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Frequency and Causes of Blood Component Discard in a Tertiary Care Hospital Blood Bank: A Five-Year Retrospective Study

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Abstract

Introduction

Blood and its components play a crucial role in healthcare, making their use vital for transfusion services. Disposal of blood components presents clinical, ethical, and financial challenges. This study aimed to assess the component-wise discard rates and identify the reasons for blood component discard at a tertiary care hospital blood bank over a five-year period.

Materials and methods

A retrospective cross-sectional study was conducted at the Blood Bank, Department of Pathology, Government Medical College and Hospital, Nagpur, from January 2021 to December 2025. This study included 54,046 blood donors. Information on blood collection, component preparation, discarded units, and disposal reasons was extracted from blood bank records. The discard rate was calculated as the proportion of discarded units among total components prepared.

Results

Throughout the study period, 1,10,886 blood components were produced, of which 3,932 were discarded, leading to a discard rate of 3.5%. Platelet concentrates had the highest discard rate (851, 4.9%). Subsequently, fresh frozen plasma accounted for 1,432 (3.6%), while packed red blood cells made up 1,273 (3.2%), and whole blood constituted 376 (2.7%). The primary reason for discard was expiry (2,296, 58.39%), followed by TTI positivity (380, 9.66%), returned unused units (294, 7.48%), undercollection (268, 6.82%), leakage (264, 6.71%), hemolysis (220, 5.60%), and clotting (210, 5.34%). Among TTIs, the highest occurrence was of HBsAg positivity, followed by syphilis, HIV, and HCV, with no malaria-positive units identified.

Conclusion

The overall discard rate was within acceptable limits, although a substantial proportion of wastage, particularly due to expiry, was potentially preventable. Strengthening inventory management, adherence to standard operating procedures, and staff training may help minimise avoidable blood component wastage.

Categories: Pathology
Keywords: blood components, blood wastage, discard rate, transfusion services, transfusion-transmitted infections

Introduction

Blood and blood components are essential for patient care in the current era of contemporary medicine. Blood transfusion services (BTS) are essential for most medical and surgical emergency procedures. An effective and properly managed BTS would improve patient care and advance the nation's healthcare system [1]. In India, human blood is categorized as a "drug" under Section 3(b) of the Drugs and Cosmetics Act of 1940. Given that globally, a person requires blood every two seconds, it is crucial to guarantee the prompt and secure availability of blood bags [2]. Blood shortages are caused by several issues, such as inadequate transportation infrastructure, inadequate inventory control, and lack of effective donor recruitment. This underscores the significance of the appropriate use of blood and its components [3].

In contemporary medical and surgical practices, blood components are utilized more frequently than whole blood. By dividing a single whole-blood donation into its components, it is possible to save three lives. In 2016 and 2017, blood banks across the country disposed of 1.18 million units of blood and its components [4]. To ensure an adequate and secure blood supply, a comprehensive blood safety strategy must be implemented. Ensuring that the shelf is consistently stocked with an appropriate inventory is the easiest method to secure the prompt availability of blood. In order to handle the continuously growing supply and demand for blood and its components, stricter guidelines for the donation of blood must be implemented,

and the correct use of blood should be ensured [5].

Blood product waste is frequently caused by damaged bags, broken seals, expired units, clotted blood, and other variables, the most significant of which is a lack of awareness and knowledge. Between 0% and 6% of blood is wasted, which is a global ethical and economic issue [6]. At present, approximately 100 nations globally have implemented national standards for the clinical use of blood and blood products [7]. Among the 10 quality indicators outlined by the National Accreditation Board for Hospitals and Health Care Providers, the "wastage rate," which measures the proportion of discarded blood components, ranks third [8].

The present study aimed to assess the frequency of blood component discard, determine component-wise discard rates, and identify the major reasons for discard in a tertiary care hospital blood bank over a five-year period. The findings of this study may help identify areas for improvement in blood component preparation, storage, inventory management, optimal utilization, and staff training, thereby contributing to the reduction of blood component discard.

Materials And Methods

Study setting

This was a retrospective, cross-sectional study conducted from January 2021 to December 2025.

Sample size

The study encompassed a total of 54,046 donors.

Inclusion criteria

This study examines blood units discarded during the research period for several reasons, such as positivity for transfusion-transmitted infections (TTIs), expiration, insufficient volume, leakage, clotting, hemolysis, and non-utilisation after issuance.

Exclusion criteria

Blood units and components that were not discarded during the study period were excluded from the analysis.

Data collection

Data pertaining to the donors were sourced from the registries of the Blood Center. Furthermore, records were maintained regarding the daily volume of blood collected, the quantity and units of whole blood and its components processed, the quantity and total units of blood components disposed of, and the rationale behind their disposal. A standardized pro forma was employed to collect comprehensive donor information, including medical history, demographic details, and informed consent for donation. After donor selection, a brief clinical evaluation was performed on the selected donors.

Study procedure

The blood units were stored at 2-6°C and then tested for transfusion-associated infection. The blood units that passed the screening underwent component separation within six hours of collection and were stored and distributed based on patient needs. Blood units from voluntary donation camps were transported in blood transport boxes at 2-10°C to ensure that the cold chain was properly maintained. Whole blood can be stored for 35 days when kept at a temperature of 2-6 °C. Commonly prepared blood components include packed red blood cells (pRBCs), fresh frozen plasma (FFP), and platelet concentrates (PCs). pRBCs can be preserved for up to 42 days when kept at a temperature range of 2-6 °C in the additive solution known as saline adenine glucose mannitol (SAGM). PCs last for five days at 22-24°C, whereas FFP can be preserved for one year at -40°C. Blood units that demonstrated deficiencies in collection, leakage, clotting, or hemolysis during storage, tested positive for TTIs, expired before reaching the end of their designated shelf life, or were not utilized after issuance from the Blood Center were subject to disposal. The blood bank's disposal process for blood and its components followed the standard operating procedures, aligning with the standards set by the National AIDS Control Organisation (NACO) [9].

Statistical analysis

Data were tabulated and analysed using Microsoft Excel 2019 MSO (version 2612; Microsoft Corporation, Redmond, WA). Descriptive statistics, including frequencies and percentages, were used to summarize the data. The discard rate was calculated as the proportion of discarded blood components relative to the total number of components prepared, expressed as a percentage. The following formula was used to determine the percentage discard [10].

Discard Rate = (Number of blood components discarded / Total number of blood components prepared) x 100

Ethical consideration

Approval was obtained from the Institutional Ethics Committee (IEC) at Government Medical College, Nagpur, with IEC number EC/Pharmac/GMC/NGP/3965.

Results

The study was conducted between January 2021 and December 2025 and involved 54,046 blood donors. Table *1* displays the distribution of donors by type and gender. There were 8,778 replacement donors (16.24%) and 45,268 voluntary donors (83.76%). There were 44,950 male and 318 female voluntary donors, and 8,696 male and 82 female replacement donors. Compared with female donors (400), male donors (53,646) made up the majority of the overall population.

Donor Type	Male	Female	Total Donors
Voluntary	44,950	318	45,268
Replacement	8696	82	8778
Total	53,646	400	54,046

TABLE 1: Distribution of blood donors by gender and donor type

Table *2* illustrates the distribution of blood components that were both collected and discarded. Throughout the trial, a total of 1,10,886 blood components were produced, out of which 3932 units were discarded, resulting in an overall discard rate of 3.5%.

Blood Components	Blood Components Collected	Blood Components Discarded	Discard Rate (%)
Whole blood	13,939	376	2.7
Packed red cells	39,786	1273	3.2
Platelet concentrates	17,375	851	4.9
Fresh frozen plasma	39,786	1432	3.6
Total	110,886	3932	3.5

TABLE 2: Distribution of collected and discarded blood components by type

Among the blood components, platelet concentrates were discarded most frequently, at 851 (4.9 %). This was followed by fresh frozen plasma at 1,432 (3.6%), packed red blood cells at 1,273 (3.2%), and whole blood at 376 (2.7%).

Table *3* presents the various reasons for the disposal of blood components. The distribution of these causes is also depicted in Figure *1*. The most important reason was expiration alone, which accounted for 2,296 (58.39%) of all discards. TTI-positive (380, 9.66%), returned unusable units (294, 7.48%), undercollection (268, 6.82%), leakage (264, 6.71%), hemolysis (220, 5.60%), and clotting (210, 5.34%) were among the other significant causes. These results emphasize the importance of managing inventories effectively, handling blood components safely, and making the best use of them to reduce wastage.

Blood Components	Expiry	TTI Positivity	Leakage	Hemolysis	Clotting	Undercollection	Returned Unused After Issue	Total Discard
Whole blood	80	130	40	25	30	45	26	376
Packed red cells	720	102	94	55	40	93	169	1273
Platelet concentrates	550	55	40	20	90	50	46	851
Fresh frozen plasma	946	93	90	120	50	80	53	1432
Total	2296	380	264	220	210	268	294	3932

TABLE 3: Distribution of causes leading to the discard of blood components

TTI: transfusion-transmitted infections

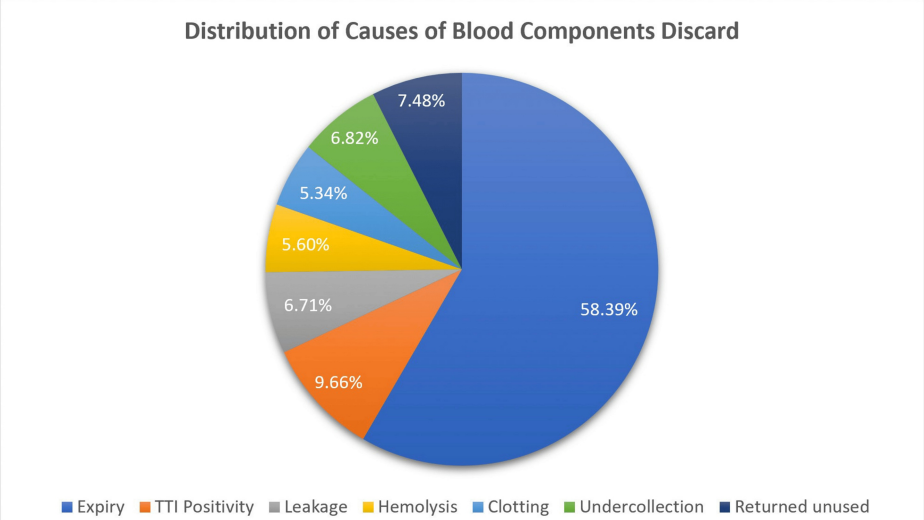

FIGURE 1: Distribution of causes of blood component discard

TTI: transfusion-transmitted infections

Table *4* shows the component-wise distribution of TTI-positive units. Hepatitis B surface antigen(HBsAg) was the most common TTI-positive finding in 274 units, followed by syphilis (41 units), HIV (37 units), and HCV (28 units). There were no units tested positive for malaria. HBsAg was positive in all four components, whereas syphilis was detected only in whole blood. These findings highlight the importance of thorough donor screening and compulsory TTI testing to ensure the safe transfusion of blood and its components and prevent TTIs.

TTI Positivity	Whole Blood	Packed Red Blood Cells	Platelet Concentrate	Fresh Frozen Plasma	Total
HBsAg	80	79	42	73	274
HCV	05	09	06	08	28
HIV	04	14	07	12	37
Syphilis	41	00	00	00	41
Malaria	00	00	00	00	00

TABLE 4: Component-wise distribution of TTI-positive units

HBsAg: hepatitis B surface antigen; HCV: hepatitis C; TTI: transfusion-transmitted infections

The present study showed a discard rate of 3.5%, which indicates satisfactory performance of blood transfusion services and efficient utilization of blood resources. A considerable proportion of the voluntary donors, at 45,268 (83.76%), reported having a strong donor recruitment strategy, which helped ensure a safer blood supply. This is an optimal use of the therapeutic value of each donation because the components are separated. The overall discard rates for platelet concentrate (851, 4.9%), fresh frozen plasma (1,432, 3.6%), packed red blood cells (1,273, 3.2%), and whole blood (376, 2.7%) were slightly higher than those of the other components but were still within acceptable limits. The primary reason for discards was expiry (2,296, 58.39%), followed by TTI positivity (380, 9.66%), unused returned units (294, 7.48%), undercollection (268, 6.82%), leakage (264, 6.71%), hemolysis (220, 5.60%), and clotting (210, 5.34%). The results show that, although the blood bank has good operational efficiency, there are certain significant problems that could be prevented and result in blood being discarded. Therefore, it is imperative to improve inventory management, stock rotation, the optimization of component preparation depending on demand and standard procedures, and staff training to optimize blood use and reduce waste.

Discussion

The wastage of blood and blood components is an important quality indicator for evaluating the efficiency of blood transfusion services and has significant clinical, ethical, and economic implications. In the present study, the overall blood component discard rate was 3,932 (3.5%), indicating relatively efficient utilization of blood resources. This finding is broadly comparable with the rates reported in previous studies by Bhuyan et al. (223, 6.3%), Kanangot et al. (1,375, 3.02%), and Luhar et al. (2,637, 2.9%) [11-13]. The variation in discard rates across these studies may be attributed to differences in inventory management practices, blood component utilization patterns, storage facilities, and institutional transfusion demands.

In the present study, the high rate of voluntary donors (45,268, 83.76%) is an important strength because voluntary donations are associated with better safety characteristics and lower rates of TTIs. These findings are consistent with the studies of Kakkar et al. and Suresh et al., who highlighted the importance of voluntary blood donation programs and awareness campaigns in strengthening safe blood supply [14,15]. The male predominance in the present study is consistent with previous studies and represents sex disparities in blood donation, which may be attributed to sociocultural factors, prevalence of anemia among females, and lack of awareness [3,16]. Donor availability and diversity could be increased by addressing this gap through focused health and awareness initiatives.

Component-wise analysis in this study revealed that platelet concentrates had the highest discard rate (851, 4.9%), followed by fresh frozen plasma (1,432, 3.6%), packed red cells (1,273, 3.2%), and whole blood (376, 2.7%). Similar findings were reported by Morish et al. and Mani et al., who attributed the high discard rates of platelet concentrates to their short shelf life and stringent storage requirements. In this study, rather than storage limitations, inventory management problems, overproduction, or reduced clinical demand at certain times could be the cause of the comparatively higher fresh frozen plasma discard rate. This emphasizes the importance of preparing components in accordance with demand and routinely checking stock levels [17,18].

In the present study, the primary reason for discarding blood units was expiry, accounting for 2,296 (58.39%) of the total discard, making it the most significant factor for blood discard. These findings were consistent with those of studies conducted by Bhuyan et al., Suresh et al., and Mani et al., in which expiry was the main cause of blood component discard in tertiary care hospital blood banks [11,15,18]. The high discard rate due to expiry is associated with an imbalance between supply and demand, overproduction of specific blood products, and short shelf life of blood products, particularly platelet concentrates. Because expiry is largely preventable, these results highlight the importance of effective inventory management. This can be achieved by strictly applying the first-in-first-out (FIFO) policy, conducting regular stock audits, preparing

components based on demand, and enhancing coordination between clinicians and blood bank staff [9,19]. By reinforcing these practices, unnecessary wastage can be greatly reduced, blood component utilization can be improved, and the overall effectiveness of transfusion services can be boosted.

In this study, additional reasons for discard of blood components were found to include insufficient collection, leakage, hemolysis, clotting, and return of unused blood units. Luhar et al. and Kakkar et al. reported similar findings suggesting that these are common and mostly preventable causes of blood discard in transfusion services [13,14]. Inadequate collection of blood can occur due to challenges in venipuncture, donor-related issues, or premature stopping of blood collection, whereas improper handling, storage, transportation, or technical errors during component preparation often lead to leakage, hemolysis, and clotting. The return of unused blood units suggests either inappropriate blood requests or lack of effective communication between clinical departments and the blood bank. These findings highlight the necessity of ongoing staff education, strict adherence to standard operating procedures, and comprehensive quality assurance practices to reduce unnecessary wastage of blood components and enhance the operational efficiency of blood banks [9,19].

In this study, 380 (9.66%) of the total discards were due to TTIs. HBsAg was the most frequently detected infection, followed by syphilis, HIV, and HCV. Malaria was not detected in any of the tested units. The prevalence of hepatitis B among TTI-positive blood donors has also been noted in other Indian studies, pointing to the ongoing persistent challenge of HBV infection in the donor population [14,15]. The relatively low proportion of discards related to TTIs suggests the effectiveness of blood bank strategies in donor selection, counselling, and mandatory screening. These findings highlight the need for stringent adherence to NACO guidelines, comprehensive serological testing, and rigorous donor screening to improve transfusion safety and minimize needless blood component discard [9,19].

This study supports the finding that, while some discarding is inevitable, a significant amount can be reduced with focused actions. To minimize waste, it is essential to improve inventory management systems, apply evidence-based utilization practices, increase technical knowledge, and improve communication between clinical departments and the blood bank. This study underscores the effectiveness of current blood bank procedures and identifies specific areas for improvement. These enhancements facilitate better resource optimization and improve patient care outcomes in tertiary healthcare settings.

Limitations

The retrospective design of the single-centre study limited its generalizability to wider contexts. The reliance on record-based data may have introduced documentation bias. Furthermore, the study did not evaluate specific consumption patterns or the clinical appropriateness of transfusions.

Conclusions

The present study provides an overview of blood component discard patterns and their major causes in a tertiary care hospital blood bank over five years. The overall discard rate was 3.5%, with platelet concentrates showing the highest component-specific discard rate. Expiry was identified as the leading cause of discard. These findings highlight potential areas for quality improvement, including better stock rotation, inventory monitoring, demand-based component preparation, and improved coordination between clinicians and blood bank personnel. Implementation of such targeted measures may help reduce blood component wastage, optimize resource utilization, and potentially improve patient care outcomes in tertiary care settings.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Rashmi Wankhade, Pratik Chide

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Drafting of the manuscript: Rashmi Wankhade, Pratik Chide

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Supervision: Rashmi Wankhade, Pratik Chide, Pradip Jadhav, Kirti Jaiswal

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. Institutional Ethics Committee of the Government Medical College and Hospital, Nagpur issued approval EC/Pharmac/GMC/NGP/3965. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **AI use statement:** The authors used Paperpal (Cactus Communications Private Limited, Mumbai, India) as follows: language polishing in Introduction and Discussion. We used AI only for language polishing and grammar. The authors confirm that they have reviewed and verified all AI-assisted content and take full responsibility for the work. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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