RMMG
Revista Médica de Minas Gerais

ORIGINAL ARTICLE

Profile of transfusion agencies and hemotherapy services in Northern Minas Gerais

Perfil das agências transfusionais e assistências hemoterápicas no Norte de Minas Gerais

Elaine Veloso Rocha Urias[1], Letícia Teixeira Guimarães[2], Gabriel Gomes Queiroz Veloso[2], José Wilson de Brito Sales[1,3], Rafael Cândido Alves Aguiar[4], José Geraldo Soares Maia[2], Leandro de Freitas Teles[1,3]

ABSTRACT

Introduction: In Northern Minas Gerais, blood transfusions are carried out in 44 hospitals across 24 municipalities affiliated with the Regional Blood Center of Montes Claros/Fundação Hemominas. Despite advances in the field of hemotherapy, transfusion practices still carry risks, which highlights the need for constant hemovigilance. Transfusion safety is directly linked to the existence of standardized procedures, trained teams, active transfusion committees, strict quality control, proper equipment management, and correction of non-conformities. This study aimed to assess the profile of Transfusion Agencies and Hemotherapy Assistance linked to the Regional Blood Center of Montes Claros. **Method:** This is a cross-sectional, descriptive, and quantitative study that analyzed the records of hospital inspections conducted in 2019 and 2022. Aspects considered included service characterization, general information, donor recruitment, transfusion procedures, the role of transfusion committees, and quality assurance. **Results:** In 2022, it was observed that 68.61% of transfusions took place in Montes Claros. Red blood cell concentrates were the most commonly used blood component (63%), followed by platelets (33%). The main non-conformities included lack of training provided to hospital staff, incompletely filled transfusion requests, outdated protocols, and absence of equipment validation. The rate of adverse events was 2.51 per 1,000 transfusions, with febrile non-hemolytic and allergic reactions being the most frequent. **Conclusion:** There was a significant reduction in non-conformities in 2022 compared to 2019, highlighting the importance of continuous education, process standardization, and regular inspections to ensure transfusion safety and the quality of services provided.

Keywords: Blood banks; Blood transfusion; Transfusion reaction.

[1] Fundação Hemominas, Montes Claros, Minas Gerais, Brazil.

[2] Universidade Estadual de Montes Claros (Unimontes), Montes Claros, Minas Gerais, Brazil.

[3] Hemocentro Regional de Montes Claros, Montes Claros, Minas Gerais, Brazil.

[4] Hemobrás, Goiana, Pernambuco, Brazil.

Associate Editor Responsible:

Frederico Duarte Garcia

Faculdade de Medicina da Universidade Federal de Minas Gerais.
Belo Horizonte/MG, Brazil.

Corresponding author:

Leandro de Freitas Teles

Hemocentro Regional de Montes Claros, Fundação Hemominas, Minas Gerais, Brazil.

E-mail: leandro.teles@hemominas.mg.gov.br

Supporting sources:

We thank the Minas Gerais State Research Support Foundation (FAPEMIG) for providing the Scientific Initiation Scholarship.

Conflicts of interest:

None.

Received on: November 01, 2025.

Approved on: April 26, 2026.

Publication Date: July 27, 2026.

DOI: 10.5935/2238-3182.2025e36106-en

RESUMO

Introdução: No Norte de Minas Gerais, as transfusões de sangue são realizadas em 44 hospitais de 24 municípios conveniados ao Hemocentro Regional de Montes Claros/Fundação Hemominas. Apesar dos avanços na área da hemoterapia, as práticas transfusionais ainda apresentam riscos, o que evidencia a necessidade de hemovigilância constante. A segurança transfusional está diretamente ligada à existência de procedimentos padronizados, equipes treinadas, comitês transfusionais atuantes, rigoroso controle de qualidade, gestão adequada dos equipamentos e correção de não conformidades. O objetivo deste estudo foi avaliar o perfil das Agências Transfusionais e das Assistências Hemoterápicas vinculadas ao Hemocentro Regional de Montes Claros. **Método:** Trata-se de um estudo transversal, descritivo e quantitativo que analisou os registros das inspeções hospitalares realizadas nos anos de 2019 e 2022. Os aspectos considerados incluíram a caracterização do serviço, informações gerais, captação de doadores, procedimentos transfusionais, atuação das comissões transfusionais e garantia da qualidade. **Resultados:** Em 2022, observou-se que 68,61% das transfusões ocorreram em Montes Claros. Concentrados de hemácias foram o hemocomponente mais utilizado (63%), seguidos por plaquetas (33%). As principais não conformidades incluíram falta de treinamento para a equipe hospitalar, preenchimento incompleto das solicitações de transfusão, protocolos desatualizados e ausência de validação dos equipamentos. A taxa de eventos adversos foi de 2,51 por 1.000 transfusões, sendo as reações febris não hemolíticas e alérgicas as mais frequentes. **Conclusão:** Houve uma redução significativa nas não conformidades em 2022 em comparação a 2019, destacando a importância da educação continuada, da padronização de processos e de inspeções regulares para garantir a segurança transfusional e a qualidade dos serviços prestados.

Palavras-chave: Bancos de sangue; Transfusão de sangue; Reação transfusional.

Introduction

Blood transfusions in Northern Minas Gerais are carried out in 24 municipalities (44 hospitals) affiliated with the Regional Blood Center of Montes Claros / Hemominas Foundation. This is a mesoregion with a population of 1,779,771 people, according to the Brazilian Institute of Geography and Statistics (2022)[1]. Hemotherapy care is provided through contracts established with hospitals, comprising 29 Transfusion Agencies (TAs) and 15 Hemotherapy Services (HSs). TAs are hemotherapy services responsible for performing pre-transfusion tests, as well as storing and distributing blood components within the hospital. HSs, on the other hand, receive blood units ready to be transfused into a specific patient, with pre-transfusion testing carried out at the Blood Center or at a contractually designated Transfusion Agency (Figure 1).

The transfusion process is not risk-free, despite the extensive knowledge accumulated and applied to date, making continuous hemovigilance essential[2]. Continuing education programs and the evaluation of transfusion agencies and hemotherapy services, considering the therapeutic use of blood components, are fundamental to improving the process and ensuring high-quality healthcare for patients. Transfusion safety is closely linked to standardized procedures, well-trained teams, the effective operation of transfusion committees, quality control, equipment management, technical oversight, and the correction of non-conformities.

This study aimed to describe the profile of the Transfusion Agencies and Hemotherapy Assistance in Northern Minas Gerais, identify their level of compliance, the factors influencing performance, and possible improvements to be implemented.

Methods

This cross-sectional, descriptive, and quantitative study was authorized by the Research Department of Fundação Hemominas and was exempt from review by the Research Ethics Committee, as it involved service evaluation and the use of secondary data. It analyzed on-site supervision records from hospitals contracted by the Regional Blood Center of Montes Claros in 2019 and 2022. Due to the COVID-19 pandemic, no supervision occurred in 2020, and in 2021, services conducted a self-assessment.

The data collection instrument, standardized by Fundação Hemominas, includes the legal requirements for hemotherapy services. The evaluated aspects included: service characteristics (complexity of care), general information, donor recruitment, transfusion practices, transfusion committee, and quality assurance. Information regarding donor recruitment, immunohematology, and quality assurance was not detailed in this study. Each item was categorized as compliant, non-compliant, or not applicable.

A total of 29 hospitals were evaluated in 2019 (22 TAs and 7 HSs), and 33 hospitals in 2022 (26 TAs and 7 HSs). Data were statistically analyzed using SPSS version 25.0.

Results

In 2019, 24,096 transfusions were performed in Northern Minas Gerais, of which 72.7% took place in Montes Claros. In 2022, a total of 24,334 transfusions were carried out in the region, with 68.61% occurring in the same municipality.

A concentration of transfusions was also observed in other municipalities in the region, such as Brasília de Minas, Janaúba, Pirapora, and Taiobeiras (Figure 2). In 2019, eighteen hospitals performed fewer than five transfusions per month, and only seven services performed more than 60 transfusions per month.

Regarding the profile and complexity of care, 30 hospitals (78.4%) offered emergency services, 27 were maternity units (71.05%), 9 had general ICUs (23.68%), 5 had neonatal ICUs (13.15%), 6 had dialysis units (15.78%), 2 had oncology services (5.2%), and 1 had a transplant service (2.6%). In terms of transfused blood components in 2019, 63% were red blood cell concentrates (12,845), 33% platelets (7,858), 10% fresh frozen plasma (2,454), and 4% cryoprecipitate (939).

Transfusions performed under the public healthcare system (SUS) accounted for 88%. A deficit in donor recruitment through hospital-based efforts was identified. In 2022, it was found that 18.6% of services performed fewer than one transfusion per month. Regarding the transfused components in 2022, 54.68% were red blood cells, 28.98% platelets, 10.98% fresh frozen plasma, and 5.35% cryoprecipitate.

The main non-conformities (NCs) identified included: lack of dissemination of training to hospital teams (2022: 25.8%), incomplete completion of transfusion request forms (2019: 48%; 2022: 20.7%), outdated or unavailable nursing procedures (2019: 27.6%; 2022: 13.8%) and medical protocols (2022: 42%), and lack of equipment validation (2022: 25.8%). Transfusion records in patient charts were compliant in 89.7%

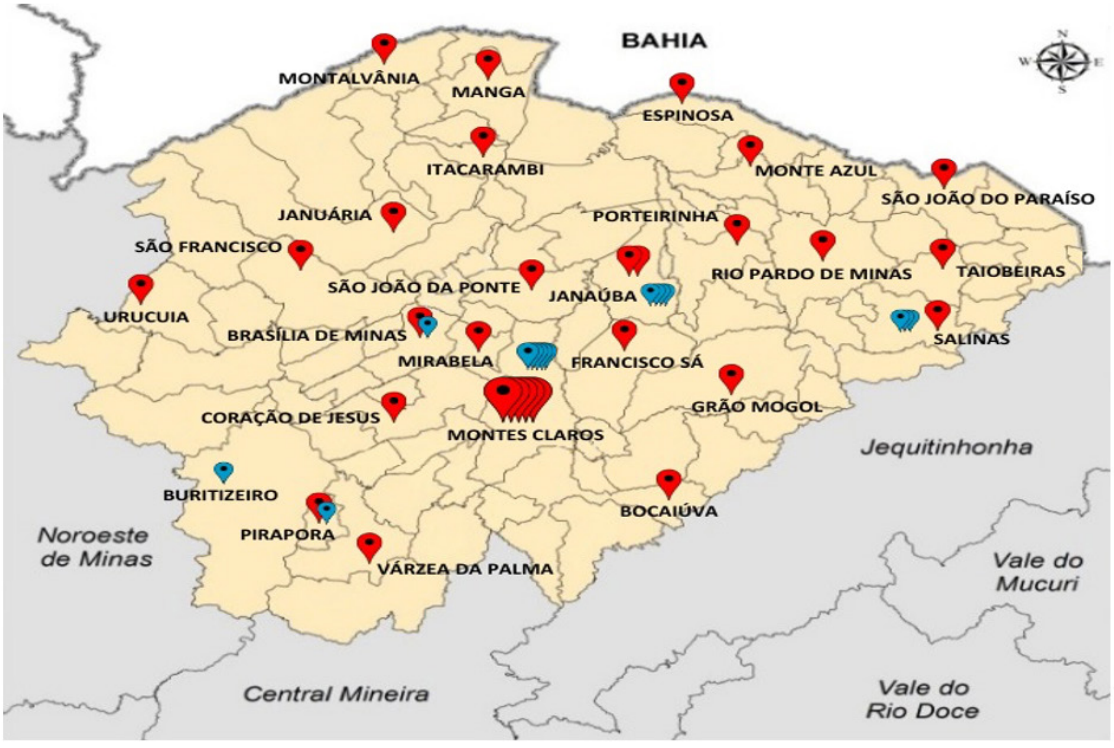

Figure 1. Transfusion Agencies (red) and Hemotherapy Services (blue) in Northern Minas Gerais – affiliated with the Regional Blood Center of Montes Claros / Hemominas Foundation.

of cases. A notable issue identified was the high turnover of responsible technical staff—30.3% for physicians and 54.5% for nurses. A significant reduction in the total number of non-conformities was observed in 2022 compared to 2019.

Regarding hemovigilance, the rate of transfusion-related adverse events was assessed. In 2022, there were 24,334 transfusions, with 61 adverse reactions reported—equivalent to a rate of 2.51 transfusion-related adverse events

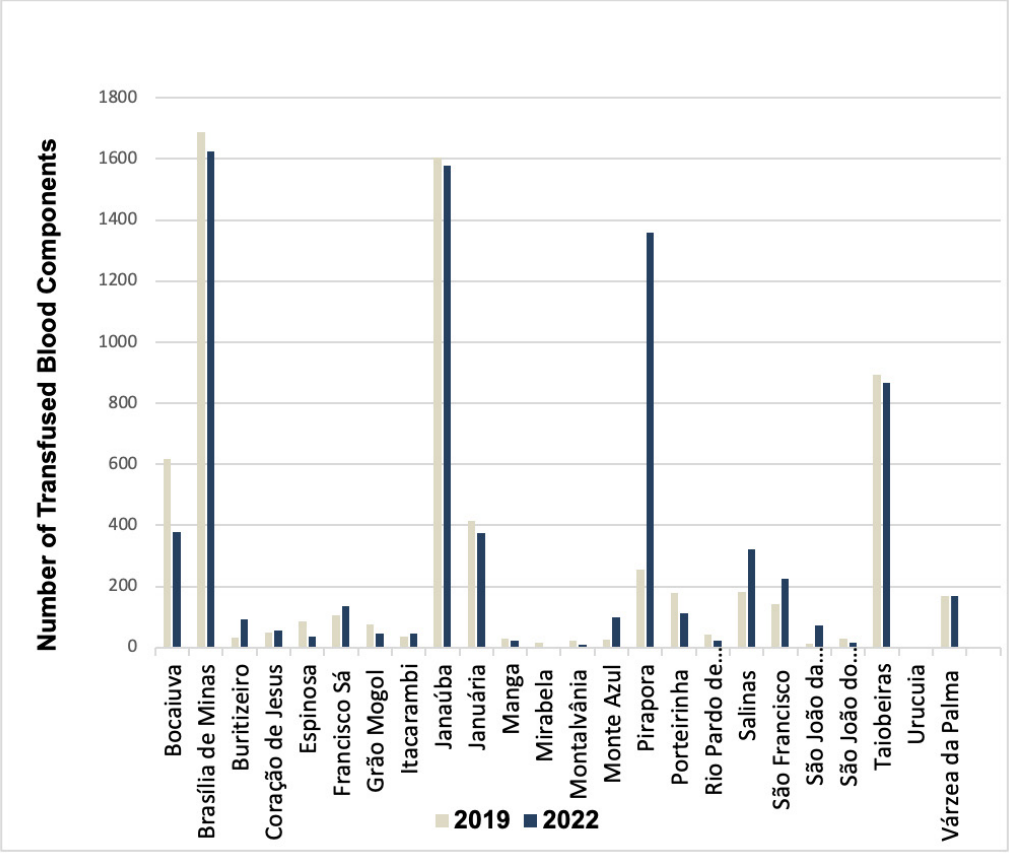

Figure 2. Number of transfusions by municipality in the years 2019 and 2022.

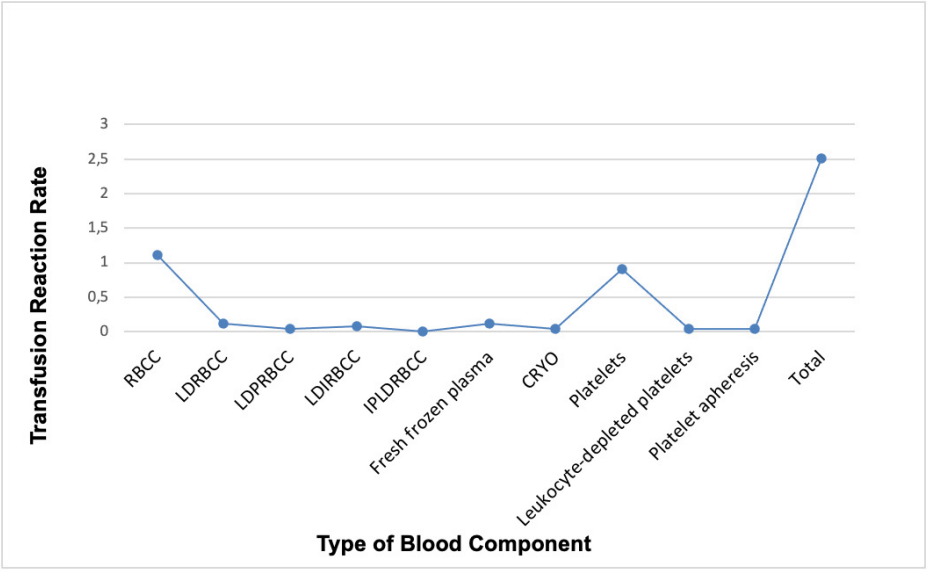

Figure 3. Number of transfusion reactions per 1,000 transfusions performed by hemotherapy services.

Subtitle: RBCC = Red Blood Cell Concentrate; LDRBCC = Leukocyte-Depleted Red Blood Cell Concentrate; LDPRBCC = Leukocyte-Depleted and Phenotyped Red Blood Cell Concentrate; LDIRBCC = Leukocyte-Depleted and Irradiated Red Blood Cell Concentrate; IPLDRBCC = Phenotyped, Leukocyte-Depleted, and Irradiated Red Blood Cell Concentrate; CRYO = Cryoprecipitate.

per 1,000 transfusions performed. The blood components most associated with adverse events were red blood cell concentrates and platelets (Figure 3).

The most frequent adverse event was febrile non-hemolytic reaction (1.15/ 1,000), followed by allergic reaction (0.53/1,000) (Figure 4).

The components most associated with febrile non-hemolytic reactions were red blood cells and platelets, while allergic reactions occurred more frequently during transfusions of platelets and fresh frozen plasma (Figure 5).

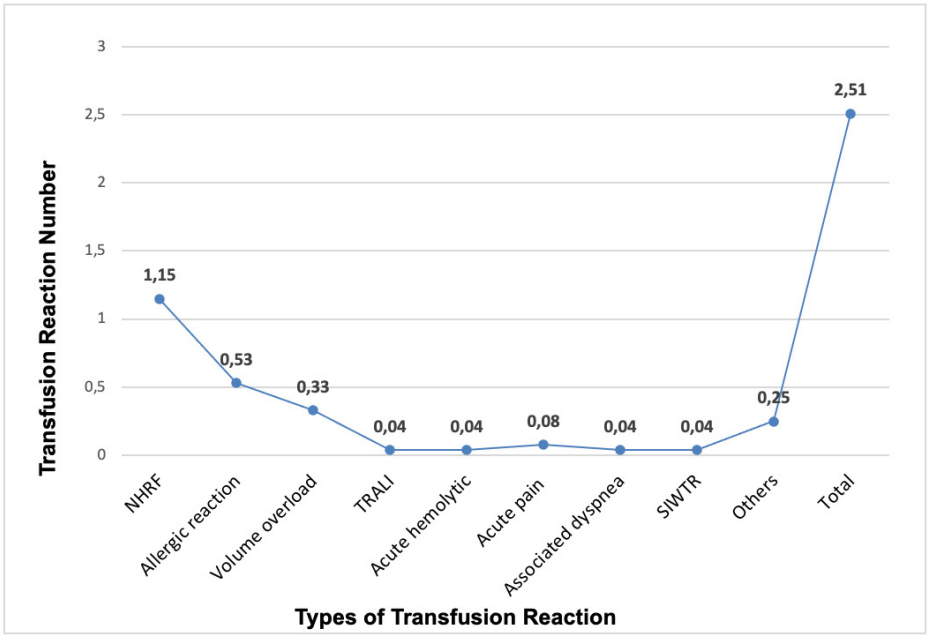

Figure 4. Number of transfusion reactions per 1,000 transfusions performed by hemotherapy services.

Subtitle: NHRF = Febrile Non-Hemolytic Reaction; TRALI = Transfusion-Related Acute Lung Injury; IGSRT = Serious Transfusion Incident without Transfusion Reaction; SIWTR = Serious incident without transfusion reaction.

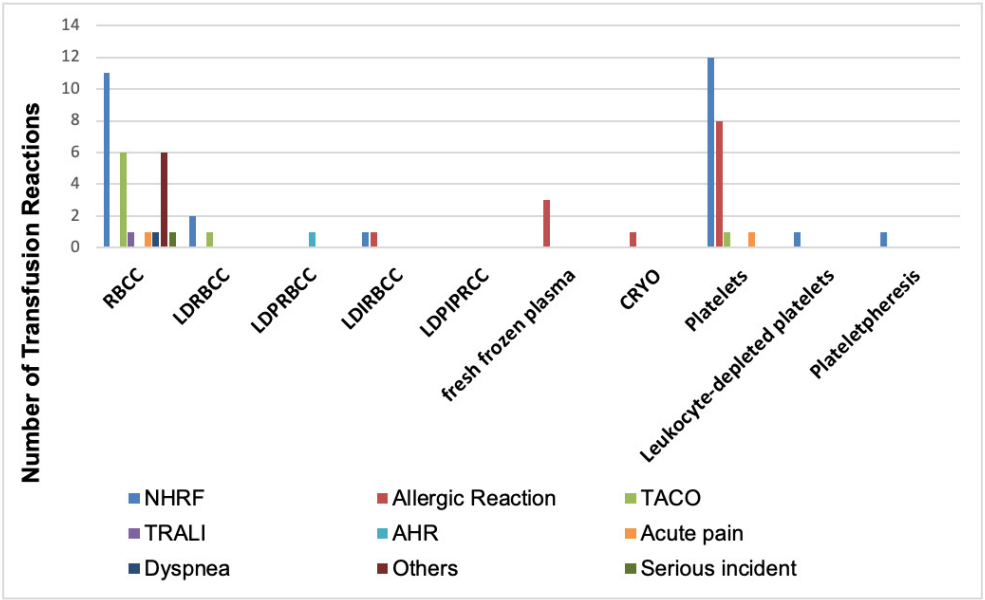

Figure 5. Association between blood components and types of transfusion reactions.

Subtitle: RBCC = Red Blood Cell Concentrate; LDRBCC = Leukocyte-Depleted Red Blood Cell Concentrate; LDPRBCC = Leukocyte-Depleted and Phenotyped Red Blood Cell Concentrate; LDIRBCC = Leukocyte-Depleted and Irradiated Red Blood Cell Concentrate; IPLDRBCC = Phenotyped, Leukocyte-Depleted, and Irradiated Red Blood Cell Concentrate; CRYO = Cryoprecipitate; NHRF = Febrile Non-Hemolytic Reaction; AHR = Acute hemolytic reaction; TACO = Transfusion-Associated Circulatory Overload; TRALI = Transfusion-Related Acute Lung Injury.

Discussion

Brazilian legislation stipulates that facilities performing major surgeries, emergency and urgent care, and/or more than 60 transfusions per month must have at least one Transfusion Agency (TA). However, services that carry out obstetric procedures or in which delays in initiating transfusions could compromise patient care must seek alternatives to minimize this risk[3].

In our region, most transfusions occur in Montes Claros and a few regional hub municipalities. However, to ensure timely care for the population, the presence of TAs is also necessary in low-demand municipalities located far from Montes Claros, especially in areas with poor road access or where river crossings require ferries.

In recent years, the evolution of transfusion therapy has led to an increase in transfusion requests, raising concerns about potentially unnecessary indications. Blood transfusion is considered one of the five most overused medical procedures, which may pose risks to quality and safety, as identified by the Joint Commission and the American Medical Association-Convened Physician Consortium for Performance Improvement (2012)[4]. In this context, the implementation of Patient Blood Management (PBM) in hemotherapy services has become urgent and is recommended by the WHO to reduce unnecessary transfusions.

A study conducted at the University Hospital of Sergipe – EBSERH found that approximately two-thirds of the physicians interviewed reported feeling insecure when prescribing blood components[5]. In the present study, outdated and/or unavailable medical protocols were found in 42% of the services in 2022, and outdated nursing procedures were found in 13.8%. Another aspect evaluated was the transfusion request forms, which showed improved completion in 2022; however, 20.7% were still incomplete. Factors that may have contributed to this improvement included the implementation of computerized record systems in some hospitals, which required the completion of mandatory fields before finalizing requests; interventions by professionals in certain Transfusion Agencies, who returned inappropriate requests; and the provision of in-hospital training programs.

High turnover among responsible technical staff was found to hinder continuity in improvement processes. Regarding adverse transfusion event records, the overall rate was 2.51/1,000 transfusions. According to data from the International Hemovigilance Network Database, which includes 25 countries, the rate of transfusion reactions was 660 per 100,000 transfused individuals[6].

Harvey et al. (2015)[7] analyzed transfusion data from 77 institutions in the United States and identified a reaction rate of 2.39/1,000 transfusions. A French study reported a rate of 3/1,000. However, another study conducted in Brazil in 2017 showed that the rate in sentinel hospitals ranged from 1.96 to 18.7/1,000 transfusions[8]. The blood components most associated with adverse events were red blood cell concentrates and platelets, which are also the most commonly used in clinical practice. This finding aligns with results from Brazilian sentinel hospital studies[8]. Regarding the type of reaction, the most frequent was febrile non-hemolytic reaction (1.15/1,000), followed by allergic reactions (0.53/1,000). Allergic reactions were more commonly observed during transfusions of platelets and fresh frozen plasma.

Productive and care activities within the blood cycle involve both people and machines, which explains the variability in risk levels and demands high surveillance mechanisms by the services themselves through their quality assurance systems[9].

The findings of this research highlight the importance of systematizing strategies to ensure that training provided by the blood center is effectively shared with the entire hospital team. Some services conduct training for medical residents, offer virtual training, or hold in-person lectures; however, the overall reach among physicians remains low. Some hospitals require training for residents and introductory training in transfusion medicine for newly hired professionals.

Another critical aspect is the annual update of protocols and ensuring easy access for consultation. In some hospitals, protocols were available in either digital or printed formats, yet not all staff members were familiar with them. Conducting regular external supervision and internal audits to identify non-conformities that need to be corrected are measures that directly impact process improvement.

Conclusion

There is a high transfusion demand concentrated in Montes Claros and a few regional hubs. The adverse event rate was 2.51/1,000 transfusions. The most prevalent non-conformities were identified, with a notable reduction in 2022 compared to 2019. Continuing education for healthcare professionals, updated procedures, equipment management, regular supervision, and monitoring of corrective actions are essential tools for continuous improvement and quality management, ultimately ensuring patient safety.

Acknowledgements

To the Minas Gerais State Research Support Foundation (FAPEMIG) and the Montes Claros Regional Blood Center - Hemominas Foundation.

Authors' Contributions

We describe contributions to the papers using the taxanomy (CRediT) provided above:

Conceptualization, Investigation, Methodology, Visualization & Writing – analysis and editing: EVR Urias; L de F Teles; GGQ Veloso; JGS Maia. *Project Management, Supervision & Writing – original draft*: EVR Urias; L de F Teles. *Resources and Funding Acquisition*: EVR Urias. *Data*

Curation & Formal Analysis: EVR Urias; LT Guimarães; JW de B Sales; RCA Aguiar; LT Guimarães; GGQ Veloso.

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