

# Critical evaluation of justifications for the transfusion of red blood cells: the reality of a government emergency hospital

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**Background:** Blood products and derivatives are indispensable resources in medical therapies. However, it is important to note that the number of donations is far from ideal. Despite constant campaign efforts, a deficit of 1 million units is expected by 2030.

**Objectives:** To determine the adequacy of the indications for red blood cell transfusion in an emergency hospital in Alagoas.

**Methods:** This was a cross-sectional observational study conducted at the Alagoas Blood Center. Of a total of 2936 red blood cell transfusion requests in 2009, 334 were randomized and compared with transfusion parameters described in the literature (primary variable). After analysis, the transfusion requests were categorized as adequate, inadequate or inconclusive. This last group included all red blood cell transfusion requests with insufficient clinical information, rendering their classification as adequate or inadequate impossible. The secondary variable involved the reasons for red blood cell transfusion. A 95% confidence interval was used in the statistical analysis.

**Results:** Forty-seven (14.07%) requests were adequate and 30 (8.98%) were inadequate. Most of the requests were classified as inconclusive (76.94%). The main indications for transfusion were upper gastrointestinal bleeding (26.95%), anemia (46.71%), hypovolemia/hypovolemic shock (10.78%) and sepsis/septic shock (3.29%).

**Conclusion:** It was not possible to reach a conclusion on the adequacy of the indication for transfusion in most of the cases. Therefore, it is important to adopt a transfusion protocol, rigorously analyze blood bank requests, to provide awareness campaigns on the rational use of blood and to implement strategies to use blood products more effectively.

**Keywords:** Erythrocyte transfusion; Blood banks; Blood preservation; Hospitals, public; Emergency service, hospital

## Introduction

Blood products and derivatives are indispensable resources in medical therapies. Erythrocyte concentrates are widely used to treat both acute and chronic anemia. However, it is important to note that the number of donations is far from ideal. Data from the Ministry of Health indicate that 1.9% of the Brazilian population donates blood. Each year, approximately 3.5 million bags are collected, while the ideal amount to maintain the national supply is 5.7 million<sup>(1)</sup>. Despite constant campaign efforts, supply projections are not favorable; in fact, a deficit of 1 million units by 2030 is estimated<sup>(2)</sup>.

Moreover, despite the adoption of stricter hemovigilance norms, the risk of adverse effects such as transfusion-related acute lung injury (TRALI)<sup>(3)</sup>, the spread of malignant cells, immunomodulation, hemolytic reactions, and the transmission of infectious diseases such as hepatitis, human immunodeficiency virus infection, Chagas disease, and herpes should not be underestimated<sup>(4-11)</sup>. Given the risks, scarcity, and high cost, the indications for the use of blood products must be accurate to avoid waste and minimize risks<sup>(9)</sup>. For six decades, a hemoglobin level < 10 g/dL or a hematocrit < 30% was used as the threshold for the indication of transfusion<sup>(12)</sup>. Although transfusion indications are not set solely on the basis of hemoglobin levels, the consensus in most cases hinges on the administration of red blood cells (RBCs) to patients with hemoglobin levels < 6 or 7 g/dL. Transfusion above these levels must be considered according to symptoms, estimated blood loss in the pre-operative period, and cardiovascular and pulmonary comorbidities<sup>(13-16)</sup>.

However, the use of blood transfusions without consideration of these parameters is common in hospital practice, particularly in emergency services. It is estimated that more than 68% of the blood transfusions performed in these services are adequately indicated<sup>(15)</sup>. As such, we ask: Are the indications for RBC transfusions adequate in the Alagoas State General Hospital? Therefore, the aim of this study was to verify the adequacy of the indications for the RBC requests in a referral emergency hospital in the State of Alagoas.

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## Methods

This study was approved by the ethics committee of the Universidade Estadual de Ciências da Saúde de Alagoas (UNCISAL). This cross-sectional observational study was conducted at the Alagoas Blood Center in 2010. The study comprised 2936 RBC requests made by the State General Hospital Oswaldo Brandão Vilela during 2009. The sample size calculation took into account 68% of the population, an absolute precision of 5%, a significance level of 0.05%, and a 95% confidence interval (CI) and was performed using the electronic calculator of the Epidemiology and Statistics Laboratory, Universidade de São Paulo. The data were stored in Excel tables and the statistical analysis was performed using the Quickcalcs statistics program. Sampling was performed by randomization, with 334 RBC requests being selected according to the proportional of requests made each month.

The primary variable of this study was the adequacy of the indication for RBC transfusion. The secondary variable involved the indications for RBC transfusion. The RBC transfusion indications were confronted with parameters obtained from the literature to verify transfusion adequacy or inadequacy. The RBC transfusions were considered adequate according to the following criteria.

### Acute anemia:

- 1) Volume of blood loss estimated to be 1500-2000 mL (class III hemorrhage);
- 2) Blood loss < 1500 mL associated with preexisting anemia, cardiovascular disease, or other relevant clinical data that justify a RBC transfusion;
- 3) Hemoglobin < 6 g/dL and values of 7-10 g/dL in stabilized patients with justifiable clinical conditions.

### Chronic anemia:

- 1) Levels < 6-7 g/dL usually require transfusions;
- 2) Hemoglobin levels of 7-10 g/dL may be considered after a study of the etiopathogenesis of anemia, presence of comorbidities (e.g., cardiovascular disease) and exclusion of possible transfusion alternatives.

### Transfusions in surgery:

- 1) Hemoglobin levels < 6-7 g/dL usually require transfusion;
- 2) Hemoglobin levels of 7-10 g/dL should be evaluated according to factors such as evidence of ischemia, major blood loss and risk factors for complications with inadequate oxygenation (low cardiopulmonary reserve, high oxygen consumption rate);
- 3) Levels > 10 g/dL, transfusions are largely unnecessary<sup>(13-16)</sup>.

### Pediatric cases (age > 4 months):

- 1) Blood loss > 15% of the total blood volume;
- 2) Emergency surgery in patients with significant preoperative

anemia without the use of other corrective therapeutic measures;

- 3) Preoperative hematocrit < 24% with signs and symptoms of anemia, chronic congenital anemia, or acquired symptomatic chronic anemia, or patients who are undergoing radiotherapy/chemotherapy;
- 4) Acute loss with hypovolemia that is unresponsive to other therapies;
- 5) Hemoglobin < 13 g/dL and patients with severe lung disease or on extracorporeal membrane oxygenation;
- 6) Presence of symptomatic congenital chronic anemia that is unresponsive to conservative treatment (sickle cell anemia, thalassemia)<sup>(17,18)</sup>.

### Pediatric cases (age < 4 months):

- 1) Hemoglobin < 7 g/dL with a low reticulocyte count and symptoms of anemia;
- 2) Hemoglobin < 10 g/dL with:
  - O<sub>2</sub> saturation < 35% (hood);
  - O<sub>2</sub> by nasal catheter;
  - Continuous positive airway pressure (CPAP)/intermittent mandatory ventilation (IMV) with mechanical ventilation and mean airway pressure < 6 cmH<sub>2</sub>O;
  - Significant apnea or bradycardia (> 6 episodes in 12 hours or two episodes in 24 hours requiring mask and bag ventilation using therapeutic doses of methylxanthines);
  - Significant tachycardia or tachypnea (heart rate > 180 beats per minute for 24 hours, respiratory rate > 80 breaths per minute for 24 hours);
  - Low weight gain. (Gain of < 10 g/day observed over four days while receiving ≥ 100 Kcal/kg/day).
- 3) Hemoglobin < 12 g/dL with:
  - O<sub>2</sub> hood > 35%;
  - CPAP/IMV and mean airway pressure ≥ 6-8 cm H<sub>2</sub>O.
- 4) Hemoglobin < 15 g/dL with:
  - Extracorporeal membrane oxygenation;
  - Cyanotic congenital heart disease<sup>(17,18)</sup>.

Requests that were deemed inconclusive included those that:

- 1) Did not describe hemoglobin levels, except in cases of acute anemia;
- 2) Did not describe the estimated blood loss according to clinical criteria (urine output, heart and respiratory rate, level of consciousness, blood pressure) in cases of acute anemia;
- 3) Documented RBC transfusions at 6-10 g/dL without citing any justifiable clinical parameters.

## Results

Requests were divided into adequate, inadequate or inconclusive on the basis of protocols indicating the use of RBC concentrates<sup>(14-17)</sup>. Of the 334 analyzed requests, five did not contain an indication type and were incorporated into the inconclusive group.

Most of the indications for requesting RBC were considered inconclusive (76.94%) because of the lack of justifying clinical and laboratory information. Indications such as paleness, bleeding, anemia, sepsis, and shock were included in this group. Sufficient clinical and laboratory information that adequately justified the transfusions were present in 14.07% of the RBC requests; however, 8.98% of the requests were completely inadequate (Table 1).

Table 1 - Adequacy of the red blood cell transfusion requests

	n (%)	95% confidence interval
Adequate	47 (14.07)	10.73-18.23
Inadequate	30 (8.98)	6.33-12.57
Inconclusive	257 (76.94)	72.13-81.15
Total	334 (100)	

Considering the indications for transfusion, it is possible to distinguish four groups according to frequency: upper gastrointestinal bleeding, anemia, hypovolemic shock, and sepsis/septic shock. Many of the indications, although not directly mentioned in the requests, had one of these four indications (Table 2) as the underlying cause or basic consequence. Other reasons cited for RBC transfusions included neoplasia, craniotomy, chronic renal failure, multiple trauma, abdominal trauma, and injury by firearms. A total of 634 units of packed RBC were requested. Of the patients receiving transfusions, 42.81% were women and 57.19% were men. Of the 22 pediatric cases, 19 (86.36%; 95% CI: 65.82-96.10%) were considered inconclusive and three (3.65%; 95% CI: 3.90-34.18%) were considered adequate.

Table 2 - Indications for red blood cell transfusion requests

	n (%)	95% confidence interval
Upper gastrointestinal bleeding	90 (26.95)	22.46-31.95
Anemia	156 (46.71)	41.42-52.06
Hypovolemic shock	36 (10.78)	7.86-14.59
Sepsis/septic shock	11 (3.29)	1.78-5.87
Others	41 (12.27)	9.15-16.26
Total	334 (100)	

## Discussion

Blood products are a scarce resource; their use should therefore be restricted to specific indications. Their indiscriminate use carries the risk of increased susceptibility to hospital-acquired infections, transmission of infectious diseases, TRALI, increased expenditure and mortality in critically ill patients<sup>(3-12)</sup>. Several research groups have studied the unnecessary use of blood products<sup>(15,16,20-30)</sup>. In a study at the Melbourne Royal Hospital, Metz et al. observed that 16% of the RBC transfusions were inappropriate. Among these, 66 transfusions were considered

inappropriate because the physician did not record the indication for transfusion<sup>(20)</sup>. In our study, 5 requests received by the blood bank did not include an indication. A more recent study at a Spanish university hospital studied adherence to the indications according to the national protocol for blood transfusions and observed that 13% of the indications for RBC transfusions were not in accordance with the protocol<sup>(21)</sup>. A higher rate of disagreement was found in the prescriptions of fresh frozen plasma (74%)<sup>(21)</sup>. A French study on adherence to the national protocol observed conformity in 93% of the RBC transfusions<sup>(22)</sup>. Ghali<sup>(23)</sup> concluded that up to 55.3% of RBC transfusions were unnecessary. Another study reported that 3% of transfusions in the intensive care unit were inappropriate<sup>(24)</sup>.

In Brazil, Sekine et al. concluded that 68% of the RBC requests submitted within a public hospital were in accordance with the criteria proposed by the hospital<sup>(15)</sup>. Another national survey mentioned that pre-transfusion hemoglobin values were not recorded; thus, the development of a transfusion protocol is required<sup>(25)</sup>. In our study, in addition to the adequate and inadequate categories, we included the inconclusive category. This category, included requests (74.18%) that, because of the lack of basic clinical information (age and hemoglobin level) or the presence of generalist reasons (shock, sepsis, hemorrhage), were lacking clinical parameters that could estimate blood loss. It is likely that inadequate requests were also among them, however, we just reported these as inadequate requests. Friedman et al. revealed that a review of medical records revealed a positive correlation between the lack of registration and RBC transfusions and disagreements with the hospital transfusion protocol<sup>(26)</sup>. Some studies also had major limitations in that they were not able to retrospectively analyze the quality of transfusions because of inadequate documentation<sup>(27)</sup>.

Although not the focus of this research, we speculate that the following factors influenced the high rate of inadequate and inconclusive requests: non-adherence by physicians to the transfusion protocol, the lack of a rigorous supervising committee in the blood bank to limit the number of requests, inadequate filling out of the requests, lack of public campaigns aimed at encouraging medical staff to follow current protocols and lack of awareness of the increased risks and unnecessary costs of the indiscriminate use of blood products. It is important to consider that the State General Hospital, the largest emergency hospital in the state of Alagoas, has problems typical to most Brazilian government hospitals (e.g., overcrowding, infrastructure problems). This limits the examination time dedicated to patients and leads the physicians taking immediate measures. During this study period, the State General Hospital did not have a transfusion committee.

In the literature, many studies aim to exert greater control over the use of blood products. One study, performed by auditing the largest hospitals in Sydney, reported that during the first audit, 35% of the transfusions were considered inadequate and that the intervention had little effect in reducing this number<sup>(28)</sup>.

Tuckfield et al. showed a decrease in inadequate indications for RBC concentrates from 16% to 3% after a prospective intervention with careful monitoring of blood bank physicians<sup>(29)</sup>. These and other studies reinforce

the importance of the blood bank staff reviewing the indications for blood transfusions as well as the formation of a transfusion committee<sup>(29,30)</sup>. Other measures that could be adopted to reduce excessive blood consumption include strategies published in the literature that use the descriptors “blood conservation strategies” and “bloodless medicine”<sup>(4)</sup>. Examples of these include the use of antifibrinolytic agents, cell-saver techniques, use of minimally invasive surgical techniques, blood samples for analysis in small volume tubes (microcollection), the use of erythropoietin, early identification and correction of the causative factors of anemia, and the reduction of transfusion thresholds<sup>(4)</sup>. However, it is worth noting that these strategies are not risk free and should be assessed according to each patient<sup>(4)</sup>.

## Conclusion

In 2009, only 14.07% of the RBC requests made within the Alagoas General Hospital were considered adequate, while 8.98% were considered inadequate. Due to the scarcity of clinical data provided by the physician in 76.94% of cases, it was not possible to reach a conclusion about the adequacy of the transfusion indication. Therefore, it is important to adopt a transfusion protocol, rigorously analyze blood bank requests, to provide awareness campaigns on the rational use of blood and to implement strategies to use blood products more effectively.

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