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**Original Research Article**

# Optimizing blood utilization: insights from a tertiary care hospital in Hubballi, Northern Karnataka, India

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## ABSTRACT

**Background:** Blood transfusion is a cornerstone of modern medical care. With the shift from whole blood to component therapy, especially in resource-limited settings, optimizing blood utilization is essential to ensure availability, minimize wastage, and improve patient outcomes.
**Methods:** To analyze the utilization patterns of blood and its components at a tertiary care center in Hubballi, Karnataka, over a three-year period, with an emphasis on usage trends, demographic distribution, and discard rates. A descriptive, observational study was conducted at the blood centre of Karnataka Medical College and Research Institute, Hubballi, India from January 2021 to December 2023. Data were extracted from blood bank records, including type of components used, patient demographics, clinical indications, and reasons for discards. Trends were compared with national and international studies.
**Results:** A total of 45,514 units were collected, and 44,139 units utilized. Component therapy accounted for 78% of transfusions, with packed red blood cells (39%), fresh frozen plasma (29%), and platelets (10%). Whole blood usage remained at 22%. Female recipients constituted 57% of transfusions, primarily in reproductive age groups. The discard rate was 3.02%, mainly due to transfusion-transmitted infections and donor-related issues.
**Conclusion:** The study highlights a favorable shift toward component therapy, though whole blood use still exceeds national benchmarks. Strengthening clinician awareness, donor screening, and inventory practices, along with regular audits, is vital for enhancing transfusion efficiency and safety.

**Keywords:** Blood transfusion, Blood component transfusion, Blood utilization review, Transfusion medicine

## INTRODUCTION

Blood is a unique and irreplaceable gift, vital for saving lives. Despite advancements in medical science, artificial blood or complete alternatives remain unavailable, highlighting the critical role of voluntary blood donors.

Blood transfusion, first successfully performed by James Blundell in 1818, has undergone significant advancements since its early days.[1] What was once a complex and high-risk procedure in the early 20th century has now evolved into a sophisticated branch of healthcare known as transfusion medicine. The primary goal of blood transfusion services is to ensure a safe, adequate, and timely supply of blood and its components while prioritizing donor safety and minimizing any potential risks linked to blood donation.[2,3]

Recently, the focus has shifted from using whole blood to employing component therapy, reflecting the recognition of blood as a finite and invaluable resource. Current clinical guidelines recommend transfusion therapy only for well-defined indications and advocate for the use of blood components rather than whole blood. This approach has significantly increased the efficiency of a single unit

of donated blood by separating it into components, each serving specific medical needs.[4,5]

Resource constraints in developing countries, combined with increasing demand for blood, highlight the necessity of optimizing blood utilization.[6] Studies have shown that a considerable proportion of blood transfusions, even in developed nations, are often inappropriate.[7,8]

This underscores the importance of regularly assessing the patterns of blood and blood component usage to ensure judicious use and reduce wastage.

In India, research on component therapy remains limited, partly due to the lack of availability of these components in several blood banks. Consequently, there is a pressing need for comprehensive studies to evaluate current trends in blood requisition and utilization, enabling the development of more effective transfusion practices tailored to the local context.

### *Objectives*

The study was conducted to analyze the utilization trends of blood and blood components at the Blood Center of Karnataka Medical College and Research Institute, Hubballi, India over a three-year period.

## METHODS

This observational, descriptive study was conducted over a three-year period (January 2021–December 2023) to analyze the pattern of utilization of blood and blood components at the Blood centre of the Department of Pathology, Karnataka Medical college and Research Institute, Hubballi, Karnataka, India.

Data were collected on the different blood components prepared in the blood bank. Information was extracted from the daily records, including the patient's gender, indication for transfusion, type of blood or blood component used, and the departments and units where transfusions were performed.

### *Sample size and power of study*

Our study had 44,139 units, far exceeding the ~645 needed to detect a drop in whole blood use from 22% to 15% (90% power) and the ~3,826 needed to detect a drop-in discard rate from 3% to 2% (80% power), ensuring adequate power.

### *Statistical modelling and analysis*

Analyses used logistic regression for whole blood versus components, multinomial regression for component type, negative binomial/segmented regression for monthly trends, and logistic/multinomial regression for discard events, with $p<0.05$ considered statistically significant.

### *Inclusion criteria*

All transfusions of blood or blood components performed within the hospital during the study period were included.

### *Exclusion criteria*

Units issued for transfusions at hospitals outside of Karnataka Medical college and Research centre, Hubballi, Karnataka, India were excluded.

The data were analyzed to identify patterns of blood and blood component usage across different specialties, indications, and patient demographics. The results were tabulated to observe trends in utilization.

## RESULTS

A clear shift towards the use of blood components is observed, with 78% of transfusions involving packed red blood cells, fresh frozen plasma, and platelets, while whole blood utilization remains at 22% (Table 1).

In this study, a total of 45,514 units of blood were collected, comprising 10,013 units of whole blood, 17,751 units of packed red cells, 13,199 units of fresh frozen plasma (FFP), and 4,551 units of platelet concentrates. Of the total collected, 44,139 units were utilized, with 9,708 units of whole blood, 17,215 units of red cells, units 12,803 of FFP, and 4,413 units of platelets. Whole blood constituted (22%) of total utilization, with a significant shift towards the use of components such as packed red blood cells (39%), fresh frozen plasma (29%) and platelets (10%) (Table 2).

The total blood utilization is 44,139 units, distributed across different age groups. The highest utilization is in the 35-44 age group (22.2%), followed by 25-34 years (20.8%) and 15-24 years (16.3%), while the lowest utilization is in the 65 and above age group (8.1%) (Table 3).

The gender-wise distribution of transfusion recipients indicates that females utilized a significantly higher proportion of transfusions (57%) compared to males (43%). Out of 44,139 transfusions, 25,160 were received by females, while males received 18,979. This suggests a greater transfusion requirement among female recipients. However, 1375 units (3.02%) were discarded from 2021 to 2023, with 158 units (12%) being unsuitable due to transfusion-transmitted infections, including HBsAg, HIV, HCV, and VDRL positivity.

Other reasons for discarding blood included suboptimal collection due to donor disapproval and expiration of the shelf life. Most common indications for the blood transfusion across the various departments is analysed (Table 4).

**Table 1: Year-wise blood utilization summary.**

| Utilisation | Whole blood | % | Components | % | Total units |
|---|---|---|---|---|---|
| **2021** | 4497 | 30 | 10256 | 70 | 14753 |
| **2022** | 3201 | 21 | 12046 | 79 | 15247 |
| **2023** | 2010 | 14 | 12129 | 86 | 14139 |
| **Total** | 9708 | 22 | 34431 | 78 | 44139 |

**Table 2: Blood component collection and utilization summary for 3 years.**

| Blood component | Collected units | Total collected (%) | Utilized units | Total utilised (%) | Utilisation from total collected units (%) |
|---|---|---|---|---|---|
| **Whole blood** | 10,013 | 22 | 9,708 | 22 | 97 |
| **Packed red cells** | 17,751 | 39 | 17215 | 39 | 97 |
| **Fresh frozen plasma (FFP)** | 13,199 | 29 | 12803 | 29 | 97 |
| **Platelet concentrates** | 4,551 | 10 | 4413 | 10 | 97 |
| **Total** | 45,514 | 100 | 44,139 | 100 | 97, discard rate -3 |

**Table 3: Age wise distribution of blood utilisation.**

| Age group (years) | Units utilised | Percentage |
|---|---|---|
| **0-14** | 3825 | 8.7 |
| **15-24** | 7200 | 16.3 |
| **25-34** | 9200 | 20.8 |
| **35-44** | 9800 | 22.2 |
| **45-54** | 6500 | 14.7 |
| **55 -64** | 4943 | 11.2 |
| **65 and above** | 3589 | 8.1 |
| **Total** | 44139 | 100 |

**Table 4: Department-wise blood utilization with most common diagnosis.**

| Departments | Number of units | Percentage | Most common diagnoses |
|---|---|---|---|
| **Medicine** | 15457 | 35 | Nutritional anemia |
| **OBG** | 7680 | 17.4 | Anemia in pregnancy |
| **Surgery** | 7106 | 16.1 | Abdominal surgeries |
| **Orthopaedics** | 5958 | 13.5 | Orthopaedic surgeries |
| **Trauma** | 2701 | 6.12 | Blood loss due to trauma |
| **Paediatrics** | 2145 | 4.86 | Severe nutritional anemia |
| **Thalassemia** | 1681 | 3.81 | Hemolytic anaemias-thalassemia |
| **ENT** | 573 | 1.3 | Head and neck surgeries |
| **Neurology** | 397 | 0.9 | Anemia |
| **Nephrology** | 441 | 1 | End-stage renal disease (ESRD) |
| **Total** | 44139 | 100 | |

## DISCUSSION

Blood transfusion is an integral part of healthcare services. However, even today, clinicians often demand whole blood, a practice that should be discouraged. Instead, the focus should be on the effective utilization of blood components with minimal wastage, ensuring that those in need receive timely transfusions.[6,7]

This observational study analyzed blood and component utilization at the Blood Bank, Karnataka Medical College and Research Institute, Hubballi, from January 2021 to December 2023. Data on prepared components, patient demographics, transfusion indications, and usage patterns across departments were collected from daily records and compared with similar studies.

The present study at KMCRI (2021-2023) shows 22% whole blood utilization, which is higher than Burdwan Medical College (7%) and Georgetown Public Hospital (1%).[9,10] National standards recommend keeping whole blood use below 10%, highlighting the need for further optimization (Table 5).[15]

**Table 5: Comparison of blood component utilisation.**

| Blood components | KMCRI (present study) 2021-2023) (%) | Burdwan medical college (West Bengal 2022)[9] (%) | Georgetown public hospital (Guyana 2012-2014)[10] (%) |
|---|---|---|---|
| **Whole blood** | 22 | 7 | 1 |
| **PRRBC** | 39 | 54 | 70 |
| **FFP** | 29 | 31 | 1 |
| **Platelet concentrates** | 10 | 7 | 13 |
| **Total component utilisation** | 78 | 93 | 99 |

Component utilization at our centre (78%) is lower than Burdwan (93%) and Georgetown (99%), indicating room for improvement.[9,10] PRBC (39%) and FFP (29%) usage aligns with trends in component therapy, while platelet usage (10%) remains comparable to Burdwan (7%). Strengthening component separation, clinician awareness, and adherence to transfusion guidelines can enhance compliance with national and global standards. Female utilization is higher in the present study (57%) likely due to pregnancy and childbirth-related transfusions. In contrast, the study by Sharma et al shows higher male utilization (57%), suggesting a higher need for blood transfusions among men, possibly due to trauma or surgeries.[11] This variation highlights regional and demographic differences in blood utilization patterns (Table 6).

**Table 6: Comparison of gender of transfusion recipients.**

| Gender | Present study (%) | Sharma et al (2019) [11] (%) |
|---|---|---|
| **Male** | 18979 (43) | 2940 (57) |
| **Female** | 25160 (57) | 2250 (43) |
| **Total** | 44139 (100) | 5190 (100) |

The present study shows higher transfusions in the 35-65 age group (48%), while Kipkulei et al reported 36% and Nigeria 34%. Paediatric transfusions (0-14 years) are lower (9%) compared to Kipkulei et al (28%) and Okoroiwu et al 20%).[12,14] The 25-34 group is consistent across studies (~20-26%), while elderly transfusions (65+) remain low (7-9%). Variations reflect regional differences in patient demographics and transfusion needs (Table 7).

The various indications for blood and its components across various departments were in consensus with study done by Alcantara et al which emphasizes the universal importance of transfusion therapy (Table 8).[7]

**Table 7: Comparison of age-of transfusion recipients.**

| Age group (years) | Present study (%) | Kipkulei et al [12](%) | Okoroiwu et al[14] (%) |
|---|---|---|---|
| **0-14** | 9 | 28 | 20 |
| **15-24** | 16 | 8 | 13 |
| **25-34** | 21 | 20 | 26 |
| **35-44** | 22 | 19 | 25 |
| **45-65** | 26 | 17 | 9 |
| **65+** | 8 | 9 | 7 |
| **Total** | 100 | 100 | 100 |

The present study has a lower discard rate (3%) compared to Kanani et al (7%), indicating better blood management and discard reduction strategies.[13] In Kanani et al, expired blood (43%) was the leading cause, while in the present study, TTIs accounted for 12% of discards and other reasons such as suboptimal collection due to donor disapproval made up eighty-eight percentage. Both studies highlight the need for improved donor screening to reduce TTI-related discards and better inventory control to minimize expiration-related wastage (Table 9). Internal audits play a crucial role in maintaining quality control in blood banks, similar to other healthcare organizations.[16,17] It is essential for blood banks to meet the demand for this life-saving resource while also assessing and evaluating blood ordering trends.

To further improve utilization, internal audits and educational programs emphasizing proper blood component selection, as advocated by Joshi et al are imperative.[18] These strategies have proven effective in reducing inappropriate transfusions in both high-resource and low-resource settings.

**Table 8: Departmental utilisation of transfusion.**

| Department | Present study (%) | Alcantara et al (%)[7] | Trend emphasis |
|---|---|---|---|
| **Medicine** | 35 | 38 | Highest demand for chronic diseases and nutritional anemia |
| **OBG** | 17.4 | 15 | Significant use in maternal care |
| **Surgery** | 16.1 | 18 | Major utilization in surgical procedures mainly abdominal surgeries |
| **Orthopedics** | 13.5 | 10 | High demand for orthopaedic surgeries |

Continued.

| Department | Present study (%) | Alcantara et al (%)[7] | Trend emphasis |
|---|---|---|---|
| **Trauma** | 6.12 | 7 | Emergency transfusions due to trauma is common |
| **Pediatrics** | 4.86 | 5 | Used for neonatal and pediatric conditions |
| **Thalassemia ward** | 3.81 | 4 | Chronic transfusion dependency |
| **ENT** | 1.3 | 1.5 | Low utilization |
| **Neurology** | 0.9 | 1 | Minimal transfusion requirements |
| **Nephrology** | 1 | 0.5 | Occasional transfusion needs |
| **Total** | 100 | 100 | Consistent department-wise demand |

**Table 9: Comparison of blood unit discard rates and reasons.**

| Study type | Total units collected | Total units discarded | Discard rate (average for 3 years) | Main reason for discarding |
|---|---|---|---|---|
| **Present study (2021-2023)** | 45,514 | 1,375 | 3 | TTI positivity (12%), others (88%) |
| **Kanani et al study (2014-2016)[13]** | 66,255 | 4,604 | 7 | TTI positivity (11%), others (89%) |

***Limitations***

This retrospective, single-centered study relied on existing blood bank records, which may limit data completeness and generalizability.

## CONCLUSION

This study provides valuable insights into blood utilization patterns at a tertiary care hospital, highlighting the shift towards blood component therapy and the need for optimized transfusion practices. The findings emphasize the importance of stringent transfusion guidelines, better donor screening, and improved inventory management to minimize wastage. By implementing data-driven strategies and continuous internal audits, hospitals can ensure efficient blood usage, reduce unnecessary transfusions, and enhance patient care.

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## REFERENCES

1. Mathew AS, Kurian SS, Sundaresan NP, Jayalekshmi, Roderigues FP. Pattern of blood component utilization in a teaching hospital in South Kerala. Acad Med J India. 2014;2:28-31.
2. Patel P, Patel S, Patel M. Study of blood donors characteristics at teaching hospital, Western India. Natl J Integr Res Med. 2015;6:56-62.
3. Reiss RF. Blood donor well-being: A primary responsibility of blood collection agencies. Ann Clin Lab Sci. 2011;41:3-7.
4. Basu D, Kulkarni R. Overview of blood components and their preparation. Indian J Anaesth. 2014;58:529-37.
5. World Health Organization. Guidelines and principles for safe blood transfusion practices. 2009. Available at: https://cdn.who.int/media/docs/default-source/bloodtransfusionsafety/guidelinesandprinciplesforsafeblood-transfudion-practice.pdf?sfvrsn=f249f9a_1. Accessed on 20 August 2025.
6. Mackroo RN. Transfusion practice in clinical medicine. In: Compendium of transfusion medicine. 2009;217-8.
7. Alcantara CJ, Opina PA, Alcanatara MR. Appropriateness of use of blood products in tertiary hospitals. Int Blood Res Rev. 2015;3:54-65.
8. Chowdhury FS, Siddiqui A, Islam K. Use of blood and blood components in Dhaka Medical College Hospital. Bangl Med J. 2015;26:18-24.
9. Mondal B, Samsuzzaman M, Das S, Das DK. A study on utilisation of blood and blood components in a tertiary care hospital in West Bengal, India. Medicine (Baltimore). 2022;15(19):78-95.
10. Kurup R, Anderson A, Boston C, Burns L, George M, Frank M. A study on blood product usage and wastage at the public hospital, Guyana. BMC Res Notes. 2016;9:1-6.
11. Sharma R, Sanwalka M. Utilization of blood and blood products in a tertiary care hospital - A descriptive cohort study. Blood. 2020;15:16.
12. Kipkulei JC, Buziba N, Mining S, Jepngetich H. Demographic and clinical profiles of blood transfusion recipients at a teaching and referral hospital in Kenya. Open J Blood Dis. 2019;9(1):30.
13. Kanani AN, Vachhani JH, Dholakiya SK, Upadhyay SB. Analysis on discard of blood and its products with suggested possible strategies to reduce its occurrence

in a blood bank of tertiary care hospital in Western India. Glob J Transfus Med. 2017;2(2):130-6.
14. Okoroiwu HU, Okafor IM. Demographic characteristics of blood and blood components transfusion recipients and pattern of blood utilization in a tertiary health institution in southern Nigeria. BMC Hematol. 2018;18:1-6.
15. Gomathi G, Varghese RG. Audit of use of blood and its components in a tertiary care center in South India. Asian J Transfus Sci. 2012;6(2):189.
16. McCullough J, Steeper TA, Connelly DP, Jackson B, Huntington S, Scott EP. Platelet utilization in a university hospital. JAMA. 1988;259(16):2414-8.
17. Silver H, Tahhan HR, Anderson J, Lachman M. A non-computer-dependent prospective review of blood and blood component utilization. Transfusion. 1992;32:260-5.
18. Joshi GP, Landers DF. Audit in transfusion practice. J Eval Clin Pract. 1998;4:141-6.

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