



BLOOD UTILIZATION PATTERNS AND CLINICAL INDICATIONS: A FIFTEEN-MONTH ANALYSIS AT NORTHERN RAILWAY CENTRAL HOSPITAL, NEW DELHI

Transfusion Medicine

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ABSTRACT

This study presents a comprehensive analysis of blood utilization patterns at Northern Railway Central Hospital over a 15-month period from February 2024 to April 2025. A total of 3,123 blood units were distributed across seven clinical departments, with Medicine department accounting for the highest consumption (60.7%), followed by Surgery (19.7%), Obstetrics & Gynaecology (8.5%), and Orthopaedics (8.4%). The study also examines specialized blood component usage, including Fresh Frozen Plasma (FFP) and platelets, and highlights the unique requirements for paediatric patients where split units were utilized based on weight-appropriate dosing. Emergency transfusions constituted 5.1% of total blood utilization, distributed across Medical ICU, Surgical ICU, and Casualty services. Clinical indications for transfusion varied by department, with symptomatic anaemia and gastrointestinal bleeding predominating in Medicine, while surgical branches primarily utilized blood products for preoperative haemoglobin optimization and management of acute surgical blood loss. This analysis provides valuable insights for blood centre inventory management, transfusion protocol development, and resource allocation within specialized hospital settings. The findings may inform strategies to optimize blood utilization practices and reduce wastage in similar healthcare facilities.

KEYWORDS

Blood transfusion, Utilization pattern, Clinical indications, Emergency transfusion, Tertiary care hospital

INTRODUCTION

Blood transfusion remains a critical lifesaving intervention in modern healthcare, with appropriate blood component therapy playing a vital role in patient management across various clinical scenarios.¹ Understanding the consumption patterns of blood and its components across different hospital departments enables better resource allocation, inventory management, and development of appropriate transfusion protocols.

Northern Railway Central Hospital, as a tertiary healthcare facility serving railway employees and their dependents of northern railway zone predominantly, presents a unique case study for blood utilization patterns. The Northern Railway zone is the largest in Indian Railways and operates across several states including Jammu & Kashmir, Punjab, Haryana, Himachal Pradesh, Uttarakhand, Uttar Pradesh, and Delhi, as well as the Union Territory of Chandigarh.

This retrospective analysis examines blood consumption data over a 15-month period from February 2024 to April 2025, with particular attention to departmental distribution, clinical indications, and special considerations such as emergency transfusions and paediatric requirements.²

The primary objectives of this study were to:

1. Analyse the distribution pattern of blood units across different clinical departments.
2. Identify the major clinical indications for blood transfusion in various specialties.
3. Evaluate emergency transfusion patterns.
4. Assess specialized blood component utilization.
5. Document adaptations for paediatric transfusion requirements.

This analysis provides valuable insights that can inform blood centre management practices, help optimize inventory control, reduce wastage, and ensure appropriate distribution of this vital and limited resource. Recent studies by Yazer et al. (2022) have demonstrated how blood utilization patterns can be impacted by external factors such as the COVID-19 pandemic, highlighting the importance of understanding baseline consumption patterns to prepare for fluctuations.³

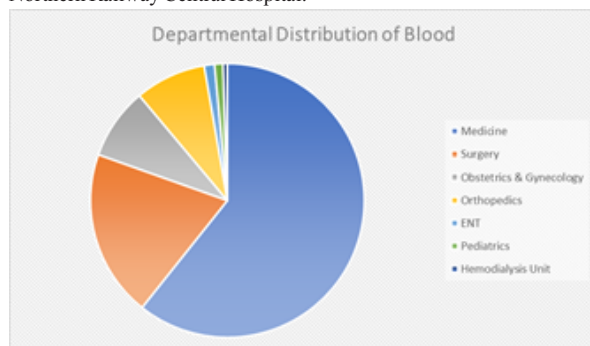
MATERIALS AND METHODS

This retrospective observational study was conducted at Blood Centre/Northern Railway Central Hospital. All blood units issued between February 2024 and April 2025 (15 months) were included in the analysis. Data regarding blood unit issuance was extracted from the blood centre records.

Descriptive statistics were employed to analyse the data. The distribution of blood units across departments was presented as both absolute numbers and percentages of total utilization. Microsoft Excel was used for data analysis and visualization.

RESULTS

During the 15-month study period from February 2024 to April 2025, a total of 3,123 blood units were issued to various departments at Northern Railway Central Hospital.



A special mention to be made for 158 blood units (5.1% of total) which were utilized for emergency transfusions, distributed across Medical ICU, Surgical ICU, and Casualty services. These emergency transfusions were crucial for managing acute blood loss, hemodynamic instability, and life-threatening anaemia requiring immediate intervention.⁴ The special indications included cases of road traffic accidents or train accidents. Casualty is the place where the patient visits first. Sometimes in accident cases, patients must be immediately stabilised or immobilised in a particular position to reduce the fracture and minimize the blood loss. Till it becomes possible to shift the patient to the ICU/OT/ward, it is imperative that lifesaving blood be transfused in casualty itself.

In addition to whole blood and packed red blood cells, specialized blood components including Fresh Frozen Plasma (FFP) and platelets were utilized based on specific clinical requirements.⁵ FFP was predominantly used for coagulopathy correction, massive transfusion protocols, and specific clinical scenarios like internal gastrointestinal bleeding, till identification of the specific cause.

Platelet transfusions were utilized for thrombocytopenia management, haematological disorders, oncological conditions, and as part of massive transfusion protocols.

The study highlighted special considerations for paediatric patients, where blood units were split according to weight-based dosing requirements.⁶ This practice optimized the use of limited resources while ensuring appropriate transfusion volumes for paediatric patients. The splitting of units allowed for:

- Weight-appropriate dosing (typically 10-15 ml/kg for packed red blood cells)
- Minimization of donor exposure

- Reduction of transfusion-associated circulatory overload risk
- Efficient utilization of blood resources

It is also ensured that children, especially neonates are given fresh blood, no more than 7 days old blood.

DISCUSSION

The analysis of blood utilization patterns at Northern Railway Central Hospital provides valuable insights into transfusion practices across various clinical departments. The predominance of the Medicine Department in blood consumption (60.7%) aligns with findings from similar studies worldwide, where medical indications, particularly management of anaemia and gastrointestinal bleeding, constitute major reasons for transfusion.¹

The Medicine Department consumed the highest number of blood units (1,896), accounting for 60.7% of total utilization. The primary clinical indications included symptomatic anaemia requiring correction, acute and chronic gastrointestinal bleeding, and haematological disorders including Thalassemia, Acute Myeloid Leukaemia, Chronic Myeloid Leukemia and Chronic Lymphocytic Leukaemia.⁴ Malignancies requiring supportive transfusion were also significant contributors to blood usage in this department. The general dictum besides to supplement bone marrow production, is to have a minimum haemoglobin of 8 gm/dl to be able to give chemotherapy. Even if the patient is haemodynamically stable, blood transfusions are done so that chemotherapy schedule is not disturbed. Chronic kidney disease with refractory anaemia rounded out the major indications in the Medicine Department.

The relatively high utilization in surgical departments (Surgery and Orthopaedics combined accounting for 28.1%) reflects the nature of procedures performed and the emphasis on preoperative haemoglobin optimization to improve surgical outcomes and postoperative recovery. This practice is consistent with evidence-based guidelines recommending preoperative anaemia correction to reduce perioperative morbidity and mortality.⁷

The Surgery Department utilized 616 units (19.7%) of blood with main indications being preoperative haemoglobin optimization (a rule of thumb with the surgeons is to have a haemoglobin of at least 10 gm/dl to be able to take up the patient for any surgery), acute blood loss during surgical procedures, postoperative anaemia management, and major trauma requiring massive transfusion.

The Obstetrics & Gynaecology Department's utilization (8.5%) highlights the critical role of blood products in managing obstetric emergencies, particularly postpartum haemorrhage, which remains a leading cause of maternal mortality worldwide. The availability of prompt blood transfusion services is essential for reducing adverse outcomes in such scenarios.⁸ This department consumed 264 units (8.5%) with indications including postpartum haemorrhage, antenatal and postnatal anaemia, obstetric emergencies like ruptured ectopic pregnancies, gynaecological surgeries with significant blood loss, and oncosurgeries involving uterine and ovarian malignancies.

The Orthopaedics Department utilized 262 units (8.4%) primarily for traumatic injuries with haemorrhage, major orthopaedic surgeries (joint replacements, spinal surgeries), management of postoperative anaemia, revision surgeries with anticipated significant blood loss, and cases of multiple myeloma.

Other departments including ENT (38 units, 1.2%), Paediatrics (31 units, 1.0%), and Haemodialysis Unit (16 units, 0.5%) accounted for smaller proportions of blood utilization, mainly for major surgical interventions like mandibulectomy, maxillectomy, haemolytic disease of the newborn, congenital anaemias, exchange transfusion, and during dialysis procedures respectively.

The practice of splitting blood units for paediatric patients demonstrates an evidence-based approach to paediatric transfusion medicine, where weight-based dosing is essential for preventing transfusion-associated complications while ensuring therapeutic efficacy.⁵

Emergency transfusions constituting 5.1% of total utilization underscores the importance of maintaining adequate emergency blood reserves and efficient cross-matching protocols to address urgent clinical scenarios requiring immediate intervention.

Our findings generally align with patterns observed in similar healthcare settings. A study by Kumar et al. (2023) in a tertiary care hospital found that medicine departments accounted for 55-65% of blood utilization, with surgical departments representing 20-30%, and obstetrics accounting for 5-10%, which closely mirrors our distribution pattern.³

Similarly, Singh et al. (2024) reported that gastrointestinal bleeding and symptomatic anaemia were the predominant indications for transfusion in medical departments, accounting for over 50% of medical transfusions, which is consistent with our observations.⁵ Similar utilization patterns were also observed in specialized healthcare facilities as documented by Srivastava et al. (2023) in their multi-center analysis of blood component therapy trends.⁷

The clear pattern of departmental blood utilization can inform inventory management strategies, particularly in ensuring adequate supplies for high-consumption departments like Medicine and Surgery.³

The significant proportion of emergency transfusions (5.1%) emphasizes the need for maintaining a robust emergency release protocol and adequate O-negative blood reserves for immediate release in critical situations.

This study has several limitations that should be acknowledged. The retrospective nature of the analysis restricts our ability to assess the appropriateness of individual transfusion decisions, potentially overlooking nuances in clinical decision-making processes. We were unable to evaluate clinical outcomes related to transfusion practices, which would have provided valuable insights into the effectiveness of current protocols. Data on blood component wastage was not included in this analysis, limiting our understanding of resource efficiency. Additionally, seasonal variations in blood utilization were not analyzed, which could have revealed important temporal patterns relevant for inventory management. The study represents patterns in a specialized railway hospital with a specific patient demographic, which may limit generalizability to other healthcare settings with different population characteristics. Furthermore, incomplete requisition forms received from clinicians occasionally lacked critical information such as the actual indication for blood transfusion, haemoglobin levels, or history of previous transfusions, which could have enhanced the depth of our analysis.

CONCLUSION

This comprehensive analysis of blood utilization patterns at Northern Railway Central Hospital demonstrates distinct departmental consumption trends with Medicine, Surgery, Obstetrics & Gynaecology, and Orthopaedics being the primary consumers. Clinical indications varied by specialty, with symptomatic anaemia and gastrointestinal bleeding predominating in Medicine, while surgical departments focused on perioperative haemoglobin management.

The practice of unit splitting for paediatric patients represents an efficient approach to resource utilization while maintaining patient safety. Emergency transfusions constituted a significant proportion of blood utilization, highlighting the critical role of efficient blood centering services in managing acute clinical scenarios.

These findings provide valuable insights for blood centre inventory management, development of hospital-specific transfusion protocols, and resource allocation. Future studies could focus on assessing the appropriateness of transfusion practices against established guidelines, evaluating clinical outcomes, and implementing interventions to optimize blood utilization and minimize wastage.

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