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Rationale for discard of blood and blood components in a tertiary care hospital blood center in Central India: A prospective observational study

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Abstract:
Blood and blood components are limited healthcare resources and understanding the causes of their discard is essential for improving transfusion service efficiency. A prospective observational study was conducted at the Department of Transfusion Medicine and Blood Centre, AIIMS Raipur, India, from May 2024 to October 2025 to evaluate the magnitude and causes of blood component discard. Among 52,760 blood components prepared during the study period, 5,226 were discarded, resulting in an overall discard rate of 9.91%, with platelet concentrates (13.18%) and fresh frozen plasma (12.06%) showing the highest discard rates. Storage-related causes accounted for the largest proportion of discarded units (49.77%), mainly due to expiry and leakage during storage or thawing, while quality-control failure was the leading processing-related cause, particularly among platelets. Thus, strengthening inventory management, quality assurance practices and cold-chain maintenance may substantially reduce avoidable blood component wastage and improve the utilization of transfusion resources.

Keywords: Blood discard, blood components, packed red blood cells, fresh frozen plasma, platelet concentrates, cryoprecipitate, blood bank, transfusion medicine, quality control, inventory management

Background:
Blood transfusion services are vital to trauma patients, patients with obstetric emergencies, surgical patients, patients receiving oncological treatments, patients with haematological issues and critically ill patients. Blood and blood products are finite resources that must be donated, tested, prepared, stored appropriately and monitored for safety. Therefore, it is important to minimise waste (unnecessary discards) when managing blood and blood product resources through transfusion services **[1]**. The use of blood components such as packed red cells, fresh frozen plasma, platelet concentrates and cryoprecipitates has enhanced the efficacy of transfusion practices. However, this change also introduced additional opportunities for loss during blood collection and subsequent processing, storage and issuance **[2]**. Platelet concentrates have the highest waste rate due to their relatively short shelf-life and the uncertainty of future requests for them **[3]**. Research conducted at tertiary-care medical facilities has reported a wide variety of waste or discard rates for blood components. The majority of waste and discards are attributed to platelets and fresh-frozen plasma **[4, 5]**. Reasons for blood waste or discard include expiration, leakage during storage or thawing, reactive transfusion-transmitted infections, lipemic units and quality control failures **[5, 6]**. Wasting blood not only means that blood will not be available for transfusion, but also results in the loss or inefficiency of staff, supplies, testing resources and increased health care expenses **[7]**. Therefore, it is of interest to evaluate the rationale for discard of blood and blood components in a tertiary care hospital blood centre in Central India.

Materials and methods:
To measure the volume of whole blood and its associated components discarded by the Department of Transfusion Medicine at AIIMS Raipur, this study is an observational study based on medical records from May 2023 to October 2025. In this study, all units of PRBC, FFP (fresh frozen plasma), platelets, cryoprecipitate and whole blood collected directly from donors through in-house donations and outdoor camping were evaluated for donation-related wastage. It excluded units obtained via apheresis donations, autologous donations, or therapeutic phlebotomies. Discarded information was collected from the blood bank's discard logs and the medical records of all units of blood collected through donation during the aforementioned time period using a pre-designed record form developed by the researchers at AIIMS Raipur. Discard reasons were grouped into donation-related, processing-related, shipping/storage-related and post-issue reasons. Donation-related reasons for discards included transfusion-transmitted infection (TTI) positive units; insufficient amount per unit; units too low a volume per donor; and lipemic (rich in fat) units. Examples of processing or shipping/storage-related discards include items that have failed quality control tests, have holes in the container, are past their expiration date, or show homolysis. The eligible units that were discarded during the designated study period were completely enumerated from the records and all collected data were entered into an Excel spreadsheet where analysis was completed with R software version 4.4.0, which produced frequency, percentage and rate (overall and by component) calculations of total and monthly waste generated by blood donations. Before beginning this study, ethical approval was obtained from the Institutional Ethics Committee of AIIMS Raipur and the anonymity of all donors was protected.

Results:
The research, conducted over 18 months, evaluated 52,760 manufactured blood products. Of those, 5,226 were disposed of, for an overall disposal rate of 9.91%. The highest percentage of products that were discarded were platelet concentrates (13.18%) and fresh frozen plasma (12.06%). However, the lowest percentage of products discarded was PRBC and cryoprecipitate. There were four main reasons for blood product disposal: 49.77% of all products disposed of were due to issues related to storage, 28.51% were related to issues that occurred during the donation process, 17.85% were caused by errors during product processing and 3.87% were due to issues encountered after the product had been issued. Expiry was the leading reason for disposal, with 1,323 blood products discarded, while leakage from storage or thawing caused 1,270 products to be discarded.

Quality control failures were another significant reason for the disposal of blood products, primarily affecting platelet products, resulting in the disposal of 688 products. Whole blood disposal is frequently due to insufficient quantity to produce an acceptable volume, while cryoprecipitate product disposal is generally due to storage leakage and/or the unit being unused after issuance. Monthly statistical trends indicated marked variation in donation, production and disposal patterns. **Table 1** shows the total number of blood components prepared and discarded along with component-wise discard rates. **Table 2** shows the overall monthly variation in blood donation, preparation and discards patterns during the study period. **Table 3** shows month-wise variability in PRBC preparation and discard, while **Table 4** shows similar trends for fresh-frozen plasma. **Table 5** presents the monthly trend in platelet preparation and discard, whereas **Table 6** highlights the intermittent preparation pattern and the low discard of cryoprecipitate. **Table 7** shows variation in whole-blood donation and discards across months. **Table 8** shows the overall distribution of discard categories, indicating that storage-related causes accounted for the highest proportion of discarded units. **Table 9** presents the component-wise reasons for discard, with expiry and leakage during storage as the major contributors. **Table 10** shows the category-wise distribution of discarded blood components, highlighting that platelet and FFP discards were predominantly associated with storage-related and processing-related causes.

Table 1: Blood components prepared and discarded at AIIMS Raipur (May 2024–October 2025)

Component	Prepared	Discarded	Discard rate (out of all components prepared)	Discard rate (out of same component prepared)
All Components	52,760	5,226	9.91%	NA
PRBC	17,668	786	1.49%	4.45%
FFP	17,455	2,109	4.00%	12.06%
Platelets	17,337	2,285	4.33%	13.18%
Whole Blood	0	32	0.06%	0%
Cryoprecipitate	300	14	0.03%	4.67%

Table 2: Monthly trend of blood donations, component preparation and discard at AIIMS Raipur

Parameter	Lowest observed	Highest observed	Observation
Blood donations	820 units (December 2024)	1,230 units (July 2025)	Donation pattern varied across months
Component preparation	2,375 units (December 2024)	3,510 units (September 2024)	Increased preparation during peak donation periods
Component discard	152 units (May 2024)	467 units (July 2025)	Discard increased toward later months

Table 3: Monthly trend of PRBC preparation and discard

Observation	Details
Lowest monthly PRBC volume	Approximately 880 units/month
Highest monthly PRBC volume	Approximately 1,240 units/month
Higher preparation periods	July–September 2024 and June–August 2025
Lower preparation periods	December 2024 and March 2025

Table 4: Monthly trend of fresh frozen plasma preparation and discard

Observation	Details
Lowest monthly FFP volume	Approximately 880 units/month
Highest monthly FFP volume	Approximately 1,250 units/month
Higher preparation periods	July–September 2024 and June–August 2025
Lower preparation periods	December 2024 and March 2025

Table 5: Monthly trend of platelet preparation and discard

Observation	Details
Lowest monthly platelet volume	Approximately 820 units/month
Highest monthly platelet volume	Approximately 1,250 units/month
Higher preparation periods	July–September 2024 and June–August 2025
Lower preparation periods	November–December 2024

Table 6: Monthly trend of cryoprecipitate preparation and discard

Observation	Details
Preparation pattern	Intermittent across study period
Peak preparation periods	August 2024, February–March 2025, September–October 2025
Discard pattern	Minimal or near-zero discard in most months

Table 7: Monthly trend of whole blood donation and discard

Observation	Details
Lowest monthly donations	Low 800s units/month
Highest monthly donations	More than 1,200 units/month
Higher donation periods	August–September 2024 and July–August 2025
Lower donation periods	December 2024 to February 2025

Table 8: Discard categories of blood and blood components at AIIMS Raipur

Discard category	Number discarded (%)

Donation-related	1,490 (28.51%)
Processing-related	933 (17.85%)
Storage-related	2,601 (49.77%)
Post-issue related	202 (3.87%)

Table 9: Category-wise reasons for discard of blood and blood components

Discard reason	PRBC (786)	FFP (2109)	Platelets (2285)	Whole Blood (32)	Cryoprecipitate (14)	Total (5226)
TTI reactive	323	317	310	1	0	951
Antibody positive	3	5	5	0	0	13
Clot	9	2	20	1	0	32
Lipemic	20	242	156	0	0	418
Low volume	6	3	4	0	0	13
QNS	25	1	1	26	0	53
QC failure	0	41	647	0	0	688
Leakage during processing	35	0	198	3	0	236
Expired	361	28	934	0	0	1323
Leakage during storage	0	1261	0	0	9	1270
Unused after issue	0	197	0	0	5	202

Table 10: Category-wise distribution of discarded blood components

Discard category	PRBC	FFP	Platelets	Whole Blood	Cryoprecipitate
Donation-related	388 (49.36%)	572 (27.12%)	501 (21.93%)	29 (90.62%)	0
Processing-related	35 (4.45%)	48 (2.28%)	847 (37.07%)	3 (9.38%)	0
Storage-related	363 (46.18%)	1292 (61.26%)	937 (41.01%)	0	9 (64.29%)
Post-issue	0	197 (9.34%)	0	0	5 (35.71%)

Discussion:

This study examined the rate of wasted or discarded blood at a blood donation centre in Central India over 18 months. The study's total discard rate was 9.91%, indicating that a significant amount of blood could not be given to patients who needed it. Medical facilities that offer blood collection services to many hospitals have experienced similar losses due to logistical issues with blood donation collection **[8, 9]**. Platelets had the highest rate of waste or discards, followed by fresh frozen plasma. Platelets have the largest amount of waste due to the short amount of time they can be used, the fact that they must be continuously shaken to keep them alive and the quickly changing needs of patients **[10]**. Recent studies support this by showing that most platelets are expired by the hospital blood banks **[11, 12].** Our findings are also in agreement with those of Navyashree *et al.* who reported that platelet concentrates constituted the highest proportion of discarded blood components, with expiry and storage-related factors being the predominant reasons for discard, emphasizing the importance of effective inventory management and quality assurance in blood banks **[21].** In our study, we also found that platelets were wasted or discarded due to quality-control issues, underscoring the importance of better systems at blood donation collection sites and a process to monitor them. Fresh-frozen plasma also had high levels of waste or discards due to leaks during storage and thawing. Similar results were found in a recent audit of what has happened to fresh frozen plasma in hospital blood donation collections **[13]**. All leakage issues during freezing and thawing were attributed to improper handling, noncompliance with protocol, or equipment issues during plasma processing. By having standard protocols for thawing plasma and having a reliable way to keep it frozen, we could eliminate the waste these processes have caused **[14]**. This article analyses discarded blood units and the reasons for their discards. This research found that almost half of the units discarded were due to storage-related causes. The top reason for discard was deemed to be expiration date, particularly for PRBC (Platelet-Rich Blood Products) and platelets. Similar results were reported in other studies, which observed a strong correlation between inventory misalignment and demand fluctuations **[9, 11 and 15]**. Studies have showed that the use of inventory control systems, such as first-in-first-out stock rotation, demand-driven inventory, donor duplication policies and computerised inventory tracking systems, is effective in reducing wastage associated with expiration dates **[16]**. Donation-related reasons also contributed to blood unit wastage. The majority of discarded units were due to transfusion-transmitted infections (TTIs). The TTI's reaction to donor screening and infectious marker testing remains crucial to the safety of the blood supply. In addition to discards due to TTIs, there were also lipemic units, low-volume collections and units with insufficient quantity. A greater emphasis on donor counselling, appropriate donor selection and improved phlebotomy practices will help to reduce the number of lost operational units **[17]**. The majority of processing-related units that were discarded were due to quality-control failures. Similar problems in blood bank quality assurance systems and component-processing errors have led to platelet discard, as reported in blood bank audits **[18]**. Continuous staff education on quality control processes, process validation, routine monitoring of component quality parameters and equipment maintenance are critical to eliminating losses from processing errors. The month-wise variability in the above issues indicates that seasonality affects donation volumes, component preparation and component discards; thus, seasonal fluctuations in blood collection and clinical demand will also contribute to waste levels. Continued audits and monthly monitoring of discard levels are both effective ways to identify operational issues and improve efficiency in transfusion services **[19]**. Overall, the findings indicate that through the implementation of targeted interventions in inventory management, donor

safety, quality assurance in the preparation of components and maintenance of cold-chain equipment, a significant number of units could potentially be saved from discards and that the effectiveness of blood centres could be improved, as such units will provide greater patient safety through the availability of blood components **[20]**.

Conclusion:

We show that platelet concentrates and fresh frozen plasma had the highest discard rates among blood components, with storage-related causes such as expiry and leakage accounting for the majority of wastage. Strengthening inventory optimisation, component-processing quality systems and cold-chain management practices may significantly reduce avoidable blood discard and improve the efficiency of transfusion services. Continuous monitoring and implementation of targeted quality-improvement strategies are essential to ensure optimal utilisation of this limited and valuable healthcare resource.

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