

Original article

Haemostatic Blood Component Utilisation at the Central Blood Bank of Tobruk, Libya, 2022–June 2026: A Retrospective Analysis of Platelet Concentrates, Fresh Frozen Plasma and Cryoprecipitate

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Abstract

Monitoring the utilisation of platelet concentrates, fresh frozen plasma (FFP) and cryoprecipitate is important for blood-component planning, inventory control and transfusion stewardship, particularly in resource-limited settings. The Objective of this study is to describe preparation and issue patterns for platelet concentrates, FFP, and cryoprecipitate at the Central Blood Bank of Tobruk, eastern Libya, from 2022 to June 2026. A retrospective descriptive analysis was conducted using institutional statistical reports for 2022–2025 and January–June 2026. We calculated annual component totals, year-on-year changes, coefficients of variation, linear trends, and issue rates. During 2022–2025, 11,490 units were issued: 7,063 platelet units (61.5%), 4,254 FFP units (37.0%), and 173 cryoprecipitate units (1.5%). Platelet issue increased from 1,477 units in 2022 to 2,147 in 2024, then fell to 1,530 in 2025. Recorded platelet issue rates were below 50% in 2023–2025, while FFP and cryoprecipitate issue rates exceeded 100% in 2024, an administrative artefact of carryover stock prepared in previous years, not over-issuance. Between January and June 2026, a further 1,529 units were issued, bringing the overall study total to 13,019 units. Platelets were the predominant non-red-cell component issued, while cryoprecipitate use was low and highly variable. Improved inventory reporting, demand forecasting, and indication-based audits are needed.

Keywords. Blood Component Utilisation, Platelet Concentrates, Fresh Frozen Plasma, Cryoprecipitate, Transfusion Services, Blood Bank.

Introduction

The rational use of blood components is a cornerstone of safe transfusion practice. Effective blood systems require quality-assured component preparation matched to clinical need [1,2]. Component therapy allows blood products to be targeted to specific pathophysiological deficits [3]. Platelet concentrates, FFP and cryoprecipitate each have distinct indications and storage requirements, making utilisation monitoring important for supply planning and patient safety [3–7]. Large national blood collection and utilisation surveys in high-income settings provide benchmark data on component availability and clinical use against which local practice can be compared [8]. Global modelling indicates that the availability of blood products falls well short of clinical need, with the largest gaps in low- and middle-income countries [9]. The World Health Organization has repeatedly emphasised that access to safe blood depends not only on adequate, voluntary, non-remunerated donation but also on the rational clinical use of blood, since components that are prepared but never transfused represent a direct loss of a scarce, perishable resource [1,2].

International experience shows that the clinical use of haemostatic components is frequently suboptimal. A systematic review of randomised trials found limited evidence of benefit for many FFP indications [10], and prospective audits in several countries have documented inappropriate FFP use in approximately 20–50% of units, with particularly high rates when FFP is given for non-bleeding patients or as surgical prophylaxis [11,12]. At the same time, randomised trials and guideline syntheses have refined the indications and dosing of platelet transfusion, supporting count-based prophylactic thresholds [13–15]. These findings underline the value of routinely monitoring component preparation, issues, and wastage as part of quality assurance.

Published data from the Eastern Mediterranean region remain scarce. Multi-centre studies have characterised donor populations and donation-related iron depletion in the region, including in Libya [22], but we found no published study describing component-level utilisation of platelets, FFP and cryoprecipitate in Libya. The Central Blood Bank of Tobruk serves hospitals and clinics in eastern Libya. This study analysed platelet concentrates, FFP and cryoprecipitate during four complete calendar years, 2022–2025, and the first six months of 2026, excluding whole blood and packed red blood cells.

Methods

Study design and data source

A retrospective descriptive analysis was conducted using institutional statistical reports for 2022, 2023, 2024, and 2025 and a January–June 2026 half-year report. Counts were transcribed from blood-component production and issued-component tables.

Variables and statistical analysis

For each reporting period, units recorded as prepared or available and units issued to hospitals and clinics were extracted for FFP, platelet concentrates and cryoprecipitate. Data were analysed using IBM SPSS 30. Totals, annual means,

standard deviations, coefficients of variation, year-on-year changes, linear regression slopes, Pearson correlations and two-tailed p-values were calculated for 2022–2025. Given the small number of complete-year observations ($n = 4$), all inferential analyses were considered exploratory. Statistical significance was set at $p < 0.05$.

The issue rate was calculated as issued units divided by units recorded as prepared or available, multiplied by 100. Since the reports did not consistently distinguish newly prepared units from carryover stock, these ratios are administrative utilisation measures rather than direct measures of wastage. Values above 100% are consistent with use of carryover stock. The January–June 2026 data were analysed separately; simple annualisation was used only as a sensitivity estimate.

Results

Component mix, 2022–2025

Over the four complete years, 11,490 units of the three non-red-cell components were issued. Platelet concentrates accounted for 7,063 units (61.5%), FFP for 4,254 units (37.0%), and cryoprecipitate for 173 units (1.5%) (Figure 1).

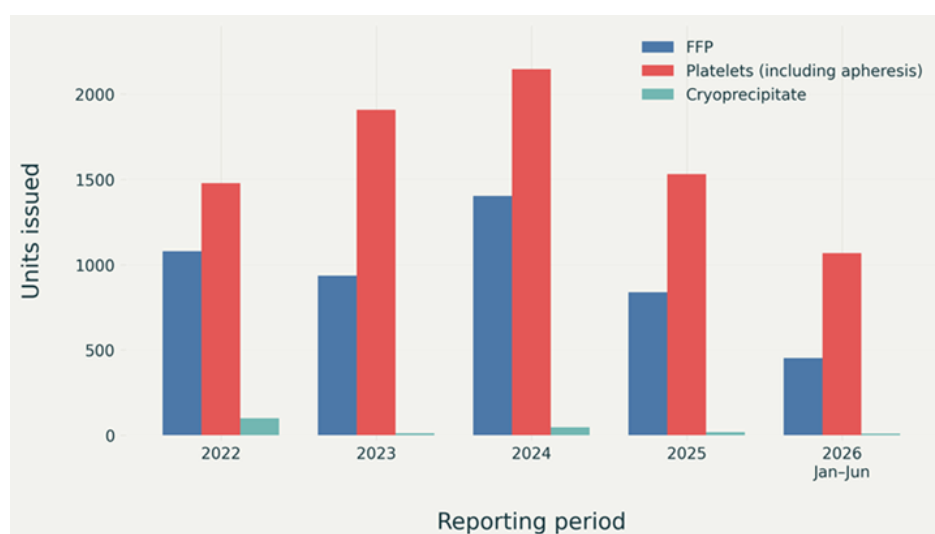


Figure 1. Annual issued units of FFP, platelet concentrates and cryoprecipitate, 2022–2025, with January–June 2026 shown for comparison. FFP, fresh frozen plasma. The 2026 values represent six months only.

Platelet issue increased by 29.2% in 2023 compared with 2022 and by a further 12.5% in 2024, before declining by 28.7% to 1,530 units in 2025. The 2022–2025 linear trend was not statistically significant (slope +39.7 units/year; $r = 0.16$; $p = 0.839$). FFP issue decreased by 13.3% in 2023, increased by 50.1% in 2024, and decreased by 40.3% in 2025 (slope –25.2 units/year; $r = -0.13$; $p = 0.868$). Cryoprecipitate showed the greatest relative instability (CV 93.6%).

FFP and platelet issue were moderately correlated across the four complete years ($r = 0.68$), but this was not statistically significant ($p = 0.322$). Clinical-indication data were unavailable, so potential shared drivers could not be confirmed.

Issue rates and inventory balance

Platelet issue rates were 40.8–44.2% in 2023–2025, indicating a mismatch between recorded preparation or availability and issue; expiry and discard data were unavailable; therefore, wastage could not be quantified. FFP issue rates were 66.6% in 2023, 104.2% in 2024, and 41.7% in 2025. Cryoprecipitate issue rates were 33.3%, 106.8%, and 37.0%, respectively. Values above 100% (FFP 104.2% and cryoprecipitate 106.8% in 2024) are an administrative artefact of carryover stock prepared in previous reporting years being issued within the current year; they do not indicate over-issuance. Equally, because expiry and discard data were unavailable, rates below 100% cannot be interpreted as direct measures of wastage.

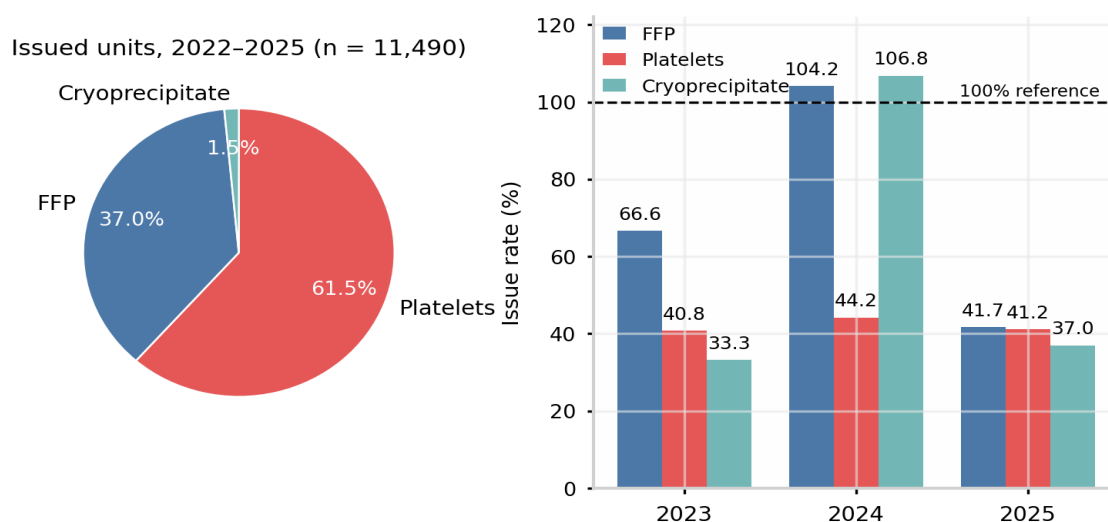


Figure 2. Component distribution and issue rates.

Left panel: percentage share of issued platelet concentrates, FFP, and cryoprecipitate during 2022–2025 ($n = 11,490$ units). Right panel: issue rates by component for 2023–2025. Issue rate was calculated as issued units divided by units recorded as prepared or available, multiplied by 100.

The dashed horizontal line indicates 100%. Values above this line (FFP 104.2% and cryoprecipitate 106.8% in 2024) are an administrative artefact of carryover stock prepared in earlier reporting years being issued within the current year; they do not represent over-issuance. Conversely, values below 100% should not be interpreted as wastage, because expiry and discard were not recorded. Platelet issue rates were 40.8%, 44.2% and 41.2% in 2023, 2024 and 2025, respectively.

First half of 2026

Between January and June 2026, 453 FFP units, 1,067 platelet units and 9 cryoprecipitate units were issued, for a total of 1,529 units. This was 64.1% of the 2025 full-year total. Simple annualisation would yield approximately 3,058 units, but this projection is uncertain because seasonal variation could not be assessed. Adding these 1,529 units to the 11,490 units issued during the four complete years gives the overall study total of 13,019 units issued between 2022 and June 2026.

Discussion

Platelets were the predominant non-red-cell component issued in Tobruk, accounting for 61.5% of units in 2022–2025. Cryoprecipitate use was low and highly variable. The component pattern may reflect local case mix and service activity, but individual clinical indications were not available for analysis.

The predominance of platelets is consistent with reports from other centres, where platelet concentrates form the largest share of non-red-cell component issue, but the magnitude of the platelet share in Tobruk is notable and warrants verification against local oncology, haematology and obstetric activity. The substantial mismatch between recorded platelet preparation or availability and issue should prompt review of component forecasting and inventory management. However, direct wastage cannot be inferred without documentation of expiry and discard. The variable FFP and cryoprecipitate issue rates support the need for clearer reporting of preparation, carryover stock, issue, expiry, and wastage.

The year-on-year volatility observed in Tobruk, particularly the 50% swing in FFP issue between 2023 and 2024, is larger than that reported in blood systems with stable demand forecasting and audit feedback [20,21]. International audits indicate that a substantial proportion of FFP is transfused outside guideline indications, most commonly for non-bleeding patients, warfarin reversal without major bleeding, and volume expansion [10-12]. It is therefore plausible that fluctuations in Tobruk reflect variable clinical requesting rather than true changes in case mix; equally, variable clinician awareness and requesting practices cannot be excluded. Without indication-level data, these explanations cannot be distinguished, which is itself an argument for the audit and reporting reforms recommended below.

Platelet inventory and wastage

Platelet concentrates have the shortest shelf life of the components studied, typically five to seven days, and expiry is the leading cause of platelet wastage in most published series [23]. Issue rates of 40.8–44.2% imply that more than half of the recorded platelet stock was not issued within the reporting framework used, although carryover accounting prevents a direct wastage estimate. Simple, low-cost forecasting methods, including time-series and mean-annual-increment approaches, have been shown to improve the balance between platelet supply and demand even in settings without advanced statistical capacity [21], and closer collaboration between blood centres and hospital transfusion services reduces both shortages and discards [20].

FFP and cryoprecipitate in haemostatic resuscitation

The evidence base for FFP use outside major haemorrhage is weak [10], and current guidance restricts prophylactic use in the absence of bleeding or invasive procedures [6,12]. In major haemorrhage, however, early replacement of fibrinogen is a core element of modern protocols: fibrinogen falls early in postpartum haemorrhage and predicts progression to severe bleeding [16], trauma mortality is lower with higher plasma:platelet:red-cell ratios in the first 24 hours [18], and major haemorrhage guidelines recommend early cryoprecipitate or fibrinogen replacement alongside tranexamic acid [17,19]. The very low and unstable cryoprecipitate issue in Tobruk therefore deserves specific attention. The blood bank does not restrict cryoprecipitate preparation, so this pattern is attributed to clinicians not requesting the component or not being aware of it, rather than to restricted preparation at the blood bank; if clinicians do not request cryoprecipitate appropriately, patients with obstetric haemorrhage, trauma and disseminated intravascular coagulation may be undertreated. This possibility cannot be confirmed from aggregate issue data alone.

Limitations

This ecological analysis used aggregated administrative reports. The 2022 report was differently structured and may not be fully comparable with later years. The 2026 observation period was only six months, and patient-level clinical indications, carryover inventory, expiry, wastage, and adverse-event data were unavailable. The small number of complete-year observations limited statistical power, and the correlations reported should be interpreted as hypothesis-generating only.

Recommendations

First, the blood bank should adopt indication-based transfusion audits for FFP and cryoprecipitate, using published clinical thresholds to assess the appropriateness of component requests and issue [4-7,10-12,19]. Audit results should be fed back to requesting clinicians, a strategy that has reduced inappropriate FFP use elsewhere [12].

Second, demand-forecasting methods for platelet preparation should be evaluated using rolling surgical, obstetric and other service-level indicators so that preparation can be better aligned with clinical need [20,21]. Platelet prophylaxis policies should follow current count-based thresholds [7,13-15].

Third, clinician awareness and requesting behaviour regarding cryoprecipitate should be reviewed, since the blood bank does not restrict its preparation, particularly in relation to obstetric haemorrhage, in line with early fibrinogen replacement and tranexamic acid strategies [16,17,19].

Finally, future annual reports should separately document component preparation, carryover stock, issue, expiry and wastage to enable accurate assessment of inventory performance and potential losses, following international wastage-monitoring practice [2,8,20,23].

Conclusion

Between 2022 and June 2026, the Central Blood Bank of Tobruk issued 13,019 units of platelet concentrates, FFP and cryoprecipitate (11,490 units during the four complete years 2022–2025 and 1,529 units in January–June 2026). During the four complete years from 2022 to 2025, platelets accounted for 61.5% of issued units, FFP for 37.0% and cryoprecipitate for 1.5%. Better inventory reporting, demand forecasting and indication-based transfusion audits could improve the efficiency and safety of haemostatic-component supply in eastern Libya.

Ethics and data availability

This study used aggregated, non-identifiable institutional statistical reports and did not involve access to patient-level data. Administrative approval for use of the reports was obtained from the Central Blood Bank of Tobruk. The underlying aggregated data are available from the corresponding author, subject to institutional approval.

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