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Original Research Article

Wasted Lifelines: A Retrospective Study on Causes and Trends in Blood Component Discards in a Tertiary Care Hospital

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Abstract

Background: Blood is an irreplaceable therapeutic resource, and its judicious use is critical to patient care. However, wastage of blood and blood components remains a significant challenge for transfusion services worldwide.

Aim: This study aimed to identify the causes and trends of blood component discards in a tertiary care teaching hospital and provide evidence-based recommendations to minimize wastage.

Materials and Methods: A retrospective study was conducted at a tertiary care hospital blood centre in South India over four years (May 2021–April 2025). Data were collected from donor, discard, and transfusion registers. Blood components prepared included packed red blood cells (PRBC), fresh frozen plasma (FFP), platelet-rich concentrate (PRC), whole blood, and cryoprecipitate. Discard rates and causes were analysed.

Results: A total of 7,436 blood units were collected, yielding 16,124 components. Overall discard rate was 4.1% (662 units). PRC recorded the highest discard rate (28.24%), followed by whole blood (24.89%), cryoprecipitate (4.54%), FFP (1.41%), and PRBC (1.29%). Expiry was the leading cause of wastage (59.8%), followed by quality control purposes (13.3%), leakage (12.4%), and transfusion-transmitted infections (6.8%). Platelet discards were disproportionately high due to their short shelf life, while whole blood discards were mainly due to seropositivity, predominantly hepatitis B.

Conclusion: Despite acceptable discard rates for PRBC and FFP, high wastage of PRC and whole blood underscores the need for strengthened donor screening, improved inventory management, better handling protocols, and enhanced interdepartmental coordination. Adoption of electronic blood bank information systems, strict first-expiry-first-out practices, and regular audits can substantially reduce avoidable wastage, ensuring more efficient utilization of this scarce, life-saving resource.

Keywords: Blood Components, ffp, Platelets, Minimal Waste, Blood Transfusion.

Introduction

Blood is a vital and irreplaceable resource that is used in both routine and emergency medical settings. It is also a crucial therapeutic intervention in contemporary patient care. [1]. It is a vital element of human life for which no artificial substitute has yet been discovered [2]. Prompt access to safe blood is essential for the delivery of quality healthcare services and greatly helps in reducing avoidable death in the healthcare system [3]. There is now a heightened and growing challenge in the healthcare industry because of the increasing demand for blood and its components [4]. This emphasizes the need for proper utilization of blood and its components with preferably "NO" or minimal wastage [5]. A key quality indicator for evaluating the efficacy of Blood Transfusion Services (BTS) is the discard rate of blood and blood components. These discard rates offer insight into the overall planning and technical efficiency of the department, as well as its coordination with other clinical departments that rely on transfusion services [6]. The establishment and rigorous implementation of standardized protocols within the blood centre are fundamental to minimizing the

wastage of blood and its components, which in turn contributes to the conservation of vital human and financial resources. This study endeavours to systematically identify and categorize the principal causes of blood and blood component wastage along with analysing their monthly trends. Furthermore, it aims to develop evidence-based, actionable recommendations for enhancing quality improvement initiatives, refining staff training programs and optimizing inventory management strategies to effectively mitigate future wastage.

Aim: This study aimed to identify the causes and trends of blood component discards in a tertiary care teaching hospital and provide evidence-based recommendations to minimize wastage.

Objectives:

1. To categorize the primary causes of blood and blood component waste.
2. To analyse monthly wastage trends for each component.
3. To formulate actionable recommendations to minimize future wastage

Materials and Methods

A Retrospective study was carried out at Blood Centre from Tertiary care teaching hospital, South India from May 2021 to April 2025. All blood units collected from healthy donors who met the requirements of the Drugs and Cosmetics Act, 1940, and Rules 1945 [7] were included in the study. There were no exclusion criteria in this study.

Blood Component Preparation: Blood components, including Packed Red Blood Cells (PRBC), Fresh Frozen Plasma (FFP), and platelet-rich concentrates (PRC), were prepared from double and triple blood bags. Component preparation occurred under strict aseptic conditions. This followed the Food and Drug Administration (FDA) guidelines based on demand and available staff in the blood bank [8].

Discard Procedures and Quality Assurance: Discarded blood bags were managed according to the standard operating procedures aid down by the National AIDS Control Organization (NACO) [9]. The quality of whole blood and blood components was assessed in accordance with the National Accreditation Board for Hospitals and Healthcare Providers (NABH) guidelines [10].

Data Collection: Data for the study were systematically collected from the following registers maintained at the Blood Centre: donor register, discard register, master chart register, transfusion-transmitted diseases register, and Component Preparation register.

Results:

In this study, over the four-year study period, a total of 7,436 blood units were collected. From these 16124 blood components were prepared. This included 7,203 units of packed red blood cells (PRBC), 7,203 units of fresh frozen plasma (FFP), 1,441 units of platelet-rich concentrate (PRC), 233 units of whole blood and 44 units of cryoprecipitate (CRYO).

An analysis of component discard showed that 93 units of PRBC were discarded, leading to a discard rate of 1.29%. For FFP, 102 units were discarded, resulting in a rate of 1.41%. PRC had the highest discard rate with 407 units discarded representing 28.24%, whereas CRYO had two units discarded with rate of 4.54% and whole blood had 58 units of discard with rate of 24.89%.

Table 1: Analysis of discarded units of blood components against total component prepared

Components	No. of units prepared	No. of units discarded	Discard rate
Whole blood	233	58	24.89%
Packed red blood cells	7203	93	1.29%
Fresh Frozen plasma	7203	102	1.41%
Platelet rich concentrate	1441	407	28.24%
Cryoprecipitate	44	2	4.54%
Total	16124	662	4.1%

The analysis of the reasons for discarding blood products showed that "Expiry" was the main cause accounting for 59.8% of all discarded units. This was followed by discards due to "Quality Control (QC) purposes" at 13.3%, "Leakage" at 12.4% and Transfusion transmitted infections at 6.8%. Other causes including insufficient volume, red cell contamination and lipemia accounted for less than 5% of the total discards.

Table 2: Analysis of reason for discards percentage

Expiry	396 (59.8%)
QC purpose	88 (13.3%)
Leakage	82 (12.4%)
TTI	45 (6.8%)
Insufficient Volume	17 (2.56%)

Antibody screening positive	13 (2.0%)
Lipemia	10 (1.51%)
Red cell contamination	4 (0.6%)
Leakage during centrifuge	4 (0.6%)
DCT positive	3 (0.45%)

The findings indicate that while the discard rates for PRBC and FFP were within acceptable limits, the high discard rate of PRC needs further investigation. Additionally, the high incidence of expiry as a reason for discarding suggests a need for better inventory management and use strategies to reduce avoidable waste.

Table 3: Analysis of discarded units of blood components against total component prepared

Total discarded	HBsAg	HIV	HCV	VDRL
45	27	2	3	13

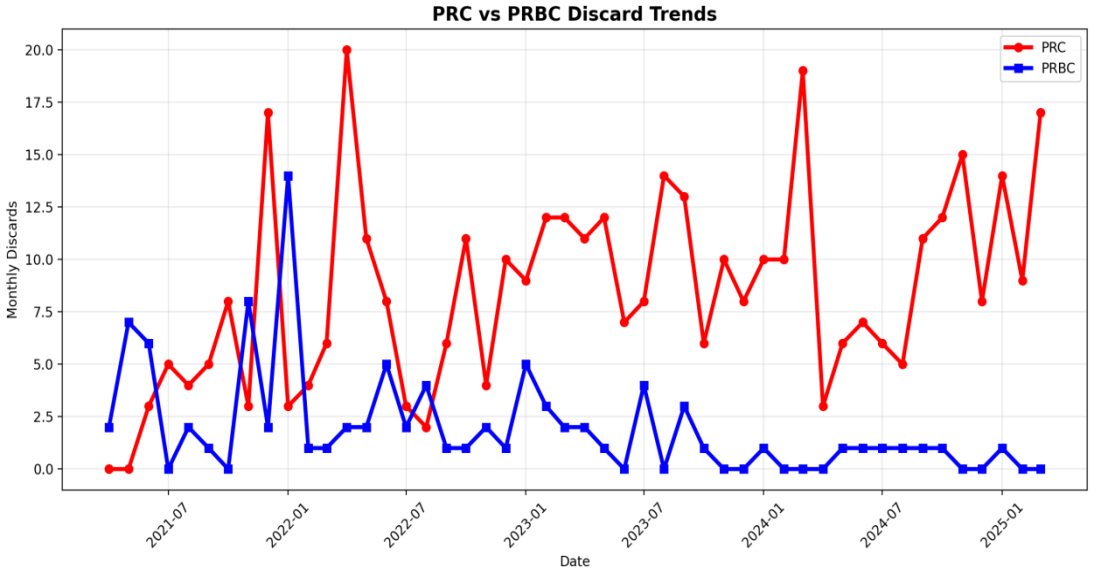

Figure 1: Trend analysis of PRC vs PRBC Discard trends

PRC contributes most discards across the period with several peaks especially from 2023 onward.PRBC and FFP are intermittent contributors.

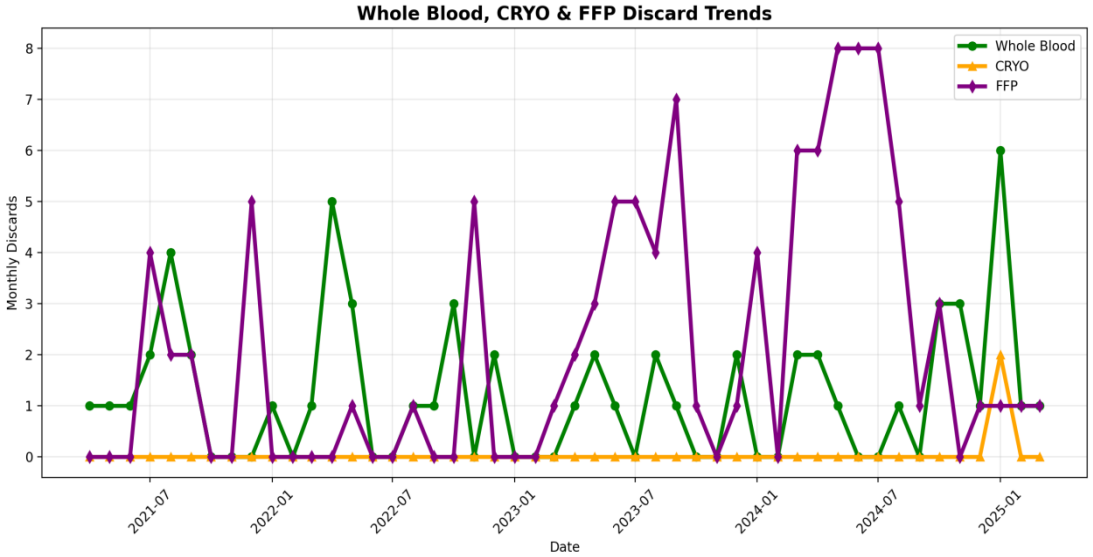

Figure 2: Trend analysis of whole blood, CRYO and FFP discard trends

FP and CRYO wastage is relatively controlled, whole blood discards are a persistent problem and need targeted interventions (better donor screening and infection control).

Discussion

Because of more precise and improved diagnosis of complex diseases that require transfusion, there is currently a greater need for blood and blood components. Reduced needless waste of blood and blood components can be achieved through effective blood bank management. An overview of the different reasons for discarding whole blood and blood components over time can be obtained through a self-audit [11].

The overall discard rate of 4.1% observed in this study is within the acceptable range reported in several Indian studies but shows considerable variation across components. Platelets recorded the highest discard rate, consistent with their limited five-day storage period. This is in line with Mamatha S.V. et al. [12], who reported a higher platelet discard rate of 40.7%. Several large single-Centre and multi-year studies likewise report that platelet products—because of their very short shelf life—account for a disproportionate fraction of discards, with expiry being the most frequent proximate cause. Kulkarni et al. and Bashir et al. both identified expiry of platelets as the leading cause of discard, followed by seropositivity and physical damage [13,14].

Whole blood discards (24.89%) were notably higher than in previous studies by Suresh et al. [9] (5.7%), Sharma et al. [15] (4.46%), and Bobde et al. [16] (6.63%), largely due to TTI positivity, with hepatitis B as the leading infection. The higher discard rate in the present study could reflect regional variations in transfusion-transmitted infection (TTI) prevalence, as well as differences in donor selection, screening strategies, and public health interventions. Studies have shown that hepatitis B virus (HBV) continues to be the most common TTI among blood donors in India, contributing significantly to blood unit wastage [17,18]. Strengthening donor education and expanding voluntary, repeat donor pools are critical strategies to reduce the prevalence of TTIs in donated blood. Implementation of nucleic acid amplification testing (NAT) has been shown to significantly reduce the window period for HBV, HCV, and HIV detection, thereby decreasing the risk of TTI-related discards [19]. Regional epidemiological surveillance and targeted health interventions could further mitigate the problem.

Leakage was the predominant reason for discarding FFP, responsible for over three-fourths of cases, highlighting the need for improved handling protocols during processing and storage. FFP is often stored at extremely low temperatures (typically −30°C or lower). This makes the plastic bags rigid and brittle, thus more prone to cracking or rupturing during handling, storage, or transportation. Additional factors include: Mishandling during centrifugation or bag processing, where sharp edges or mechanical stress can cause tears. Inadequate packaging, such as storing bare frozen bags without protective containers, increasing vulnerability to breakage.

The proportion of discards due to expiry (59.8%) in the present study exceeds the figures reported by Suresh et al. [9] (25.1%) and Lakum et al. [20] (16.01%). This reflects challenges in inventory rotation, demand prediction, and interdepartmental communication. This discrepancy highlights persistent challenges in efficient inventory management and suggests systemic issues in stock rotation, demand forecasting, and interdepartmental coordination.

High discard rates due to expiry often indicate suboptimal stock rotation practices, such as inadequate implementation of the "first-expire, first-out" (FEFO) principle. Studies have emphasized that strict adherence to FEFO and real-time inventory tracking significantly reduces wastage [21]. Poor rotation can result in older units remaining unused while newer units are dispensed, particularly in high-volume or poorly digitized settings.

Another major contributor is inaccurate demand prediction. If requisitions are based on historical averages without accounting for seasonal variation, patient load fluctuations, or surgical schedules, overstocking is likely, leading to expiries. According to Vamsee et al., mismatches between supply and actual clinical demand are a major determinant of blood component wastage, particularly in tertiary care centers [22].

Interdepartmental communication also plays a pivotal role. Lack of timely feedback from clinical units regarding anticipated usage, cancellations, or transfusion deferrals can prevent redistribution of soon-to-expire units. Jain et al. noted that improved coordination between transfusion services and clinical teams, along with timely returns of unused units, can reduce expiries by up to 30% [23].

Furthermore, infrastructure and policy-related issues such as absence of an electronic blood bank information system (BBIS), limited redistribution policies, and lack of component-sharing networks between institutions can compound the problem. As observed by Sharma et al., centres with robust BBIS and inter-institutional exchange protocols reported expiry-related wastage rates below 10% [24]. Finally, cultural, and behavioural factors—such as clinicians' preference for "fresh" units or

over-ordering as a precaution—may indirectly contribute to expiries. Educating clinical staff on appropriate ordering practices and shelf-life awareness has been shown to improve utilization efficiency [25].

Overall, the elevated discard proportion in the present study underscores the need for multifaceted interventions, including:

- Implementation of FEFO with barcode-based tracking,
- Real-time demand analytics,
- Strengthening communication between transfusion medicine and clinical units,
- Adoption of BBIS,
- Periodic audits and feedback mechanism.

The proportion of discards due to expiry (59.8%) in the present study exceeds the figures reported by Suresh et al. [8] (25.1%) and Lakum et al. [20] (16.01%). This striking difference highlights persistent challenges in inventory rotation, demand forecasting, and coordination across departments involved in the requisition and distribution of blood products.

Poor inventory management, particularly failure to adopt a first-in–first-out (FIFO) strategy, often leads to units nearing expiry not being prioritized for issue, resulting in wastage (Mukherjee et al., 2020) [26]. Additionally, suboptimal demand prediction due to inconsistent usage patterns, lack of real-time data analytics, or sudden cancellations of planned surgeries can exacerbate overstocking and eventual expiry (Kumar et al., 2014) [27].

Interdepartmental communication also plays a critical role. A lack of coordination between blood banks and clinical departments can result in the requisition of excessive units "just in case," many of which are ultimately returned unused and cannot be reissued due to time-out-of-refrigerator constraints (Shah Shahani et al., 2010) [28]. Furthermore, the absence of electronic inventory systems or centralized tracking contributes to delayed identification of near-expiry units, limiting redistribution opportunities (WHO, 2017) [29].

These findings emphasize the need for robust inventory control policies, periodic audits, implementation of computerized blood bank management systems, and staff training to ensure efficient blood utilization and minimize wastage.

QC-related discards accounted for 13.3% in this study, higher than the 4.66% reported by Joshi et al. [30], suggesting possible overuse of units for QC purposes or lack of alternative sampling strategies. Packed red blood cells (PRBCs) and fresh frozen plasma (FFP) contributed fewer expiry-related losses in relative terms, which is expected given their longer approved storage durations and the greater flexibility they afford inventory managers. Nevertheless, outdating of PRBCs remained nontrivial, indicating room to enhance demand forecasting and stock rotation practices (e.g., strict first-expiry-first-out, active review of slow-moving blood groups, and timely redistribution of near-expiry units to high-utilization services). By integrating smarter demand forecasting, reinforcing prudent inventory rotation practices, and optimizing QC protocols, blood centers can significantly elevate efficiency and reduce the loss of these invaluable resources. Expiry of blood components accounted for a significant proportion of wastage, particularly of platelets due to their limited shelf life. This reflects challenges in demand forecasting, inventory management, and judicious requisition practices by clinical departments. Improved communication between the blood bank and clinical teams, along with implementation of inventory management systems, could reduce expiry-related discards.

Leakage, storage issues, and underutilization of specific components (such as cryoprecipitate and plasma) were also noted as contributors to wastage. These findings suggest the need for ongoing staff training in handling and storage protocols, as well as awareness campaigns to encourage appropriate and evidence-based utilization of all blood components.

An encouraging observation from our study was the gradual decline in discard rates over the study period, indicating that targeted interventions and increased awareness can yield positive results. However, the discard rates remain unacceptably high compared to global standards, and further improvement is necessary.

Our findings underline the necessity of a multipronged strategy: enhancing donor screening to reduce seropositive collections, adopting advanced inventory management tools to limit expiry, enforcing strict adherence to quality control measures to prevent leakage and contamination, and promoting rational use of blood products among clinicians.

Conclusion

A substantial proportion of donated blood is wasted due to preventable causes such as seropositivity, expiry, leakage, and improper storage or handling. Among these, expiry and seropositivity emerged as the leading contributors. The trends observed underscore the need for improved donor screening, optimized inventory management, and strict adherence to storage and transfusion protocols. Regular audits, staff training, and implementation of evidence-based blood utilization practices can significantly minimize wastage, thereby ensuring judicious use of this scarce and life-saving

resource. Strengthening interdepartmental coordination and promoting rational transfusion practices will ultimately improve patient care while reducing the economic and ethical burden associated with discarded blood components.

Limitations of this study: Its retrospective nature and reliance on institutional records, which may be subject to documentation gaps.

Furthermore, the study reflects trends from a single tertiary care center, and the findings may not be generalizable to other regions with different donor demographics or hospital practices.

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