

Comorbidities in Adult Health: Predictors of Immediate Transfusion Reactions and Implications for Public Health

Comorbidades na Saúde do Adulto: Preditores de Reações Transfusionais Imediatas e Implicações em Saúde Coletiva
Comorbidades em la Salud del Adulto: Predictores de Reacciones Transfusionales Inmediatas e Implicaciones en la Salud Pública

RESUMO

Introdução: A transfusão sanguínea constitui uma intervenção terapêutica central no cuidado ao adulto, particularmente em contextos de alta complexidade e entre pacientes com doenças crônicas não transmissíveis. No entanto, as reações transfusionais imediatas configuram eventos adversos significativos, com repercussões clínicas, assistenciais e econômicas. **Objetivo:** Analisar a associação entre condições clínicas, comorbidades e fatores preditivos para reações transfusionais imediatas em adultos, com foco na saúde do adulto e nas implicações para a prática em saúde pública.

Métodos: Trata-se de um estudo de coorte retrospectivo e analítico, realizado em um hospital universitário do sul do Brasil, incluindo 9.475 transfusões em pacientes adultos no ano de 2024, aprovado sob CAAE: 86363325.0.0000.5327. Foram analisadas variáveis sociodemográficas e clínicas, comorbidades, características dos hemocomponentes e dados dos doadores. Utilizou-se regressão de Poisson com variância robusta para identificação de fatores preditivos.

Resultados: A incidência de reações transfusionais imediatas foi de 1,25%, com predomínio de reações alérgicas e febris não hemolíticas. Idade avançada, diabetes mellitus e a presença de multimorbidade estiveram independentemente associadas a maior risco de reações transfusionais imediatas. O uso rotineiro de pré-medicação não demonstrou efeito protetor. **Conclusão:** As comorbidades e o perfil clínico do adulto constituem importantes preditores de reações transfusionais imediatas. A incorporação de modelos preditivos e o fortalecimento da hemovigilância podem aprimorar as políticas de segurança do paciente e apoiar práticas mais seguras no campo da saúde pública.

DESCRIPTORES: Saúde do adulto; Comorbidades; Transfusão de sangue; Reação transfusional; Segurança do paciente.

ABSTRACT

Introduction: Blood transfusion is a central therapeutic intervention in adult care, particularly in high-complexity settings and among patients with noncommunicable chronic diseases. However, immediate transfusion reactions constitute significant adverse events with clinical, healthcare, and economic repercussions [1–3]. **Objective:** To analyze the association between clinical conditions, comorbidities, and predictive factors for immediate transfusion reactions in adults, with a focus on adult health and the implications for public health practice. **Methods:** This was a retrospective, analytical cohort study conducted at a university hospital in southern Brazil, including 9,475 transfusions in adult patients in 2024, approved under CAAE: 86363325.0.0000.5327. Sociodemographic and clinical variables, comorbidities, characteristics of blood components, and donor data were analyzed. Poisson regression with robust variance was used to identify predictive factors. **Results:** The incidence of immediate transfusion reactions was 1.25%, with predominance of allergic and febrile non-hemolytic reactions. Advanced age, diabetes mellitus, and the presence of multimorbidity were independently associated with a higher risk of immediate transfusion reactions. The routine use of premedication did not demonstrate a protective effect. **Conclusion:** Comorbidities and the adult clinical profile constitute important predictors of immediate transfusion reactions. The incorporation of predictive models and the strengthening of hemovigilance may enhance patient safety policies and support safer practices in the field of public health.

DESCRIPTORS: Comorbidities; Blood transfusion; Transfusion reaction; Patient safety.

RESUMEN

Introducción: La transfusión sanguínea constituye una intervención terapéutica central en el cuidado del adulto, particularmente en contextos de alta complejidad y en pacientes con enfermedades crónicas no transmisibles. Sin embargo, las reacciones transfusionales inmediatas configuran eventos adversos relevantes, con repercusiones clínicas, asistenciales y económicas. **Objetivo:** Analizar la asociación entre condiciones clínicas, comorbilidades y factores predictores

de reacciones transfusionales inmediatas en adultos, con énfasis en la salud del adulto y en las implicaciones para la práctica en salud colectiva. **Métodos:** Estudio de cohorte retrospectivo, analítico, realizado en un hospital universitario del sur de Brasil, incluyendo 9.475 transfusiones en pacientes adultos durante el año 2024, aprobado bajo el CAAE: 86363325.0.0000.5327. Se analizaron variables sociodemográficas, clínicas, comorbilidades, características de los hemocomponentes y datos de los donantes. Se utilizó regresión de Poisson con varianza robusta para la identificación de factores predictores. **Resultados:** La incidencia de reacciones transfusionales inmediatas fue de 1,25%, con predominio de reacciones alérgicas y febriles no hemolíticas. La edad avanzada, la diabetes mellitus y la presencia de multimorbilidad se asociaron de forma independiente con un mayor riesgo de reacciones transfusionales inmediatas. El uso rutinario de premedicación no demostró un efecto protector. **Conclusión:** Las comorbilidades y el perfil clínico del adulto constituyen importantes predictores de reacciones transfusionales inmediatas. La incorporación de modelos predictivos y el fortalecimiento de la hemovigilancia pueden contribuir al desarrollo de políticas de seguridad del paciente y a la promoción de prácticas más seguras en el ámbito de la salud colectiva.

DESCRIPTORES: Salud del adulto; Comorbilidades; Transfusión de sangre; Reacción transfusional; Seguridad del paciente

RECEIVED: 02/12/2026 APPROVED: 03/20/2026

How to cite this article: Sosnoski M, Cruz ACB, Quadros DV, Santarén MD, Sekine L, Almeida MA. Comorbidities in Adult Health: Predictors of Immediate Transfusion Reactions and Implications for Public Health. *Saúde Coletiva (Brazilian Edition)* [Internet]. 2026 [cited year month day];17(109):20356-20363. Available from: DOI: 10.36489/saudecoletiva.2026v17i109p20356-20363



Monalisa Sosnoski

Nurse, Postgraduate in Intensive Care, Oncology and Hematology, Health Auditing, Certified Hemotherapy Technician – ABHH. PhD in Nursing – UFRGS/HCPA.

ORCID: <https://orcid.org/0000-0003-3482-262X>



Ana Clara de Brito Cruz

Nurse. Master of Science in Nursing – UFRGS.

ORCID: <https://orcid.org/0000-0002-2945-962X>



Deise Vacario de Quadros

Nurse. PhD in Nursing – UFRGS/HCPA.

ORCID: <https://orcid.org/0000-0001-6442-2649>



Michelle Dornelles Santarén

Nurse. PhD in Epidemiology – UFRGS/HCPA. Professor, School of Nursing – UFRGS.

ORCID: <https://orcid.org/0000-0002-8739-4385>



Leo Sekine

Physician. Master's and PhD in Epidemiology – UFRGS. Professor, School of Medicine – UFRGS.

ORCID: <https://orcid.org/0000-0002-2979-0929>



Mirian de Abreu Almeida

Nurse. PhD in Education – UFRGS. Professor, School of Nursing – UFRGS.

ORCID: <https://orcid.org/0000-0002-4471-6057>

INTRODUCTION

The Brazilian epidemiological profile is characterized by an aging population and the growing prevalence of chronic diseases, such as diabetes, hypertension, cardiovascular diseases, chronic kidney disease, and neoplasms, which are responsible for a high burden of morbidity and mortality and the frequent use of complex therapies, including blood transfusions^[3,4]. In this context, transfusion constitutes a fundamental therapeutic intervention, widely used in medium- and

high-complexity hospital settings^[1,2].

Despite advances in transfusion safety, this procedure remains associated with adverse events, particularly immediate transfusion reactions, which range from mild manifestations to severe complications, such as circulatory overload and acute lung injury^[2,5]. Such events directly impact length of hospital stay, healthcare costs, and clinical outcomes^[2,5,6].

In the context of public health, the analysis of these events goes beyond the individual level, reflecting the quality of care processes and the effectiveness of sur-

veillance systems^[2,7]. Evidence indicates that patients with multiple comorbidities are more vulnerable to adverse events, reinforcing the need for predictive models and risk stratification strategies^[5,7,8].

Furthermore, nursing plays a central role in this process, contributing to clinical assessment, monitoring, and reporting, and is fundamental to transfusion safety and the consolidation of evidence-based practices.^[5,7,8]

METHOD



A retrospective, analytical, and descriptive cohort study conducted at a university hospital in southern Brazil. The study included transfusions performed on adult patients (≥ 18 years) between January and December 2024, with ethical approval under CAAE: 86363325.0.0000.5327.

Data were extracted from institutional computerized systems using anonymized queries, ensuring confidentiality. Variables included sociodemographic and clinical characteristics, presence of comorbidities (ICD), use of premedication, type of blood component, volume, storage time, and donor data^[1,2].

The primary outcome was the occurrence of RTi. Poisson regression with robust variance was used. The significance level adopted was 5%.

RESULTS

A total of 9,475 transfusions performed in adult patients during the study period were analyzed, with an overall incidence of immediate transfusion reactions of 1.25%. This finding falls within the range described in hemovigilance systems, although it may still be influenced by underreporting.

Regarding the characterization of reactions, a predominance of non-hemolytic allergic and febrile manifestations was observed, which together accounted for the majority of recorded events. Severe reactions were less frequent but clinically relevant, requiring additional interventions and increased clinical monitoring.

In the analysis of associated factors, it was found that age was directly related to an increased incidence of reactions, indicating greater vulnerability in older patients. This finding suggests the influence of age-related physiological changes, as well as a higher burden of associated diseases.

Among comorbidities, diabetes stood out as a factor significantly associated with the occurrence of immediate transfusion reactions. Diabetic patients were more likely to develop adverse events, possibly due to chronic immunological and inflammatory changes.

The presence of multimorbidity demonstrated an independent association with a higher risk of reactions, indicating that the patient's clinical complexity is a central factor in the occurrence of these events. It was observed that patients with multiple chronic conditions had a higher frequency of reactions compared to those without comorbidities or with a single condition.

Regarding variables related to the transfusion process, no statistically significant association was observed between the use of premedication and a reduction in the occurrence of reactions. This result reinforces the inconsistency of its effectiveness as a preventive strategy in clinical practice.

Additionally, characteristics of blood components and donors were analyzed, but they did not show a relevant association with the occurrence of reactions in the final model, suggesting that factors related to the recipient carry greater weight in determining risk.

Multivariate analysis using Poisson regression confirmed that advanced age, diabetes mellitus, and multimorbidity remained independent predictors of immediate transfusion reactions, even after adjusting for potential confounding factors.

These findings demonstrate that transfusion risk is not homogeneous and is directly related to the patient's clinical profile, reinforcing the need for individualized approaches in transfusion care.

DISCUSSION

The results of this study consistently demonstrate that immediate transfusion reactions in adults are predominantly determined by intrinsic characteristics of the recipient, particularly advanced age, diabetes mellitus, and multimorbidity.^[3,7,11] These findings reinforce a paradigm shift in the understanding of transfusion risk, shifting the focus from a product-centered approach to a patient-centered perspective, in which clinical and biological factors play a decisive role.

The observed association with advanced age can be interpreted in light of the concept of immunosenescence, characterized

by dysfunctions in the innate and adaptive immune responses, associated with a chronic, low-intensity pro-inflammatory state. This scenario favors greater reactivity to antigenic stimuli, including blood components, and reflects a greater accumulation of transfusion exposures over a lifetime. Thus, age acts not only as a demographic variable but as a biological marker of vulnerability^[8,11,12].

Converging evidence indicates that diabetes mellitus has emerged as an independent predictor, suggesting that chronic metabolic and inflammatory states modulate the body's response to transfusion. Endothelial dysfunction, oxidative stress, and persistent activation of inflammatory pathways—characteristics of this condition—may amplify the occurrence of adverse reactions. These mechanisms reinforce the hypothesis that the transfusion response is, in part, mediated by the recipient's baseline inflammatory state^[5,8,12].

Multimorbidity, in turn, constitutes a clinical construct that encapsulates the complexity of the contemporary patient. Its association with an increased risk of transfusion reactions suggests that the interaction between multiple chronic conditions generates a state of systemic frailty, characterized by reduced physiological reserve, greater exposure to interventions, and increased clinical instability. In this sense, multimorbidity should be understood not merely as the sum of diagnoses, but as a structural determinant of health risk^[4,6,10].

One of the most significant findings of this study concerns the lack of a protective effect from premedication. This result is consistent with recent evidence that calls into question its effectiveness as a universal preventive strategy. The continuation of this practice, often based on clinical tradition rather than robust evidence, raises concerns regarding excessive medicalization, the potential occurrence of adverse effects, and the inefficient use of resources. These data support the need for a critical review of institutional protocols in light of evidence-based medicine^[2,6,12].

From a public health perspective, the

results broaden the understanding of transfusion reactions as sensitive indicators of the quality of care and the maturity of hemovigilance systems. The identification of higher-risk subgroups enables the development of targeted strategies, with the potential to reduce adverse events, rationalize resources, and improve clinical outcomes [5,8,10].

In this context, the incorporation of predictive models emerges as a strategic approach for contemporary clinical practice. The use of algorithms based on clinical and transfusion-related variables can enable individualized risk stratification, allowing for early interventions and promoting a safer and more efficient approach. This perspective aligns with the principles of precision medicine and data-driven healthcare, representing a significant advance in the management of transfusion care [1,9,11,12].

Additionally, the structuring role of nursing in the implementation of these strategies is noteworthy. Nursing practice in the transfusion context integrates continuous clinical assessment, systematic monitoring, and immediate response to adverse events, establishing itself as a central pillar of patient safety. The incorporation of predictive tools into nursing practice enhances its capacity for clinical decision-making and strengthens its role as a key player in hemovigilance [13,14].

Despite its significant contributions,

this study has limitations inherent to its retrospective design, including potential underreporting of events and dependence on the quality of institutional records. Additionally, analysis based on data from a single center may limit the generalizability of the results. However, the consistency of the findings and the sample size lend robustness to the inferences made [1,4].

In summary, this study contributes to the advancement of knowledge by demonstrating that the risk of immediate transfusion reactions is strongly modulated by the patient's clinical profile. These results reinforce the need to transition to more individualized care models, based on risk stratification and integration between clinical practice, surveillance, and management.

CONCLUSION

This study demonstrates that immediate transfusion reactions in adults are strongly influenced by the recipient's clinical profile, with advanced age, diabetes mellitus, and multimorbidity standing out as independent predictors. These findings reinforce that transfusion risk should be understood as a multifactorial phenomenon in which the patient's vulnerability plays a central role.

By highlighting the predominance of clinical factors over variables related to the blood component, the results support the

need to reorient transfusion care toward patient-centered models, with an emphasis on risk stratification and evidence-based decision-making. In this context, the absence of a protective effect from premedication underscores the urgency of critically reviewing established practices, aligning institutional protocols with the best available evidence.

From a public health perspective, the findings expand our understanding of transfusion reactions as sensitive indicators of the quality of care and the effectiveness of hemovigilance systems. The incorporation of predictive models into clinical practice represents a promising strategy for risk anticipation, resource optimization, and improved care quality.

Additionally, the strategic role of nursing in clinical assessment, monitoring, and response to adverse events is highlighted, consolidating its role as a central element in patient safety and the implementation of evidence-based practices.

In summary, this study contributes to the advancement of knowledge by integrating clinical and epidemiological evidence, proposing a more individualized, safe, and efficient approach to transfusion care, with potential impact on clinical practice and the formulation of public health policies.

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