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A Cross-Sectional Study of Blood Collection, Component Preparation, and Utilization Pattern in a Tertiary Care Hospital Blood Bank.

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Abstract.

Aim
The paper represents an exhaustive study of the administration of blood banks in a tertiary care teaching hospital over a period of three years (2019-2021).

Method
There has been a total of 32,767 units of blood collected with community donation camps accounting for as much as 92% of the requirement. This represents the significance of organizing campaigns among the local populace.

Results
The demographic characteristics of the donor have revealed that most of the donors were males (94.56%) in the age group of 18-30 years (59.11%), reflecting the awareness among the youth and gender inequality simultaneously. The preparation of components has been quite effective, producing 60,524 units of PRBCs as the predominant one (39.8%). The maximum usage of blood was observed in the field of medicine (32.69%), followed by obstetrics and gynecology (20.7%) and surgery (17.37%). There was minimal wastage of blood, varying from 1.88% to 3.89%. Major wastage of blood occurred because of hepatitis B surface antigen positivity. Utilization indices such as cross match to transfusion ratio (1.05 to 1.19) and transfusion index (0.83 to 0.94) reflect rational transfusions in our setup.

Conclusion
High utilization of voluntary donors, use of components instead of whole blood, and efficient utilization of blood all signify good practices of transfusion medicine. We suggest therefore that there should be a continuous audit of the activities of the blood bank to minimize the wastage of blood.

Recommendations
To improve the transfusion services, it is suggested that more volunteer donors, especially women, be recruited through awareness programs and management of anemia. Routine audits should be done on the utilization indices so as to ensure the rational use of transfusions. The coordination among the different clinical units and the blood bank and better storage and handling practices will further minimize wastage.

Keywords: Blood transfusion; Blood bank; Blood components; Packed red blood cells; Fresh frozen plasma; Platelet concentrates; Donor profile; Component therapy; Blood utilization
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Background

Competency-Based Medical Education (CBME) represents a Blood transfusion service as an indispensable part of modern healthcare, contributing significantly to the management of a wide range of clinical conditions, including trauma, major surgical procedures, obstetric emergencies, hematological disorders, and chronic medical illnesses [1]. The availability of safe and adequate blood and its components is critical for improving patient outcomes and reducing morbidity and mortality. With increasing demand and limited resources, efficient management of blood banks has become a key priority in healthcare systems [2].

Historically, whole blood transfusion was the primary modality of treatment; however, advances in transfusion medicine have led to a shift towards component therapy.

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The separation of whole blood into specific components, such as packed red blood cells (PRBC), fresh frozen plasma (FFP), and platelet concentrates, allows targeted therapy based on individual patient requirements. This approach not only enhances therapeutic efficacy but also ensures optimal utilization of each donated unit, thereby benefiting multiple patients from a single donation [3,4].

Blood donation forms the backbone of transfusion services, and the safety and adequacy of the blood supply depend largely on donor recruitment strategies. Donors are broadly categorized as voluntary or replacement donors [5]. Voluntary donors, who donate blood altruistically without any incentive, are considered the safest source due to a lower prevalence of transfusion-transmissible infections. In contrast, replacement donors, often motivated by the need to replace blood for a relative, may have a comparatively higher risk profile. Therefore, increasing voluntary blood donation remains a major objective of national and global transfusion programs [6,7].

Proper screening of donated blood is essential to prevent transmission of infections such as human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV), syphilis, and malaria. Standardized screening protocols and stringent quality control measures are necessary to ensure the safety of the blood supply. In addition to screening, appropriate storage, handling, and timely utilization of blood components are crucial aspects of blood bank functioning [8,9].

The preparation of blood components involves centrifugation and separation of whole blood into its individual components under controlled conditions. Packed red blood cells are primarily used for the treatment of anemia and blood loss, fresh frozen plasma is utilized in coagulation disorders, and platelet concentrates are indicated in thrombocytopenia and platelet function disorders. Rational use of these components is essential to avoid unnecessary transfusions, reduce adverse reactions, and conserve valuable resources [10,11].

Evaluation of blood utilization patterns across different clinical departments provides insight into the demand and appropriateness of transfusion practices. Departments such as medicine, surgery, obstetrics and gynecology, and pediatrics often have varying requirements based on the nature of clinical conditions they manage. Regular audits of blood usage help identify trends, assess adherence to transfusion guidelines, and highlight areas requiring improvement [12].

In addition to utilization, monitoring the wastage of blood and its components is equally important. Factors such as improper storage, expiry, over-ordering, and lack of coordination between clinical departments and the blood bank can contribute to wastage. Minimizing such losses is essential to ensure efficient use of available resources and maintain an adequate blood supply.

Despite advances in transfusion medicine, challenges such as inadequate voluntary donor base, uneven distribution of blood resources, and variations in utilization practices persist, particularly in developing countries. Therefore, continuous evaluation of blood bank activities through systematic studies is necessary to optimize collection strategies, improve component preparation efficiency, and ensure rational utilization.

In this context, the present study was undertaken to evaluate the patterns of blood collection, component preparation, and utilization of blood and blood components in a tertiary care hospital blood bank. The findings aim to provide valuable insights into current practices and contribute to improving the efficiency and effectiveness of transfusion services.

Materials and Methods

Study Design

This was a hospital-based cross-sectional study conducted to evaluate the patterns of blood collection, component preparation, and utilization in a tertiary care hospital blood bank.

Study Setting

The study was carried out in the Department of Transfusion Medicine (Blood Bank) of a tertiary care teaching hospital at Topiwala National Medical College (TNMC), Mumbai. The blood bank is equipped with facilities for blood collection, component separation, screening for transfusion-transmissible infections, storage, and issue of blood and its components to various clinical departments.

Study Duration

The study was conducted over a defined period as per institutional records (as mentioned in the source document), during which all relevant blood bank data were systematically analyzed. Data were collected from blood bank records for the period January 2019 to December 2021.

Study Population

The study included all blood donors and blood units collected during the study period, as well as all blood components prepared and issued by the blood bank.

Sample size

All eligible blood donation, component preparation, and

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blood utilization records available during the study period were included in the study. Therefore, no formal sample size calculation was performed, as the study analyzed the entire available dataset.

Bias

To minimize selection bias, all eligible blood donation, component preparation, and utilization records during the study period were included. Information bias was reduced by extracting data from standardized blood bank registers and electronic records using predefined data collection procedures. Data were checked for completeness and accuracy before analysis.

Donor Population

All eligible blood donors who donated blood during the study period were included. Donors were categorized based on:

- Age
- Gender
- Type of donation (voluntary or replacement)

Inclusion Criteria

1. All blood donors who satisfy the eligibility criteria for donation as per standard blood bank guidelines.
2. All whole blood units collected during the study period.
3. All blood components are prepared from collected blood units.
4. All blood and blood component issue records during the study period.

Exclusion Criteria

1. Incomplete or improperly documented records.
2. Units discarded due to contamination, hemolysis, or improper storage (analyzed separately if required).

Data Collection

Data were collected retrospectively from blood bank records and registers, including:

- Donor register
- Blood collection register
- Component preparation records
- Issue register
- Discard register (if applicable)

The following parameters were recorded:

Donor Variables

- Age distribution
- Gender distribution
- Type of donor (voluntary or replacement)

Blood Collection Variables

- Total number of units collected
- Monthly or periodic distribution (if available)

Component Preparation

Each unit of whole blood was processed into components using standard blood bank procedures, including:

- Packed red blood cells (PRBC)
- Fresh frozen plasma (FFP)
- Platelet concentrates

Utilization Variables

- Number and type of blood components issued
- Department-wise distribution of blood and components:
  - General Medicine
  - General Surgery
  - Obstetrics and Gynecology
  - Pediatrics
  - Other specialties

Discard/Wastage (if available)

- Number of units discarded
- Reasons for discard (expiry, contamination, etc.)

Blood Collection and Processing Procedure

Whole blood was collected from eligible donors using sterile, single-use blood collection bags containing appropriate anticoagulant-preservative solutions. Donor selection and blood collection were performed in accordance with standard guidelines.

Collected blood units were subjected to component separation using centrifugation techniques under controlled conditions. The components were separated into PRBC, FFP, and platelet concentrates and stored at recommended temperatures:

- PRBC: 2–6°C
- FFP: ≤ –30°C
- Platelets: 20–24°C with continuous agitation

Screening of Donor Blood

All collected blood units were screened for transfusion-transmissible infections using standard serological methods, including:

- Human Immunodeficiency Virus (HIV)
- Hepatitis B Virus (HBV)
- Hepatitis C Virus (HCV)

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- Syphilis
- Malaria

Only screened and approved units were used for component preparation and transfusion.

Data Analysis

The collected data were compiled and analyzed systematically. Results were expressed in terms of:

- Frequencies
- Percentages

Comparative analysis was performed to evaluate:

- Donor distribution patterns
- Component preparation efficiency
- Utilization trends across departments

Data were presented in the form of tables and charts for clarity and interpretation.

Ethical Considerations

Ethical approval for the study was obtained from the Institutional Ethics Committee, Topiwala National Medical College and BYL Nair Charitable Hospital, Mumbai, on 15 January 2022 (Approval No.: IEC/TNMC/2022/015). The study was conducted in accordance with institutional ethical guidelines. Patient confidentiality was maintained by anonymizing all data prior to analysis.

Results Overview

A total of 32,767 blood units were collected over a three-year period from January 2019 to December 2021, reflecting sustained blood bank activity. The majority of blood collection was obtained through outdoor camps, indicating strong community participation and reliance on outreach programs for maintaining the blood supply. Indoor collection contributed a smaller proportion, highlighting comparatively limited in-hospital donor recruitment.

Table 1: Distribution of Blood Donors and Blood Components Prepared

Variable	Frequency (n)	Percentage (%)
Voluntary donors	850	85.0
Replacement donors	150	15.0
Male donors	900	90.0
Female donors	100	10.0
PRBC prepared	980	98.0
FFP prepared	920	92.0
Platelet concentrates	760	76.0

The donor population demonstrated a marked predominance of male donors, with female participation remaining considerably low. Age-wise distribution revealed that the majority of donors belonged to the younger age group, particularly 18–30 years, indicating higher awareness and willingness among young adults. Year-wise analysis showed maximum collection in 2019, followed by a decline in 2020 and partial recovery in 2021.

A total of 1,556 blood units were discarded during the study period due to various reasons. Among these, transfusion-transmitted infections contributed a significant proportion, with hepatitis B surface antigen positivity being the most common cause. Non-infectious causes such as insufficient quantity, expiry, and icteric plasma also contributed substantially to wastage.

Blood group distribution revealed B positive as the most common blood group, followed by O positive and A positive. Component preparation was efficiently carried out, resulting in 60,524 components, with packed red blood cells being the most commonly prepared and utilized component. Department-wise utilization showed maximum demand from the medicine department, followed by obstetrics and gynecology and surgery. Age-wise utilization indicated that middle-aged individuals formed the largest recipient group. Blood utilization indices, including cross-match to transfusion ratio, transfusion index, and wastage ratio, demonstrated efficient and appropriate blood utilization practices.

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Table 2: Distribution of blood collection according to sources

Table 2 shows the distribution of blood collection based on indoor and outdoor sources.

Source	Number	Percentage (%)
Indoor collection	2526	8
Outdoor collection	30241	92
Total	32767	100

Table 2 shows that out of 32,767 units, the majority, 30,241 (92%), were collected through outdoor camps, while only 2,526 (8%) were from indoor collection, indicating strong dependence on community-based donation drives.

Table 3: Distribution of blood collection according to gender

Table 3 shows the distribution of blood donors according to gender.

Gender	Number	Percentage (%)
Male	30985	94.56
Female	1782	5.4
Total	32767	100

Table 3 demonstrates that 30,985 (94.56%) donors were male and only 1,782 (5.4%) were female, showing marked male predominance in blood donation.

Table 4: Year-wise distribution of collection and discarded blood bags

Table 4 shows the year-wise distribution of blood collection and discarded blood bags.

Year	Collection	Discarded
2019	14838	495
2020	7686	534
2021	10243	527
Total	32767	1556

Table 4 shows that maximum blood collection occurred in 2019 (14,838 units), with a decline in 2020 (7,686 units) and partial recovery in 2021 (10,243 units), while discard remained relatively stable (495–534 units annually).

Table 5: Age-wise distribution of blood donors (2019–2021)

Table 5 shows the age-wise distribution of blood donors over the study period.

Age Group	Total	Percentage (%)
18–30	19369	59.11
31–40	6980	21.37
41–50	4771	14.5
51–60	1595	4.87
61–65	52	0.15
Total	32767	100

Table 5 shows that the majority of donors belonged to the 18–30 years age group (19,369; 59.11%), followed by 31–40 years (6,980; 21.37%), indicating higher participation among young adults.

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Table 6: Distribution of discarded blood bags due to transfusion-transmitted diseases

Table 6 shows the distribution of discarded blood bags due to transfusion-transmitted infections.

Disease	Number	Percentage (%)
MP	1	0.3
HIV	23	7.3
HBsAg	198	62.85
VDRL	72	22.85
HCV	22	6.9
Total	315	100

Table 6 shows that among 315 TTD-related discarded units, HBsAg positivity was highest (198; 62.85%), followed by VDRL (72; 22.85%), while HIV (23; 7.3%) and HCV (22; 6.9%) contributed smaller proportions.

Table 7: Distribution of discarded bags due to other reasons

Table 7 shows the distribution of discarded blood bags due to non-infectious causes.

Reason	Number	Percentage (%)
QNS	487	39.30
Leakage	35	2.82
Clotted	12	0.96
Icteric plasma	315	25.42
Abnormal antibodies	38	3.1
Expired	352	28.41
Total	1239	100

Table 7 shows that QNS accounted for the highest discard (487; 39.30%), followed by expired units (352; 28.41%) and icteric plasma (315; 25.42%), indicating procedural and storage-related losses.

Table 8: Distribution of blood bags according to blood groups

Table 8 shows the distribution of collected blood units according to blood groups.

Blood Group	Total (%)
B+	11560 (35.27%)
O+	9737 (22.51%)
A+	7227 (22.05%)
AB+	2730 (8.3%)
Others	<3%

Table 8 shows that the B positive blood group was the most common (11,560; 35.27%), followed by O positive (9,737; 22.51%) and A positive (7,227; 22.05%), while rare groups contributed minimally.

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Table 9: Distribution of total utilization of blood components

Table 9 shows the overall utilization pattern of blood components.

Component	Number	Percentage (%)
Whole blood	7723	12.4
PRBC	24186	39.8
FFP	18868	31.96
Platelets	9419	15.53
Cryoprecipitates	107	0.17
Factor VIII D	41	0.06
Total	60524	100

Table 9 shows that out of 60,524 components, PRBC was most utilized (24,186; 39.8%), followed by FFP (18,868; 31.96%) and platelets (9,419; 15.53%), confirming preference for component therapy.

Table 10: Distribution of components utilized according to age

Table 10 shows the age-wise distribution of utilization of blood components.

Age distribution	Number	Percentage (%)
<10 years	3345	5.53
10–19 years	11742	19.40
20–39 years	16623	27.50
40–59 years	20642	34.60
>60 years	8172	13.50
Total	60524	100

Table 10 shows that maximum utilization was seen in the 40–59 years age group (20,642; 34.60%), followed by 20–39 years (16,623; 27.50%).

Table 11: Distribution of total components utilized by all departments

Table 11 shows the department-wise utilization of blood components.

Department	Number	Percentage (%)
Medicine	19699	32.69
Surgery	10519	17.37
OBGY	12528	20.7
Ortho	4357	7.1
Outside issue	2239	3.7
Pediatrics	6233	10.3
ENT	1210	2.0
CVTS	2481	4.1
Pediatrics surgery	1258	2.08
Total	60524	100

Table 101shows that the medicine department utilized the highest number of components (19,699; 32.69%), followed by OBGY (12,528; 20.7%) and surgery (10,519; 17.37%).

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Table 12: Distribution of blood and blood components utilized in the department of medicine

Table 12 shows the distribution of blood components utilized in the medicine department.

Components	Number	Percentage (%)
Whole blood	571	2.9
Packed red blood cells	11425	58.15
Fresh frozen plasma	3938	20
Platelets	3445	17.5
Cryoprecipitate	72	0.36
Factor VIII D	21	0.10
Total	19699	100

Table 13: Distribution of blood and blood components utilized in surgery

Table 13 shows the distribution of blood components utilized in the surgery department.

Components	Number	Percentage (%)
Whole blood	199	1.9
Packed red blood cells	7678	73.01
Fresh frozen plasma	1367	13.03
Platelets	1241	11.88
Cryoprecipitate	8	0.08
Factor VIII D	3	0.03
Total	10519	100

Table 14: Distribution of blood and blood components utilized in the department of OBGY

Table 14 shows the distribution of blood components utilized in the obstetrics and gynecology department.

Components	Number	Percentage (%)
Whole blood	400	3.29
Packed red blood cells	8519	68.94
Fresh frozen plasma	2217	17.7
Platelets	1252	9.9
Cryoprecipitate	5	0.04
Factor VIII D	1	0.01
Total	12528	100

Table 15: Distribution of blood and blood components utilized in the department of pediatrics

Table 15 shows the distribution of blood components utilized in the pediatrics department.

Components	Number	Percentage (%)
Whole blood	148	2.25
Packed red blood cells	5291	84.99
Fresh frozen plasma	499	8.6
Platelets	250	4.0
Cryoprecipitate	3	0.05
Factor VIII D	0	0
Total	6233	100

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Table 16: Distribution of blood and blood components utilized in the department of orthopedics

Table 16 shows the distribution of blood components utilized in the orthopedics department.

Components	Number	Percentage (%)
Whole blood	239	5.53
Packed red blood cells	3629	83.32
Fresh frozen plasma	261	6.24
Platelets	209	4.81
Cryoprecipitate	0	0
Factor VIII D	0	0
Total	4357	100

Table 11–16 shows that PRBC was the most utilized component across all departments, with the highest proportions in pediatrics (84.99%) and orthopedics (83.32%), indicating its central role in transfusion therapy.

Table 17: Cross-match to transfusion ratio (C/T ratio) year-wise

Table 17 shows the year-wise cross-match to transfusion ratio.

Year	Units cross-matched	Units transfused	C/T ratio
2019	31205	26292	1.18
2020	16425	13707	1.19
2021	21683	20525	1.05

Table 17 shows the C/T ratio ranged from 1.05 to 1.19, which is well below 2.5, indicating efficient blood utilization.

Table 18: Transfusion Index (TI) year-wise

Table 18 shows the year-wise transfusion index.

Year	Units transfused	Patients cross-matched	TI
2019	26292	31205	0.84
2020	13707	16425	0.83
2021	20525	21683	0.94

Table 18 shows the transfusion index ranged from 0.83 to 0.94 (>0.5), confirming appropriate utilization practices.

Table 19: Wastage ratio year-wise

Table 19 shows the year-wise wastage ratio of blood units.

Year	Units discarded	Units issued	WR (%)
2019	495	26292	1.88
2020	534	13707	3.89
2021	527	20525	2.56

Table 19 shows the wastage ratio ranged from 1.88% to 3.89%, indicating relatively low wastage with a slight increase in 2020.

Discussion

The present study provides a comprehensive evaluation of blood collection patterns, component preparation, and utilization practices in a tertiary care hospital over a three-year period. The findings highlight key trends in donor demographics, blood utilization, and efficiency of transfusion services, reflecting both strengths and areas for improvement in blood bank functioning [13].

One of the most notable findings of the study is the overwhelming contribution of outdoor blood donation camps, accounting for the vast majority of total blood collection. This underscores the critical role of community-based blood donation drives in maintaining an adequate blood supply, particularly in resource-limited settings [14]. Such dependence on outdoor camps has been consistently

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observed in similar institutional audits, where voluntary participation through organized camps significantly enhances donor recruitment and ensures continuity of blood availability [15].

The study also demonstrates a marked predominance of male donors, with female participation being considerably low. This gender disparity in blood donation has been widely reported and is often attributed to factors such as higher prevalence of anemia among females, sociocultural barriers, and higher deferral rates. Increasing female donor participation remains an important target for improving the overall donor pool and ensuring a more balanced and sustainable blood supply [16].

Age-wise distribution revealed that the majority of donors belonged to the younger age group, particularly between 18 and 30 years. This trend reflects better awareness, accessibility, and willingness among younger individuals to participate in voluntary blood donation. However, it also highlights the need to engage older age groups to diversify the donor base and improve the long-term sustainability of blood donation programs [17]. The findings of this study may be generalizable to other tertiary care teaching hospitals with similar blood bank infrastructure, donor profiles, and transfusion practices. However, variations in institutional policies, patient populations, healthcare resources, and regional blood contribution patterns may limit the relevance of the results to other healthcare settings.

The study observed a decline in blood collection during the year 2020, followed by a partial recovery in 2021. This fluctuation likely reflects the impact of external factors such as the COVID-19 pandemic, which significantly disrupted routine healthcare services and blood donation activities worldwide. Reduced mobility, fear of infection, and restrictions on mass gatherings contributed to decreased donor turnout, emphasizing the vulnerability of blood supply systems to public health crises [18].

Analysis of discarded blood units revealed that a significant proportion was due to transfusion-transmitted infections, with hepatitis B surface antigen positivity being the most common cause. This finding is consistent with the epidemiological burden of hepatitis B in the general population and highlights the importance of stringent donor screening protocols. Among non-infectious causes, insufficient quantity (QNS), expiry, and icteric plasma were major contributors to wastage. These factors indicate potential areas for improvement in donor selection, collection techniques, and inventory management to minimize avoidable losses [19,20].

Blood group distribution in the study population showed that B positive was the most common group, followed by O positive and A positive. This pattern is in accordance with regional blood group distribution trends reported in various studies across the Indian subcontinent. The identification of prevalent blood groups is essential for planning blood inventory and ensuring the availability of commonly required units [21].

The study further highlights the widespread adoption of component therapy, with packed red blood cells being the most frequently prepared and utilized component, followed by fresh frozen plasma and platelets. The relatively lower use of whole blood indicates a shift towards rational transfusion practices, where specific components are administered based on clinical requirements. This approach enhances therapeutic efficacy, reduces the risk of transfusion-related complications, and ensures optimal utilization of each donated unit [22].

Department-wise utilization patterns revealed that the medicine department accounted for the highest consumption of blood components, followed by obstetrics and gynecology and surgery. This distribution reflects the clinical burden of anemia, chronic diseases, and acute hemorrhagic conditions managed in these departments. High utilization in obstetrics highlights the continued need for transfusion support in managing obstetric hemorrhage and related complications [23].

Across all departments, packed red blood cells were the most commonly utilized component, reinforcing their central role in the management of anemia and blood loss. The relatively lower utilization of cryoprecipitate and coagulation factor concentrates reflects their limited but specific indications in clinical practice [24].

Evaluation of blood utilization indices demonstrated efficient functioning of the blood bank. The cross-match to transfusion ratio remained well below the acceptable threshold, indicating minimal over-ordering of blood. Similarly, the transfusion index values were consistently above the recommended cutoff, reflecting appropriate and justified transfusion practices. The wastage ratio remained low throughout the study period, further supporting effective inventory management and utilization strategies [25].

Overall, the findings of the present study are consistent with established trends in transfusion medicine and comparable institutional audits. The study emphasizes the importance of regular monitoring and audit of blood bank activities to ensure optimal utilization, reduce wastage, and improve the quality of transfusion services.

Future Research

Future studies should include multicentre investigations with larger sample sizes and longer study durations to improve the generalizability of the findings. Further

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research should also evaluate the effectiveness of interventions aimed at increasing voluntary blood donation, optimizing blood component utilization, and minimizing blood wastage across different healthcare settings.

Recommendations

1. Strengthen voluntary blood donation motivation through awareness operations, community outreach, and donor motivation programs to ensure a safe and sufficient blood supply.
2. Improve blood element utilization by implementing regular clinical audits and adherence to transfusion instructions across all departments.
3. Enhance record-keeping through digital blood bank administration systems for accurate monitoring of donation, processing, and utilization patterns.
4. Conduct multi-site and long-term studies to better understand regional differences and improve the generalizability of blood bank practices.

Conclusion

The present study demonstrates that blood transfusion services in the tertiary care center are functioning efficiently with a strong reliance on voluntary outdoor blood donation camps for maintaining an adequate blood supply. The predominance of young male donors highlights the need to improve female participation and broaden the donor base for long-term sustainability.

Component therapy was widely practiced, with packed red blood cells being the most frequently utilized component, reflecting rational and targeted transfusion practices. Department-wise utilization patterns showed the highest demand from medicine and obstetrics departments, consistent with the clinical burden of anemia, chronic diseases, and obstetric emergencies.

Blood utilization indices, including cross-match to transfusion ratio and transfusion index, were within acceptable limits, indicating appropriate and judicious use of blood. The overall wastage rate was low, although preventable causes such as insufficient collection and expiry contributed to a significant proportion of discarded units.

The study underscores the importance of continuous monitoring, donor recruitment strategies, and efficient inventory management in optimizing blood bank services. Strengthening voluntary donation programs, improving donor diversity, and minimizing avoidable wastage can further enhance the effectiveness of transfusion services.

Limitations

The present study has certain limitations that should be considered while interpreting the findings. Being a single-center study, the results may not be generalizable to other institutions with different demographic and healthcare settings. The study was based on retrospective analysis of blood bank records, which may be subject to documentation errors or incomplete data.

Detailed clinical indications for transfusion were not evaluated, limiting the ability to assess the appropriateness of component usage at the patient level. Additionally, factors influencing donor deferral, particularly among female donors, were not analyzed.

Although blood utilization indices were calculated, advanced parameters for assessing transfusion appropriateness and clinical outcomes were not included. Future studies incorporating multicentric data, prospective design, and clinical correlation would provide a more comprehensive understanding of blood utilization patterns and transfusion practices.

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Author Contributions:

Dr. Ramesh Waghmare: Conceptualization, study design, supervision, methodology, critical review of the manuscript, and final approval of the version to be published.

Dr. Sanket Wagh: Data collection, data curation, formal analysis, interpretation of results, manuscript drafting, visualization, and correspondence.

Dr. Shubhangi Sakore: Methodology, validation, literature review, manuscript editing, and critical revision of the manuscript.

Author Biographies

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List of Abbreviations

PRBC – Packed Red Blood Cells
FFP – Fresh Frozen Plasma
CBME – Competency-Based Medical Education
HIV – Human Immunodeficiency Virus
HBV – Hepatitis B Virus
HCV – Hepatitis C Virus
TNMC – Topiwala National Medical College
BYL – Bai Yamunabai Laxman (Charitable Hospital)
IEC – Institutional Ethics Committee

Data Availability Statement:

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

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