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Blood and blood component discards: An Indian tertiary-care blood bank study

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Abstract:
Blood component wastage limits product availability and increases the financial burden on transfusion services. Therefore, it is of interest to evaluate the discard patterns among blood components prepared from 20,582 donations during January–December 2023. Overall, 1,611 units (3.21%) of PRBCs, platelets, FFP and cryoprecipitate were discarded. Platelets had the highest discard rate (7.88%), mainly because of their short shelf life. Thus, data shows the improved screening, staff training, transfusion policies and demand-based platelet preparation may reduce wastage and improve resource utilization.

Keywords: Blood banks, blood component transfusion, biomedical waste, quality assurance, blood preservation

Background:
Blood transfusion services are essential components of modern healthcare and depend entirely on voluntary blood donors because no complete substitute for human blood is currently available **[1].** Blood and blood components are limited biological resources that require appropriate clinical use to prevent avoidable wastage **[2].** The persistent imbalance between demand and supply highlights the need for strict guidelines governing blood donation, component preparation, storage and transfusion practices **[3].** Blood centres therefore face the dual challenge of maintaining sufficient inventory for patient care while minimizing unnecessary expiry and discard **[4].** Systematic analysis of discarded blood and blood components can identify preventable causes of wastage and guide corrective measures **[5].** Regular discard audits can improve staff training, inventory control and demand-based component preparation within transfusion services **[1, 3].** The wastage rate is also recognized as an important quality indicator for evaluating the efficiency and resource utilization of blood centres **[2, 4].** Therefore, it is of interest to report the patterns, rates and reasons for discarding blood and blood components at a tertiary-care blood bank.

Materials and Methods:
A retrospective study on the causes of blood and blood component discard was conducted at the tertiary care hospital blood bank, from January to December 2023. Donations were sourced from voluntary and replacement donors and also from blood donation camps, in compliance with the selection criteria of the Ministry of Health and Family Welfare, Government of India. Packed red cells (PRC), fresh frozen plasma (FFP) and platelet concentrate (PC) were prepared from 350/450 ml blood bags under aseptic conditions following FDA guidelines, as per requirement. Discarding of blood bags was undertaken in compliance with the standard operating procedures of the National AIDS Control Organization (NACO). Screening for transfusion-transmissible infections (TTIs) was performed on all blood bags included in this study.

Inclusion criteria:
Blood bags tested positive for TTI, expired blood units, returned blood units, blood bags positive for ICT/DCT, high or low volume blood bags, blood units with hemolysis and blood bags damaged during processing were discarded.

Exclusion criteria:
Platelets collected by apheresis (SDP) are not included in this study. Discard rate of blood and blood components is calculated using the following formula:

Discard rate: total number of whole blood and blood components discarded x 100
Total number of whole blood and blood components prepared

Results:
Among 20582 total donors in our study, 72.24% were voluntary donors and 27.76% were replacement donors. Out of the total units collected, 1121 were kept as WB and 19461 PRBC, 9929 RDPs, 19406 FFPs and 245 cryoprecipitate were prepared **(Table 1).** Out of the total blood units, 1611 blood units and components were discarded, with an average discard rate of 3.21%. **Table 2** shows the discarded rate of blood components prepared. The number of whole blood and blood components discarded for various reasons is summarized in **Table 3**. Out of a total of 1,121 units of whole blood, 399 units were discarded, resulting in a discard rate of 35.5% (399 out of 1,121). The primary reason for the discard was positive test results for transmissible infections (TTIs), accounting for 51.62% of the discarded units. The second most common reason was an insufficient quantity of blood collected from donors, which made up 26.81% of the discarded bags. Other reasons for discarding whole blood bags included: collection of an excess volume of blood (13.53%), expiration of units due to non-utilization (6.76%), returned bags (0.25%), leakage (0.50%) and transfusion reactions (0.50%). A total of 19461 blood components were prepared for transfusion, which included 19461 packed red cells PRBC, 19406 FFPs, 9929 platelets and 245 cryoprecipitates. Total discard rate of packed RBCs was 1.73% (338 of 19461). Out of these,174 units (51.47%) were discarded due to small (inadequate) quantity followed by units testing positive for TTI (14.49 %), 10.35 % were expired units, 11.53% were discarded due to return of units, 6.50% due to ICT/DCT positivity, 4.73% due to transfusion reaction, 1.77 % due to large quantity and 1.47% for leakage. During the study period, random donor platelets (RDPs) represented the most frequently discarded component, with a discard rate of 7.88% (783/9929). The predominant reason for RDP discard was unit expiry (97.82%) owing to their short shelf life, followed by TTI-positive units (2.17%). Among 19,406 prepared FFP units, 84 were discarded, corresponding to a discard rate of 0.43%. Among discarded FFPs, the leading cause was TTI reactivity (55.95%), followed by leakage (32.14%) and return of bags (11.90%). Among 245 prepared cryoprecipitates, 7 units were

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discarded, corresponding to a discard rate of 2.85%. All 7 units of cryoprecipitates were discarded due to leakage of bags **(Figures 1-3).**

Table 1: Classification of blood donors

Categories of donors	Total	Percentage (%)
Voluntary	14869	72.24%
Replacement	5713	27.76%
Total	20582	100

Table 2: Discard rate analysis of prepared blood components.

Component	Components prepared	Units discarded	Discard rate in Percentage
Packed red cells	19461	338	1.73%
Random donor platelets	9929	783	7.88%
Fresh frozen plasma	19406	84	0.43%
Cryoprecipitate	245	7	2.85%

Table 3: Reasons for blood units' disposal

Blood & blood component	Expired	Small quantity	Large quantity	TTI reactive	ICT/DCT	Returned bag	Leakage	Transfusion reaction	Total
Whole blood	27	107	54	206	-	1	2	2	399
Packed red cells	39	174	6	49	22	27	5	16	338
Random donor platelets	766	-	-	17	-	-	-	-	783
FFPs	-	-	-	47	-	10	27	-	84
Cryoprecipitate	-	-	-	-	-	-	7	-	7
Total									**1611**

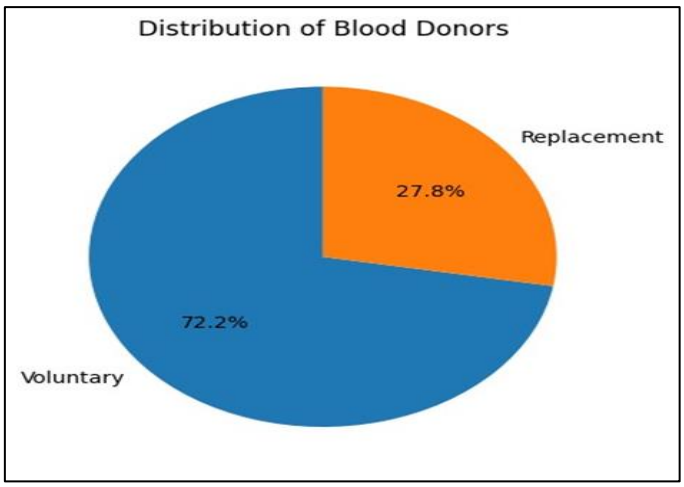

Figure 1: Pie chart depicting the proportion of voluntary and replacement blood donors in the study population

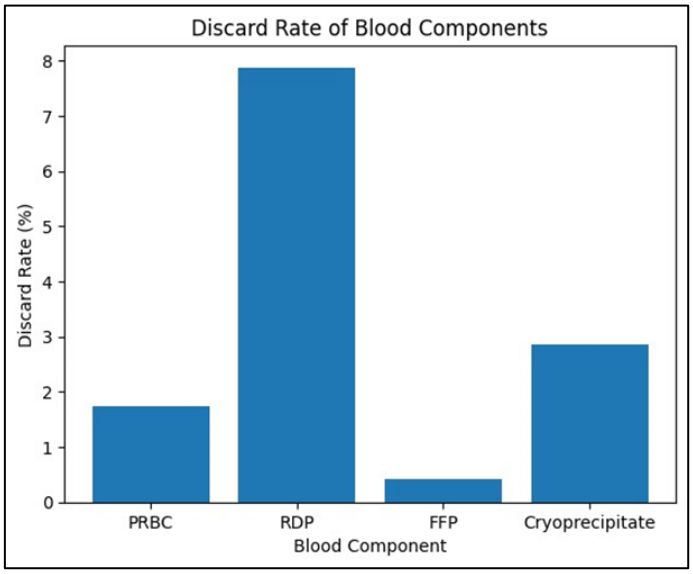

Figure 2: Bar diagram showing the discard rate of various blood components

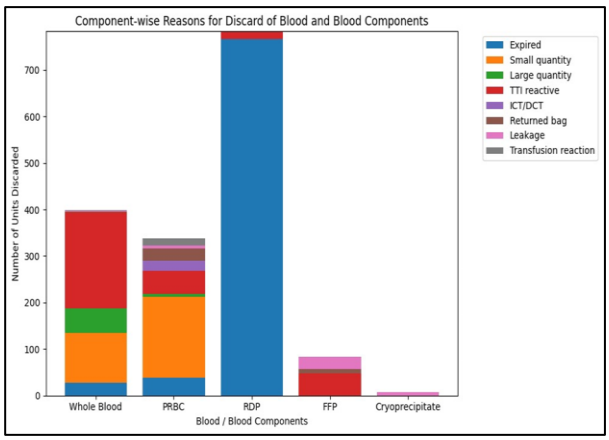

Figure 3: Stacked bar chart depicting component wise reasons for discard of blood and blood components

Discussion:

Periodic self-audit of discarded blood units is essential for identifying preventable causes of wastage and implementing corrective measures within transfusion services. In the present study, the overall discard rate of blood and blood components was 3.21%, indicating that a measurable proportion of collected resources remained unavailable for clinical use. The whole blood discard rate was 35.5%, which was considerably higher than the rates of 3.15%–7.70% reported previously **[3–7].** The leading cause was transfusion-transmitted infection (TTI) reactivity, accounting for 51.62% of discarded whole blood units, followed by suboptimal collection volume in 26.81%. The comparatively high contribution of TTI-reactive units may be explained by the institutional practice of performing TTI screening within one hour of collection and discarding reactive units before component separation. A similar predominance of TTI reactivity among discarded whole blood units has been reported, with one study attributing approximately 49% of such discards to this cause **[7].** More stringent donor selection, pre-donation screening and adherence to eligibility criteria may therefore reduce the collection of potentially unusable units. Another institutional factor was the reservation of whole blood for neonatal exchange transfusion, for which units had to be used within seven days. Subsequent adoption of reconstituted blood for neonatal

exchange transfusion may help reduce avoidable expiry-related wastage. Among the prepared blood components, 1,212 units (12.89%) were discarded. Platelets showed the highest discard rate at 7.88%, followed by cryoprecipitate at 2.85%, packed red blood cells (PRBCs) at 1.73% and fresh frozen plasma (FFP) at 0.43% **(Table 2).** The predominance of platelet wastage is clinically plausible because of their short shelf life and the difficulty of accurately predicting demand. Previous studies have also identified platelets as the most frequently discarded blood component, although some have reported substantially higher wastage than observed in the present study **[4–6].** Demand-based platelet preparation, closer inventory monitoring, redistribution between blood banks and greater use of apheresis may reduce unnecessary expiry. The comparatively lower platelet discard rate observed in this study may reflect more efficient inventory practices. The discard rate of cryoprecipitate was 2.85%, with seven of 245 units discarded because of leakage. This finding was comparable to the 3.03% discard rate reported by Dhote *et al.* **[8].** Improved handling, storage, thawing and transportation practices may further reduce damage-related losses. The PRBC discard rate was 1.73%, which was lower than most previously reported values and comparable to the 2.0% rate described in one earlier study **[6, 9].** The major causes included suboptimal collection, TTI reactivity, expiry, return after issue, positive indirect or direct antiglobulin tests, bag leakage and disposal following transfusion reactions. Suboptimal collection was mainly associated with phlebotomy failure and preparation of pediatric aliquots for thalassemia and other pediatric patients. Similar collection-related factors have been recognized as preventable contributors to red-cell wastage **[10, 11].** Kulkarni *et al.* reported substantial wastage of blood and its components, with platelet discard rates remaining particularly high, emphasizing the importance of regular audits, optimum utilization and strengthened blood transfusion services **[9]**. Shinde *et al.* observed a progressive decline in blood product discard from approximately 11% in 2018 to about 5% in 2022, while expiry and transfusion-transmitted infections remained important causes of wastage **[10]**. Mani *et al.* reported an overall blood and blood component discard rate of 5.95%, with expiry accounting for 74.56% of discarded units and platelet concentrates constituting the most frequently discarded component **[11]**. Bhuyan *et al.* documented a 6.3% blood component discard rate, of which 89.2% was attributable to transfusion-transmitted infection reactivity, highlighting the need for strengthened donor screening and regular blood bank audits **[12]**. TTI reactivity was the leading cause of FFP discard (55.95%), followed by leakage (32.14%) and non-utilization after issue (11.90%). Previous reports have similarly identified either TTI reactivity or bag leakage as major causes of plasma wastage **[3, 6]**. Overall, the findings indicate that blood component wastage results from both unavoidable biological factors and modifiable operational causes. Strengthening donor screening, staff training, phlebotomy practices, inventory control, demand-based component preparation and handling procedures may substantially reduce discard rates and improve the utilization of limited blood resources.

Conclusion:

We show the efficient use of blood and blood components is essential to reduce avoidable wastage and preserve these limited life-saving resources. Regular audits, strict transfusion policies, demand-based component preparation and effective inventory control can substantially reduce discard rates. Thus, improved donor screening, staff training and coordination between blood banks and clinical teams are essential for optimal resource utilization.

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