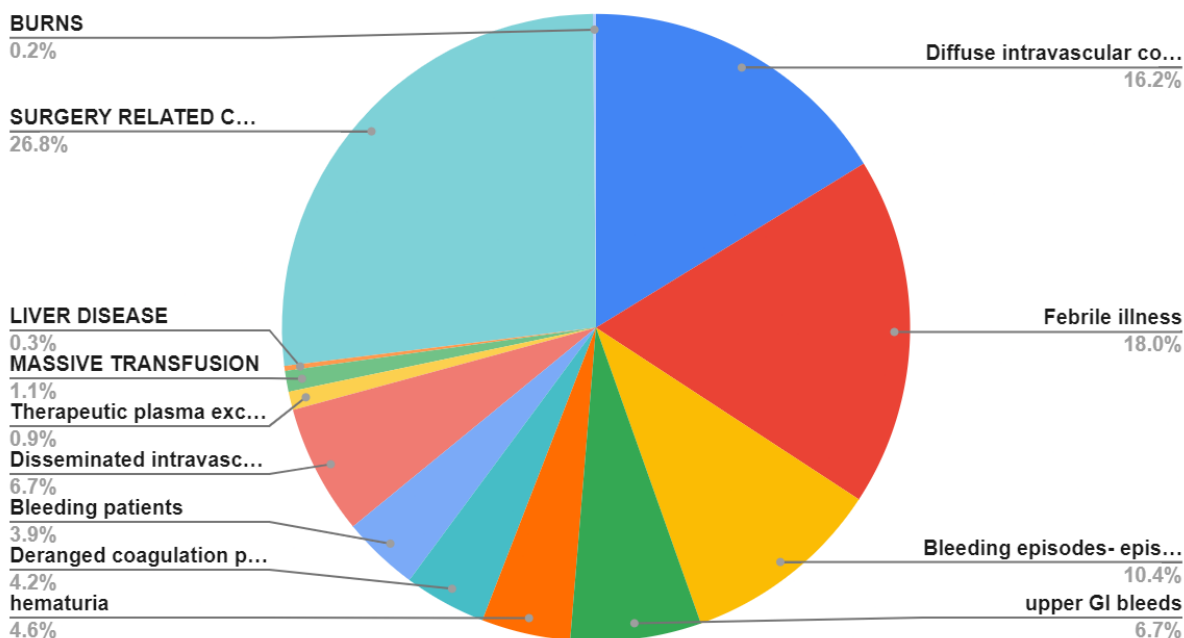


Figure 3- Pie chart showing utilization of FFPs for various medical conditions.

Platelet consumption based on medical indications-

Platelet consumption varies by illness category. Surgery and postoperative circumstances had the greatest platelet consumption rate, accounting for 17.3% of total platelet usage (282 units). Infectious and parasitic disorders, as well as circulatory system diseases, all had a significant impact in total platelet usage, accounting for 23.5% (382 units) and

13.7% (223 units), respectively. Furthermore, pregnancy-related disorders and diseases of the musculoskeletal system exhibited significant platelet demand, accounting for 10.0% (163 units) and 3.3% (53 units) of overall usage, respectively. (figure 4) These findings emphasise platelets' broad therapeutic activities in a variety of medical illnesses, emphasising their relevance in addressing haematological and surgical problems.

utilized platelets (units)

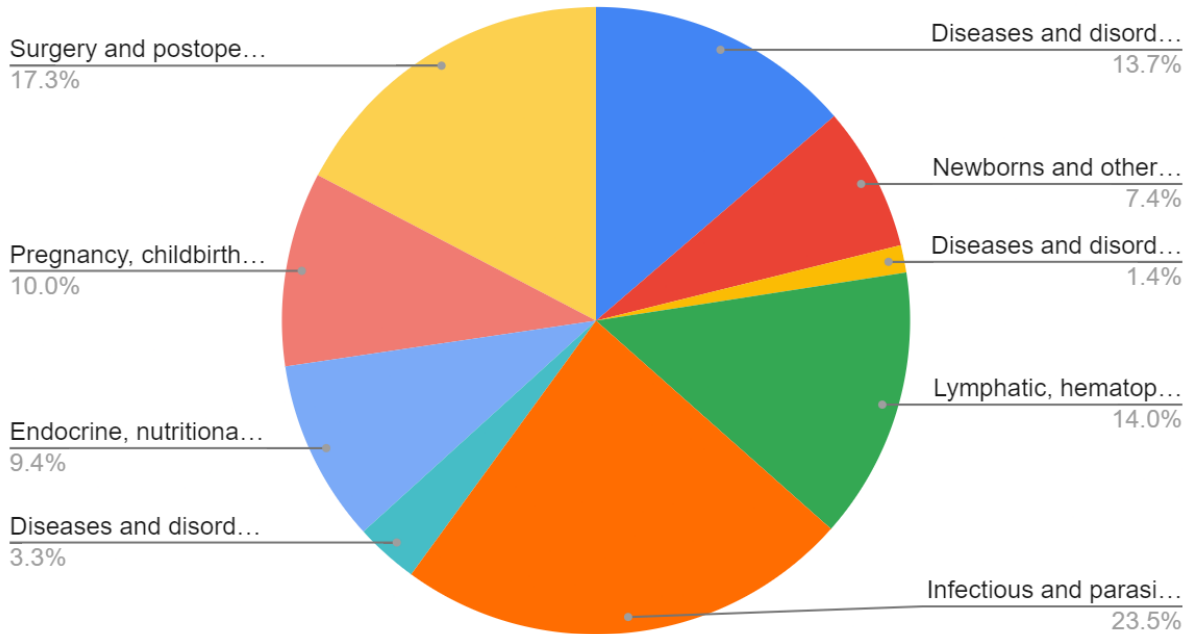


Figure 4- Platelets utilisation in various medical conditions.

Whole blood use differed by illness category. Trauma had the greatest consumption rate, accounting for 46.9% of total whole blood usage (15 units). Anaemia and labour/childbirth had equal consumption rates, each using 9 units, accounting for 28.1% of total usage. CABG (Coronary Artery Bypass Grafting) procedures used 8 units, accounting for 25.0% of total whole blood use. Orthopaedic treatments and surgical interventions were underutilised, with just one and two units employed, respectively. These findings highlight the need of using whole blood depending on specific therapeutic reasons, ensuring efficient resource allocation and effective patient care.

Whole blood units(N=8) vs Disease

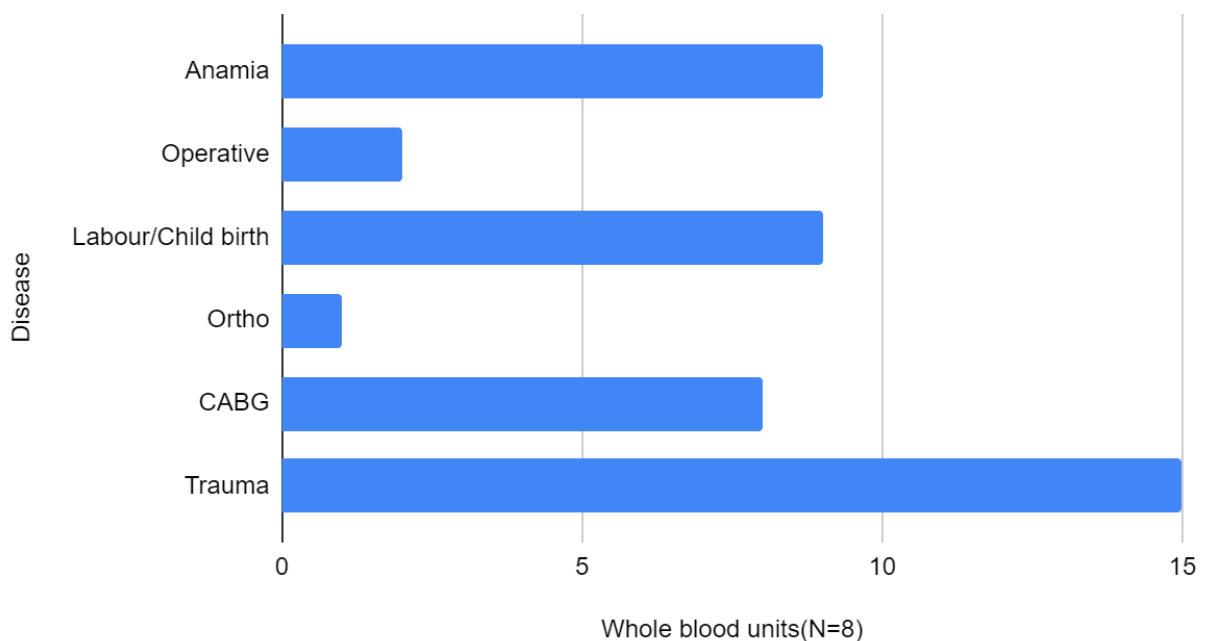


Figure 5- Bar chart showing usage of whole blood in different medical conditions.

Cryoprecipitate usage-

Massive transfusion and hypofibrinogenemia management used 28 units each, accounting for 29.8% of total cryoprecipitate consumption. Uremic bleeding also exhibited high consumption, with 34 units used, accounting for 36.2% of total usage. Hepatic coagulopathy had the lowest usage rate, with only 4 units used.

cryoprecipitates utilized(units) vs Various Disease

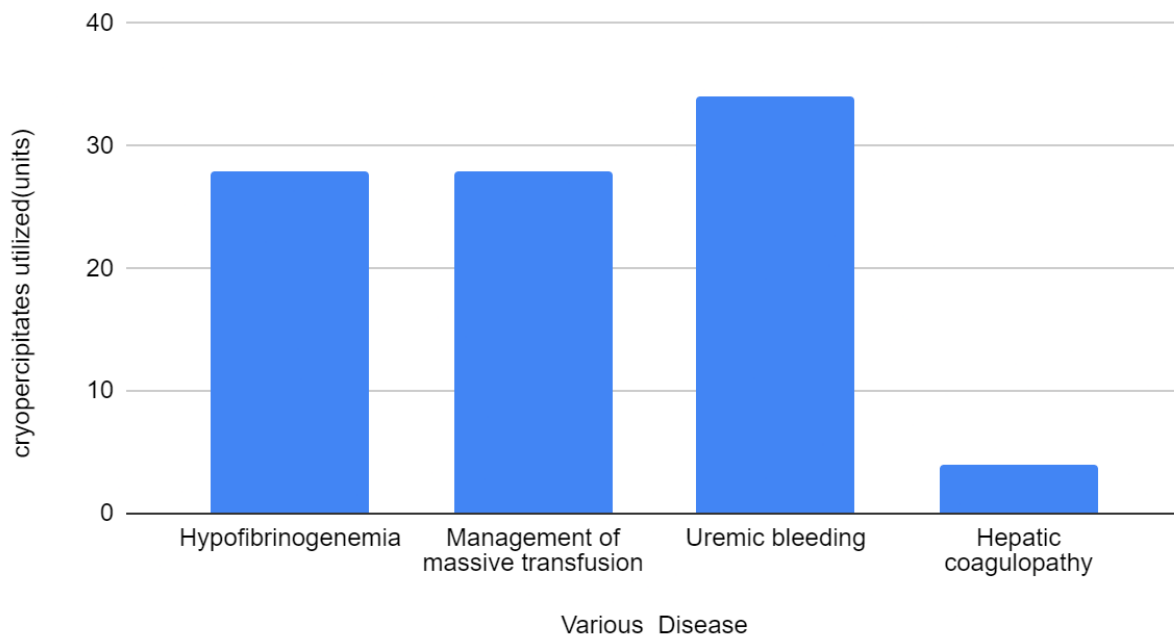


Figure 6- Usage of cryoprecipitate in various medical conditions.

DISCUSSION

Our study gives detailed information on blood component consumption at a tertiary care institution. PRBCs were the most commonly supplied component, totaling 4130 units, followed by FFP (3160 units) and platelets (1628 units). Surgery departments used a lot of PRBCs and FFPs, whereas paediatrics used mostly FFPs and PRBCs. Blood component use varies with illness, with surgery-related disorders having the largest requirement for FFP. Furthermore, platelets were widely used in oncology and infectious illnesses. Cryoprecipitates were largely utilised to treat coagulation problems. These findings highlight the need of personalised transfusion techniques in meeting varied clinical demands efficiently.

Quality assurance in blood banks ensures that patients receive safe, high-quality blood by monitoring trends, detecting usage, and assuring optimal blood ordering to provide lifesaving benefits. The Food and Drug Administration (FDA) classifies whole blood and its components as pharmaceuticals, highlighting the significance of following pharmaceutical industry standards for collection, testing, storage, and distribution.⁵

Studies have shown a significant decrease in misuse and improper use of blood following an educational effort for doctors following such reviews.^{6,7}

Our study found that the clinical demand to utilisation ratio for red cells was 81.3%. It was greater than Tripathi et al's finding of 59.8%⁸, which differed from previous research (13.6% to 23.14%⁹). Patients in the medical section used the most blood similar to our study⁸. Although the surgical division requested the most blood, they only used one-third of it on average compared to 41% in our study.⁸ Overall, anaemia was the most prevalent reason for red cell usage.

Gaur et al, in her similar study of ours, showed that their blood bank issued 8,549 units of whole blood and its products in a year, with seasonal variation. The study collected data for December 2007, with 720 units closest to the monthly average.⁵ Our study had an average blood unit dispensation of 752. Whole blood was the most utilised product, followed by packed red blood cells, fresh frozen plasma, and platelet concentrates.⁵ This was contrasting with our study in terms of PRBCs being the most common blood product dispensed followed by FFP. Blood supply was more in surgical wards, with the highest requirement from general medicine according to gaur et al. In our study we found that surgical wards including general surgery, orthopaedics, gynaecology and cardiac surgery amounted to around 41 percent followed

closely by medical wards comprising adult medicine and paediatrics combined to 36%. Medical wards received 37.4% of all demands.⁵

Fresh frozen plasma (FFP) was an important component in the care of disseminated intravascular coagulation (DIC) and liver disorders, where it can assist restore the coagulation-fibrinolysis balance and avoid bleeding, which is comparable to FFP usage in our work¹⁰.

In a study of 40,053 blood donors, Legese et al discovered in Ethiopia that the most prevalent blood group was O (41.5%), followed by A (22.8%), B (23.2%), and AB (5.5%). The majority tested Rh (D) positive¹¹. In our study, PRBC consumption statistics showed that A+ve and B+ve had the greatest usage rates (1062 and 1026 units), followed by O+ve and AB+ve (760 and 693 units, respectively). A-ve has the most negative blood type use (155 units). This difference in proportions of blood groups may be due to different geographic locations and different ethnicities. However, more similar ethnicities like Pakistan showed blood types A, AB, O, and B were distributed as follows: 134 (31.2%), 43 (10.1%), 116 (27%), and 136 (31.7%)¹², which is comparable to our study.

There have been very few published studies that address the ward-by-ward distribution of blood products in India. However, our study has a few drawbacks. The sample size may have been larger, roughly 5 years, to account for the effects of the COVID-19 pandemic. This is a retrospective dataset. A prospective long-term study comparing different blood banks in India might provide us with a clearer picture of actual blood component consumption rates and aid in the optimization of blood bank operations.

Conclusion

In conclusion, this study gives light on the complex patterns of blood component consumption in a tertiary care context. The findings highlight the significance of personalised transfusion techniques to satisfy the varying demands of patients from various departments and medical conditions. PRBCs emerged as the most often used component, with considerable variances seen among departments and disorders. FFP and platelets also performed important roles in a variety of therapeutic settings. These findings underline the importance of effective inventory management and transfusion policies in optimising resource allocation and improving patient outcomes. Moving forward, more research in this area is critical for improving transfusion processes and the quality of treatment delivered to patients.

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