Rev Rene. 2025;26:e95551.
DOI: 10.36517/2175-6783.20252695551
www.periodicos.ufc.br/rene

Original Article

Recognition of immediate transfusion reactions by nurses in the intensive care unit

Reconhecimento das reações transfusionais imediatas por enfermeiros no centro de terapia intensiva

How to cite this article:
Santos SSA, Oliveira VBCA, Pereira TM. Recognition of immediate transfusion reactions by nurses in the intensive care unit. Rev Rene. 2025;26:e95551. DOI: https://doi.org/10.36517/2175-6783.20252695551

Sabrina Sara Aparecida dos Santos[1]
Vanessa Bertoglio Comassetto Antunes de Oliveira[2]
Tatiane Moro Pereira[3]

[1]Secretaria Municipal da Saúde de Curitiba. Curitiba, PR, Brazil.
[2]Universidade Federal do Paraná. Curitiba, PR, Brazil.
[3]Fundação Estatal de Atenção à Saúde de Curitiba. Curitiba, PR, Brazil.

Corresponding author:
Sabrina Sara Aparecida dos Santos
Rua Angico, 170, Vila Santa Maria.
CEP: 83306-310. Piraquara, PR, Brazil.
E-mail: sabrina.sarah1997@gmail.com

Conflict of interest: the authors have declared that there is no conflict of interest.

ABSTRACT

Objective: to understand the contributions of an educational intervention to the recognition of immediate transfusion reactions by nurses working in the intensive care unit. **Methods:** this qualitative study, based on Thiollent's action research, was conducted with 14 nurses working in the intensive care unit of a municipal hospital. Professionals on leave due to vacation and/or other types of absence were excluded. Data collection took place through emancipatory workshops, developed in six phases: exploratory, problematization, theorization, action plan, evaluation, and dissemination. Data were analyzed using thematic content analysis. **Results:** the workshops fostered reflection on the clinical signs of immediate transfusion reactions, as well as the identification of weaknesses and suggestions for educational strategies. Among the proposed actions, theoretical training and the development of a badge-card as a practical support tool during care stood out. **Conclusion:** the intervention was perceived as a supportive resource for the clinical recognition of transfusion reactions, enhancing familiarity with the procedures established in the institutional protocol. **Contributions to practice:** the study reinforces the relevance of participatory educational strategies in daily care practice, especially in critical contexts, by promoting the integration of theory and practice in transfusion safety.

Descriptors: Nurses, Male; Transfusion Reaction; Intensive Care Units; Critical Care; Health Services Research.

RESUMO

Objetivo: compreender as contribuições de uma intervenção educativa para o reconhecimento de reações transfusionais imediatas por enfermeiros atuantes em centro de terapia intensiva. **Métodos:** estudo qualitativo, baseado na pesquisa-ação de Thiollent, desenvolvido com 14 enfermeiros atuantes em unidade de terapia intensiva de um hospital municipal. Foram excluídos profissionais afastados por férias e/ou licenças. A coleta de dados ocorreu por meio de oficinas emancipatórias, desenvolvidas em seis fases: exploratória, problematização, teorização, plano de ação, avaliação e divulgação. A análise seguiu o método de conteúdo temático. **Resultados:** as oficinas possibilitaram reflexões sobre sinais clínicos de reações transfusionais imediatas, além de favorecerem a identificação de fragilidades e sugestões de estratégias educativas. Entre as ações propostas, destacaram-se uma capacitação teórica e a criação de um cartão-crachá como material de apoio prático durante a assistência. **Conclusão:** a intervenção foi percebida como um recurso de apoio para o reconhecimento clínico de reações transfusionais, favorecendo a familiaridade com condutas previstas no protocolo institucional. **Contribuições para a prática:** o estudo reforça a relevância de estratégias educativas participativas no cotidiano assistencial, especialmente em contextos críticos, promovendo a articulação entre teoria e prática na segurança transfusional.

Descritores: Enfermeiros; Reação Transfusional; Unidades de Terapia Intensiva; Cuidados Críticos; Pesquisa sobre Serviços de Saúde.

Received: Jun. 9th 2025; Accepted: Aug. 28th 2025.

Introduction

Recent regulations have updated guidelines for nurses and nursing technicians in hemotherapy, focusing on the standardization of procedures, quality of care, and transfusion safety[1]. Hemotransfusion is the intravenous infusion of blood components to treat clinical conditions, restore oxygen transport, promote hemostasis, and recover circulating volume. Despite correct administration, transfusions can still cause adverse reactions due to the interaction between the recipient and the biologically active product[2-3].

Transfusion reactions can be severe, particularly in critically ill patients, and may occur immediately (during or up to 24 hours after the procedure) or at a later stage[2,4]. Early recognition is essential to prevent complications. In intensive care, clinical complexity demands constant vigilance and specific skills from the healthcare team, with nurses playing a central role in monitoring and responding to such events[5].

Standardization through institutional protocols is crucial for safety. At the institution studied, the protocol—created in 2014 and updated in 2023—provides guidance from the indication of blood components to the management of adverse reactions and is available in the Tasy System, under the Quality folder.

Nurses, who maintain direct contact with patients, are responsible for observing clinical signs of transfusion reactions. Technical competence and rapid decision-making are essential to mitigate risks. However, the literature points to significant gaps in training for the identification and management of these reactions[5].

Professional qualification requires more than technical standards, involving the integration of theory and practice through continuing education[6]. Educational interventions in the workplace promote the development of clinical skills and professional judgment in complex situations and should be participatory, reflective, and emancipatory[7]. Practical experience combined with reflection strengthens evidence-based decision-making, as proposed in the progressive development of clinical expertise[8].

This study is scientifically, socially, and professionally relevant, given the growing incidence of transfusions and the high prevalence of these practices in intensive care, with a predominance of immediate reactions. These circumstances highlight the urgency of actions aimed at early recognition[9]. This research seeks to fill scientific gaps and improve transfusion safety, enhancing clinical practice in high-complexity settings.

The objective of this study was to understand the contributions of an educational intervention to the recognition of immediate transfusion reactions by nurses working in the intensive care unit.

Methods

Study design

This was a qualitative, intervention-based study using the action research methodology[10], designed and described according to the recommendations of the Consolidated Criteria for Reporting Qualitative Research (COREQ). The investigation was structured into six adapted phases: exploratory, problematization, theorization, action plan, evaluation, and dissemination. The choice of action research was justified by the need to understand and address practical gaps in healthcare services in a collaborative manner with participants, aiming for real transformations in patient care. Although the central theme had been previously outlined by the researchers based on field observations and informal conversations with professionals, the definition of strategies, workshop content, and support materials was developed in a participatory way, taking into account suggestions and questions raised by the nurses in the unit.

Population

The study population consisted of all 14 staff nurses working in the three Intensive Care Units (ICUs) of a municipal hospital located in Curitiba, Paraná, Brazil. Convenience sampling was applied, con-

sidering professionals who met the criteria of availability, voluntary acceptance, and inclusion: nurses of both sexes, formally employed at the institution, and performing exclusively clinical care activities in the ICU. Nurses on vacation or leave during the data collection period were excluded.

All 14 eligible professionals were invited to participate in the study, and none declined. Therefore, the final sample comprised all 14 nurses, covering the entire eligible population.

Setting

The study was conducted in the three ICUs of a municipal hospital in Curitiba, which also serves as a practice site for the Uniprofessional Nursing Residency Program. The workshops were held in a private room within the unit, respecting participants' work shifts and availability.

Period and data collection

Selection was intentional, with an indirect invitation made through printed leaflets distributed in the unit, followed one week later by direct individual invitations. The material included the title, objectives, methodology, and researchers' contact information.

Data collection took place between February and August 2024, at times compatible with participants' availability, through emancipatory action research workshops. Sociodemographic and professional data were obtained using a semi-structured closed questionnaire administered individually in a private room, covering variables such as age, gender, work shift, years since graduation, and length of ICU experience.

The workshops addressed topics suggested by the nurses, such as signs and symptoms of transfusion reactions, recognition in critically ill patients, types and infusion times of blood components, care during administration, and the institutional protocol for immediate reactions. In the final phase, a structured questionnaire was applied to evaluate the educational strategy, considering its advantages, disadvantages, and impact on professional practice. Additionally, a follow-up interview was conducted 30 days after the intervention to verify recognized signs and symptoms and the contribution of the action to daily management.

The process was documented in a field diary, with audio recordings made using an iOS application and later transcribed into Excel® spreadsheets. To ensure anonymity, participants were identified as P1, P2, (...). The authors declare no conflicts of interest, and the study was self-funded.

Data analysis

The participants' statements were analyzed using the technique of thematic content analysis[11], with manual coding. Categories emerged from the empirical material based on recurring statements and thematic axes from the workshops. Two researchers analyzed the data independently and compared the results to ensure reliability, with saturation identified through the recurrence and comprehensiveness of the data. The categories were discussed in light of references in hemotherapy, transfusion safety, and in-service education. Credibility and auditability were reinforced through data triangulation, thick description of the context, and partial feedback to participants. The flowchart of the project phases and action research stages (Figure 1).

Ethical considerations

To conduct the research in compliance with ethical standards, participants signed the Free and Informed Consent Form and the Authorization for the Use of Voice and Image, ensuring their rights to consent, confidentiality, and anonymity. The study was approved by the Research Ethics Committee of the Municipal Health Department of Curitiba under opinion number 6,513,843/2023 and Certificate of Presentation for Ethical Consideration 75432923.0.0000.0101.

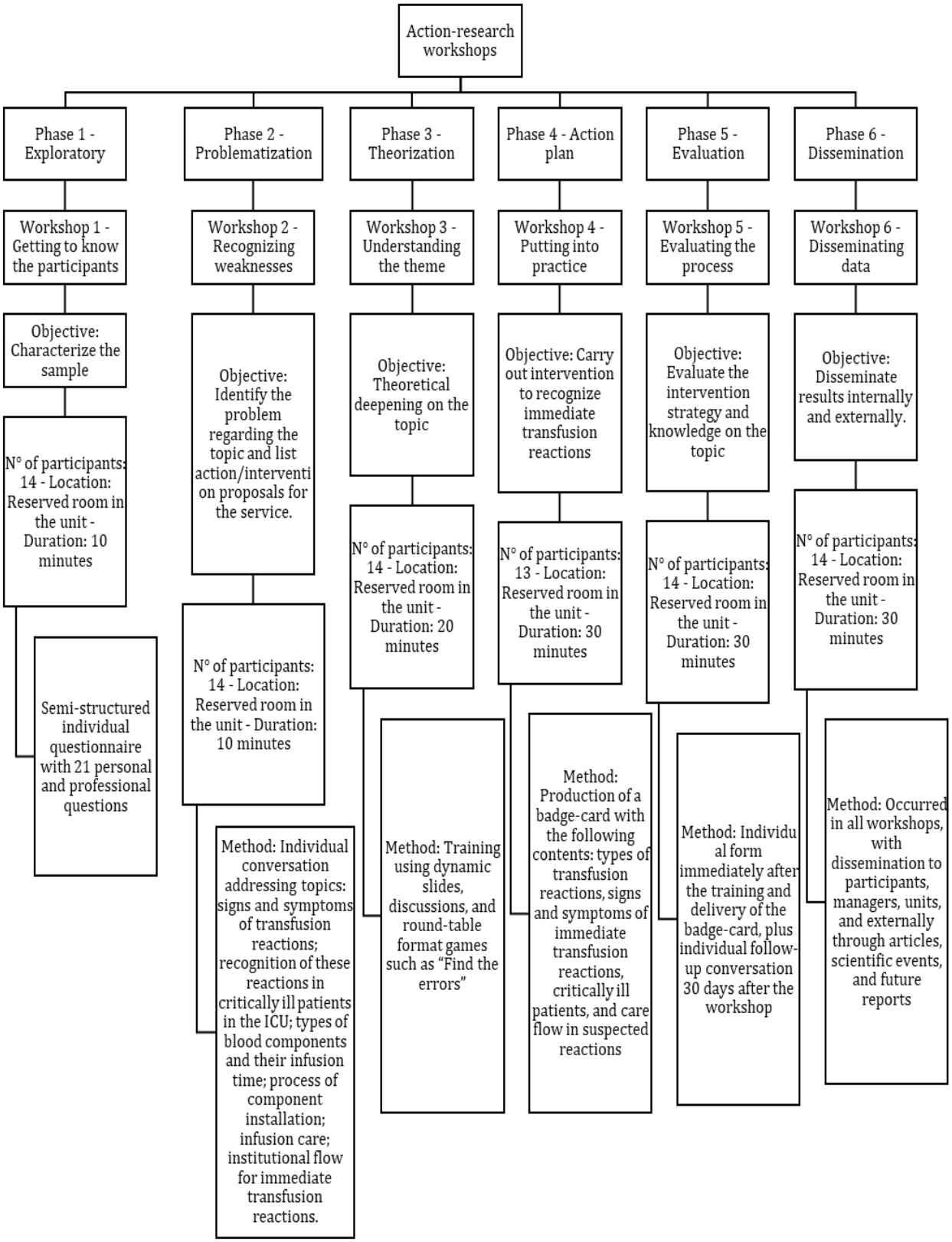

Figure 1 – Flowchart of the project phases and action research stages. Curitiba, PR, Brazil, 2024

Results

The study resulted in six workshops distributed over three meetings, following the stages of action research: the first addressed the exploratory and problematization phases, the second focused on theorization and the development of the action plan, and the third on the evaluation of the process. Data feedback was conducted transversally, promoting continuous socialization and collective knowledge construction.

The population consisted of 14 nurses, equally divided between day and night shifts, all female. Ages ranged from 26 to over 40 years, with five nurses above 40. Regarding time since graduation, six had four to seven years of experience, and five had more than 10 years. Professional experience in nursing ranged from one to more than 10 years, with 10 nurses having more than four years of experience. Twelve participants held postgraduate qualifications. Regardin experience in intensive care, ten participants had beg tween one and seven years of professional practice, while two had more than ten years of experience.

To facilitate presentation of the findings, the data were organized into the following analytical categories: pre-infusion care, care during infusion, post--infusion care, recognition of immediate transfusion reactions in critically ill patients, weaknesses to be addressed, theoretical training and intervention, advantages and disadvantages of the action plan, implementation of actions related to critically ill patients undergoing transfusion, and recognition of immediate transfusion reactions in critically ill patients post-intervention (Figure 2).

The categories emerged inductively through thematic analysis based on content analysis. The process included transcription, floating reading, initial coding, grouping by units of meaning, and cross-validation among researchers. The final categories reflect the central axes of the workshops and are aligned with the study objective and participants' perceptions.

Research phases	Categories	Aspects addressed	Frequência de menções
Phase 1 and 2 (Exploratory and Problematization)	Pre-infusion care for blood components	Monitoring of vital signs	13
		Large-bore access and verification of the blood component bag	12
		Dedicated line	11
		Double-checking during blood typing sample collection	6
	Care during the infusion of the blood component	Monitoring	14
		Remaining at the bedside	12
		Doubts about the exact infusion time	5
	Post-infusion care for blood component	Saline flushing of venous access	7
		Vital signs	14
		Lack of knowledge of institutional protocol and absence of training	12
		Disposal of the blood component bag	5
	Recognition of immediate transfusion reactions in critically ill patients	Unaware of the official classification	14
		Have witnessed reactions and there is difficulty in identifying these reactions in critically ill patients	10
		Feel confident in identifying	7
	Weaknesses to be addressed	Need for continuous training	12
		Suggestion for quick reference materials	5
Phase 3 e 4 (Theoretization and Action plan)	Theorization and intervention	Appreciation of the ID badge as a reminder	13
		Proactive role in identifying reactions and systematizing procedures	Qualitativo
Phase 5 (Evaluation)	Advantages and disadvantages of the action plan	Absence of the technical team in the training	4
		Clarity of the flows and signs/symptoms	Qualitativo
		Training upon admission and with greater frequency	3
	Implementing actions related to the critically ill patient in blood transfusion	Appreciation of subtle clinical signs	Qualitativo
		Need for adherence to the institutional protocol	Qualitativo
		Systematization of clinical reasoning	Qualitativo
	Recognition of immediate transfusion reactions in critically ill patients post-intervention	Changes in vital signs (hypotension, hypertension, tachycardia, fever, among others)	14

Figure 2 – Distribution of categories and aspects addressed with frequency of mentions according to the number of participants (n=14). Curitiba, PR, Brazil, 2025

Pre-infusion care for blood components

Participants reported prior knowledge about the care required before transfusion. Six mentioned double-checking blood typing. Verification of the blood component bag information alongside the patient's details was reported by 12 participants, as was the use of appropriately sized vascular access. Systematic monitoring of vital signs as an essential measure was mentioned by 13 nurses, while 11 emphasized the use of a dedicated infusion line. In addition, participants correctly identified the types of blood components used at the institution, as evidenced by the following statements: *It is crucial to monitor vital signs and any changes the patient may present* (P9). *Blood components include plasma, platelets, cryoprecipitate, and red blood cell concentrate* (P10).

These data demonstrate competence in the essential technical procedures for transfusion preparation. However, the lack of uniformity in practices such as double-checking blood typing and using a dedicated line suggests a need to reinforce adherence to the institutional protocol.

Care during blood componente infusion

This category emerged from participants' mentions of necessary precautions during the infusion of blood components, with a focus on preventing and early identifying immediate transfusion reactions. All participants emphasized the importance of continuous monitoring, and 12 highlighted staying at the patient's side during the first minutes of infusion. The main weakness identified was a lack of knowledge about the exact infusion time for each type of blood component, as illustrated by the statement: *I believe the infusion lasts two to four hours, although I know red blood cells can take up to six hours. The other components have smaller volumes and more bags to infuse. However, I recognize I need to update myself on the exact time* (P11).

Although safety practices are well established, conceptual gaps remain that may compromise proper infusion management, especially regarding timing and the validity of the infused blood component.

Post-infusion care for blood components

This category reflected the importance participants attributed to post-infusion care and their prior knowledge. All nurses mentioned monitoring vital signs and communicating any clinical changes. Seven highlighted flushing the intravenous line after infusion, and five cited proper disposal of the blood component bag. On the other hand, 12 reported a lack of knowledge about the institutional protocol and absence of specific training. Challenges were identified in continuous monitoring over the 24 hours following transfusion and uncertainty regarding the response workflow for suspected transfusion reactions, as reflected in the following statements: *On busier days, it is difficult to monitor the patient continuously, so we rely on the support of the technical team* (P12). *I don't remember clearly and am not sure if the institutional protocol has been updated* (P1). *When a reaction is suspected, we stop the transfusion and call the physician, but I'm not certain about the access procedure* (P2).

Discontinuity in post-transfusion care reflects structural and institutional weaknesses, indicating an urgent need for systematic training and support strategies for the team.

Recognition of immediate transfusion reactions in critically ill patients

This category assessed participants' knowledge regarding the identification of immediate transfusion reactions in critically ill patients. Ten nurses reported having experienced such reactions, but only seven felt confident in identifying them. All were unaware of the official classification. For 10 participants, identifica-

tion was more difficult in critically ill patients, whereas four highlighted the advantage of continuous monitoring. All participants could list associated signs and symptoms (Figure 3) and defined critically ill patients as those admitted to the ICU, unstable, and at risk of death. The following statements reflect these findings: *I witnessed it once: I started the transfusion and the patient began to experience itching* (P9). *The critically ill patient receives many medications and may have sepsis or shock, with symptoms that can be confused with transfusion reactions* (P10). *I believe it is easier to identify reactions in the ICU because there is continuous monitoring and the team is constantly present* (P12).

There is relevant empirical knowledge, but it is not systematized. Lack of understanding regarding reaction classification compromises clinical management, particularly given the complexity of critically ill patients.

Figure 3 – Cited signs and symptoms of immediate transfusion reactions. Curitiba, PR, Brazil, 2024

Fragilities to be addressed

In this category, participants highlighted weaknesses related to their understanding of the topic and its practical application, which could generate doubts in daily professional practice. The need for training and education on the subject was mentioned by 12 participants, and five also suggested providing easily accessible materials for future reference, as reflected in the following statements: *Having more training on the subject would be important, because now that you raised the issue, I realized several doubts I didn't even know I had. I think I was operating on autopilot* (P8). *One suggestion would be to have a quick-reference material available* (P2).

Active listening revealed that part of this lack of knowledge was unconsciously unrecognized, reinforcing the role of educational interventions as catalysts for critical reflection on practice.

Theorization and intervention

The theorization/theoretical training expanded participants' understanding of hemotransfusion. The workshops addressed topics suggested by the professionals themselves and included in the institutional protocol: blood components, infusion flow, types of transfusion reactions, signs and symptoms in critically ill patients, response workflow, and access to the complete protocol. The coordinator of the Transfusion Agency and the nurse from the Continuing Education department participated in validating the content, methodology, and institutional alignment. Activities were dynamic, featuring presentations and roundtable discussions in a welcoming environment with refreshments, which encouraged active participation. At the end, participants expressed surprise and appreciation: *Wow! I had no idea that a practice we perform almost every day is so complex and has so many aspects behind it* (P13).

The workshops also broadened participants' perspectives on ICU routines and revealed doubts regarding transfusion reactions, their signs, symptoms, and management, highlighting the need to improve recognition and care workflows. In response, a digital badge-card (Figure 4) was created and distributed after the training as a quick-reference tool.

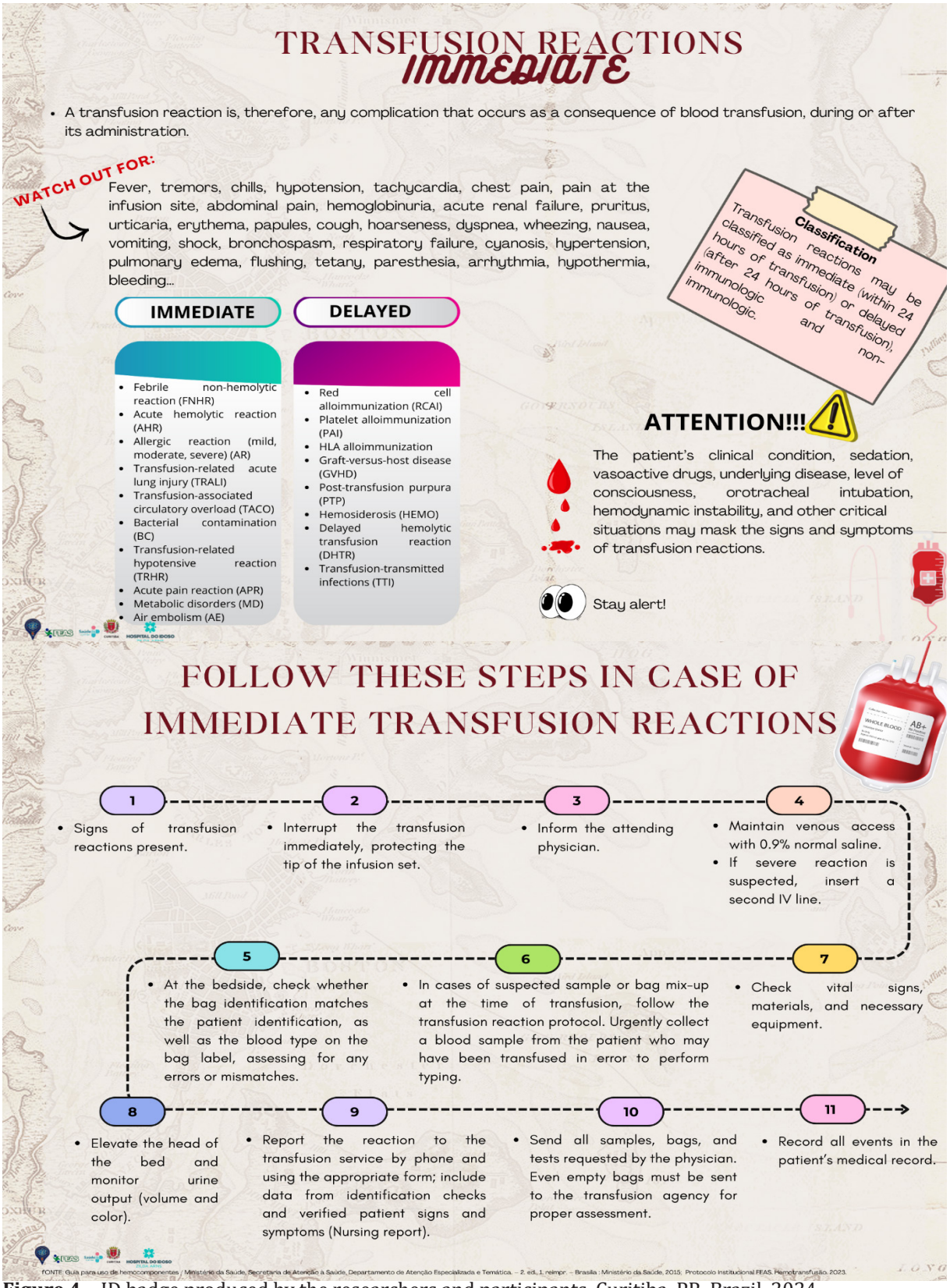

Figure 4 – ID badge produced by the researchers and participants. Curitiba, PR, Brazil, 2024

Advantages and disadvantages of the action plan

This category emerged from the need to evaluate the impact of the intervention, associated with the theorization phase, on the expansion of technical-scientific knowledge and clinical practice. Advantages included practicality, clarification of doubts, presentation of the institutional protocol, identification of signs and symptoms of immediate transfusion reactions, and review of care procedures and response workflows. Among the disadvantages, four nurses noted the exclusion of the technical support team from the research and training, and three suggested that the training should be conducted upon the admission of new staff and offered more frequently. The following statements illustrate these perceptions: *This training should be offered to all newly arrived nurses in the unit, as many come from areas where this procedure is not routine"* (P5). *Next time, it would be interesting to include the technicians in the training* (P8).

Participants perceived the intervention as a strategic tool for continuing education, while emphasizing the importance of inclusion and continuity to ensure its sustainability in the clinical setting.

Implementation of actions related to critically ill patients in hemotransfusion

Thirty days after the theorization and implementation of the action plan, participants reported that the training contributed to systematizing clinical reasoning and strengthening safe practice in hemotransfusion for critically ill patients. They highlighted the importance of continuous monitoring, readiness to recognize immediate reactions, adherence to the institutional protocol, and use of the badge-card as a reminder in a high-complexity environment. They also observed a change in professional behavior, with increased vigilance and proactive engagement in patient care, as expressed in the following statement: *After the training, I remember the infusion time for each blood component and always perform double-checking of blood typing to prevent errors. I stay at the bedside for 10 minutes, observing the patient, and if any changes occur, I stop the transfusion immediately and call the on-duty physician. I also have the 'cheat sheet' on my badge* (P5).

These reports highlight the value of technical knowledge combined with qualified decision-making, indicating that the intervention positively impacted perceptions of autonomy, responsibility, and preparedness in care.

Recognition of immediate transfusion reactions in critically ill patients – post-intervention

Participants were asked how they would identify suspected immediate transfusion reactions. They cited alterations in vital signs, hypotension/hypertension, tachycardia, fever, skin rashes, reddish urine, dyspnea, hoarseness, desaturation, pruritus, decreased level of consciousness, cough, flushing, pain at the puncture site, tremors, and bleeding, as illustrated in the following statement: *Patients in the ICU usually present unstable clinical conditions, which makes it difficult to recognize transfusion reactions. However, with the training and discussions conducted, I believe our evaluation during transfusion will improve* (P11). *Any change in the patient after the start of infusion can be considered a suspected transfusion reaction* (P3).

These statements indicate that the training improved clarity in identification, distinguishing expected manifestations from changes requiring transfusion interruption, while reinforcing clinical criteria and the appropriate moment to seek medical support in alignment with protocols.

Data feedback occurred in all sessions, providing information to participants, managers, and units, and was also shared externally through this study, scientific events, and future reports.

Discussion

The intensive care unit (ICU) is a high-complexity environment, intended for critically ill and unstable patients requiring intensive care. In this context, the nursing team is essential for ensuring patient safety, continuous monitoring, and individualized care[12-14].

The study population was predominantly fema-

le, confirming that nursing remains largely a female profession[15–16]. In 2020, the Brazilian Federal Nursing Council (COFEN) registered approximately 2.7 million nursing professionals in Brazil, with 24.6% being registered nurses. COFEN data recorded 287,119 nurses, 88% of whom were women[16]. Factors such as age over 40 and more than four years of professional experience indicate consolidated expertise and professional maturity. At this stage, nurses achieve career maturity, with greater command of cognitive skills and competencies, seeking better opportunities and job stability[13-14]. Participants' profiles also included postgraduate education, reflecting a growing concern with expanding knowledge to enhance patient safety[13,16]. The complexity of decision-making in intensive care requires qualified nurses capable of addressing ethical and technical challenges efficiently[14,16].

Participants emphasized essential care before, during, and after the administration of blood components. According to the institutional protocol and the Blood Components Guide, the process begins with medical prescription, and the nurse is responsible for execution. Hemotransfusion is a high-complexity practice that carries risks related to patient physiology, product quality, and potential errors. Therefore, it requires technical knowledge, mastery of proper procedures, and strict adherence to standards to ensure patient safety throughout the process[2].

Care aspects not explicitly mentioned by participants include patient identification verification, checking the collected tube data, proper hand hygiene and use of personal protective equipment, storage of blood components in specialized boxes, and initiating the infusion within 30 minutes after removal from refrigeration. During the procedure, it is essential to monitor changes in blood component color, control the drip rate, and document the date, time, and vital signs in the medical record[2].

Medical records should include start and end times of the transfusion, vital signs, and identification of the blood component, ensuring compliance and adverse event reporting. Slow infusion during the first few minutes is recommended, as severe reactions most frequently occur during this period. The nurse's presence during the first ten minutes is critical for rapid intervention and patient safety[2,5].

Immediate transfusion reactions can occur from the start of infusion up to 24 hours post-administration[2]. However, participants reported challenges in performing continuous monitoring during this interval due to workload and staffing limitations, highlighting the need for stronger institutional support for the nursing team. Restricted access to the institutional transfusion protocol and lack of specific training emerged as additional weaknesses, indicating gaps in continuing education and the integration of formal guidelines into daily practice.

Limited knowledge in hemotherapy compromises care quality and patient safety. To ensure safety and reduce adverse events, healthcare institutions must provide periodic, continuous training to nursing staff, ensuring adequate preparation[5,13-14].

Regarding actions in suspected immediate transfusion reactions, participants reported uncertainty about maintaining or discarding the intravenous line and the blood component bag after stopping the transfusion. The intravenous line should be maintained with 0.9% saline, and a second line established in severe reactions. The used infusion set, along with the bag (even if empty) and laboratory samples, must be sent to the transfusion service for investigation. Other measures include verifying the match between the bag and patient ID, monitoring urine output, elevating the head of the bed for comfort, documenting thoroughly in the medical record, and collecting samples for laboratory analysis[2-3].

Regarding knowledge of immediate transfusion reactions, participants reported prior experience and confidence in identification in critically ill patients, associated with practical experience. However, none demonstrated mastery of formal reaction classification, highlighting a gap in specific technical knowledge.

Although nurses are not responsible for diagnosis, they must remain vigilant throughout the infusion process to recognize early signs and symptoms of these reactions. This vigilance is essential for ensu-

ring a prompt, appropriate response and minimizing patient risk[2,5,13].

Identification of immediate transfusion reactions in critically ill patients is challenging due to clinical complexity and concomitant therapies. Frequent decompensation of cardiovascular, respiratory, neurological, renal, and metabolic systems complicates early recognition. Nonetheless, the intensive care environment, with specialized support such as hemodynamic monitoring and renal therapy, facilitates rigorous clinical surveillance[17]. Professional knowledge of signs and symptoms is critical, as they correspond to over 98% of reported cases[2-3,18]. These signs — chills, fever, urticaria, dyspnea, hypertension, headache, edema, tachycardia, chest pain, erythema, cough, rash, vomiting, and pruritus — may go unnoticed, particularly due to the severity of ICU patients[2,19-21].

Professionals must be trained to monitor, recognize, and act according to protocols and emergency procedures[22-23]. After training and distribution of the badge-card containing protocol guidance and immediate transfusion reactions, nurses expressed surprise at the content, highlighting the importance of understanding each transfusion step. These results underscore the significant contribution of continuing education within the institution[24-25].

By integrating health education into the workplace, continuing education links technical-scientific knowledge with professionals' lived experiences, promoting critical reflection and changes in daily practice. Effective training processes value prior knowledge, active listening, and horizontal dialogue, allowing professionals to recognize themselves as active participants in care construction[7].

Continuous training, with thematic planning, regular content updates, and adequate frequency, is essential to strengthen clinical autonomy and patient safety. In this process, concrete experience gains centrality, considering that clinical competencies develop through situated practice and reflective experience[8]. Despite the intensive demands of ICU care, educational interventions should be encouraged as a powerful strategy to enhance care quality, professional recognition, and the consolidation of a culture of excellence in healthcare[5,25-26].

Evaluation of the training revealed that the topic was highly relevant to the unit's routine. Participants reviewed content, clarified doubts, and improved recognition of signs and symptoms of immediate transfusion reactions in critically ill patients. However, the absence of the technical support team was noted. Although the study targeted nurses, who are formally responsible for essential transfusion steps, technical staff actively participate in monitoring and detecting complications. This educational gap may compromise care completeness and safety, emphasizing the importance of teamwork for ICU efficiency[14,23-26].

The training highlighted the importance of knowledge of institutional protocols and constant vigilance during transfusions. Results emphasize the value of dialogical and reflective educational practices[7], recognizing professionals' prior knowledge and fostering critical autonomy. The workshop integrated theory and practice, promoting situated competencies and reinforcing that clinical expertise is built through experience and contextualized reflection. Continuing education thus proved strategic in qualifying transfusion care in high-complexity environments[8].

Study limitations

The main limitation of this study was its conduction in a single hospital in Curitiba, which restricts the generalizability of the results to other contexts, as practices and training may vary between institutions. Another limitation is the difficulty in measuring long-term impact, as the study focused on short- to medium-term evaluation. Changes in professional behavior may not be immediately visible, requiring more time to consolidate, which complicates the assessment of the intervention's effectiveness over time.

Contributions to practice

The educational intervention contributed to enhancing nurses' competence in recognizing imme-

diate transfusion reactions, promoting greater accuracy in identifying clinical signs and safer clinical conduct. The interactive workshops facilitated clinical reasoning and strengthened decision-making in critical situations. Regarding adherence to institutional protocols, participants demonstrated increased familiarity with the institutional document and more rapid incorporation of standardized procedures, particularly with the use of the badge-card as a quick reference tool during patient care. Finally, the experience highlighted the potential of continuing education with participatory methodologies to integrate theory and practice, fostering situated learning applicable to the realities of intensive care units.

Conclusion

The study provided insight into how an educational intervention, based on the action research methodology, was perceived by intensive care unit nurses as a useful strategy for recognizing immediate transfusion reactions. The workshops and supporting materials helped expand familiarity with clinical signs, care flow, and the institutional protocol, contributing to safer patient care. Although the nurses possessed prior knowledge, gaps were identified in the recognition and management of reactions, underscoring the importance of formative spaces embedded in practice. The findings reinforce the value of continuing education as an integrative component between experience and professional development, contributing to the improvement of care in high-complexity settings.

Authors' contributions

Concepção e desenho do estudo, análise e interpretação dos dados, redação do manuscrito, revisão crítica do conteúdo intelectual, aprovação final da versão a ser publicada e assumem responsabilidade por todos os aspectos do trabalho, garantindo sua exatidão e integridade. Santos SSA, Oliveira VBCA, Pereira TM. Aprovação final da versão a ser publicada: Oliveira VBCA, Pereira TM.

References

1. Conselho Federal de Enfermagem (COFEN). Resolução COFEN nº 709, de 19 de agosto de 2022. Atualiza a Norma Técnica que dispõe sobre a Atuação de Enfermeiro e de Técnico de Enfermagem em Hemoterapia. [Internet]. 2022 [cited Jun 15, 2025]. Available from: https://www.cofen.gov.br/resolucao-cofen-no-709-2022/
2. Ministério da Saúde (BR). Guia para uso de hemocomponentes [Internet]. 2015 [cited Jun 15, 2025]. Available from: https://bvsms.saude.gov.br/bvs/publicacoes/guia_uso_hemocomponentes_2ed.pdf
3. Rehan M, Iqbal T, Sarwar M, Khan MS, Tariq MH, Ain Q, et al. Pattern of acute adverse transfusion reactions in patients with burn injuries: a novel initiative towards haemovigilance at the national burn centre of Pakistan. Ann Burns Fire Disasters [Internet]. 2023 [cited Jun 15, 2024];36(3):261-5. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC11042048/pdf/abfd-2023-03-261.pdf
4. Agência Nacional de Vigilância Sanitária (BR). Boletim Informativo Vigipós [Internet]. 2022 [cited Jun 15, 2025]. Available from: https://www.gov.br/anvisa/pt-br/assuntos/noticias-anvisa/2022/boletim-avalia-o-sistema-de-notificacao-e-investigacao-em-vigilancia-sanitaria/copy_of_V32BOLETIMPGAGGMON2022.pdf
5. Mori K, Tsukamoto Y, Makino S, Takabayashi T, Kurosawa M, Ohashi W, et al. Effect of intensive care provided by nurse practitioners for postoperative patients: a retrospective observational before-and-after study. PLoS One. 2022;17(1):e0262605. doi: https://doi.org/0.1371/journal.pone.0262605
6. Ministério da Saúde (BR). Secretaria de Gestão do Trabalho e da Educação na Saúde. Política Nacional de Educação Permanente em Saúde [Internet]. 2009 [cited Jul 22, 2025]. Available from: https://bvsms.saude.gov.br/bvs/publicacoes/pacto_saude_volume9.pdf
7. Freire P. Pedagogia da autonomia: saberes necessários à prática educativa. São Paulo: Paz & Terra; 2019.
8. Benner P. Educating nurses: a call for radical transformation-how far have we come? J Nurs Educ. 2012;51(4):183-4. doi: https://dx.doi.org/10.3928/01484834-20120402-01

9. Agência Nacional de Vigilância Sanitária (BR). Notificações em hemovigilância. Painel Notivisa em Hemovigilância em Reações Transfusionais [Internet]. 2023 [cited Jun 15, 2025]. Available from: https://www.gov.br/anvisa/pt-br/acessoainformacao/dadosabertos/informacoes-analiticas/notificacoes-em-hemovigilancia

10. Thiollent M. Metodologia da pesquisa-ação. São Paulo: Cortez; 2011.

11. Bardin L. Análise de conteúdo. São Paulo: Edições 70; 2016.

12. Pereira EB, Santos VG, Silva FP, Silva RA, Souza CF, Costa VC, et al. Hemovigilância: conhecimento da equipe de enfermagem sobre reações transfusionais. Enferm Foco. 2021;12(4):702-9. doi: https://doi.org/0.21675/2357-707X.2021.v12.n4.4479

13. Braga BR, Ribeiro GS, Morais F, Bezerra AA, Santana JP, Silva CM, et al. Enfermagem em UTI: cuidados essenciais na assistência direta ao paciente. Nursing. 2024;28(313):9333-9. doi: https://doi.org/10.36489/nursing.2022v28i313p9333-9339

14. Carmo KM, Silva EF, Lima MA, Oliveira PS, Moura RF. Perfil da enfermagem brasileira sob a perspectiva de classe, gênero e raça/cor da pele. Cuad Educ Desarro. 2024;16(3):e3549. doi: https://doi.org/10.55905/cuadv16n3-015

15. Marinho GL, Queiroz MEV. Cobertura populacional de enfermeiros no Brasil: estimativas com base em diferentes fontes de dados. Trab Educ Saúde. 2023;21:e00916202. doi: https://dx.doi.org/10.1590/1981-7746-ojs916

16. Conselho Federal de Medicina (CFM). Resolução nº 2.271, de 14 de fevereiro de 2020. Define as unidades de terapia intensiva e unidades de cuidado intermediário conforme sua complexidade e nível de cuidado [Internet]. 2020 [cited Jun 15, 2025]. Available from: https://www.in.gov.br/web/dou/-/resolucao-n-2.271-de-14-de-fevereiro-de-2020-253606068

17. Ackfeld T, Schmutz T, Guechi Y, Le Terrier C. Blood transfusion reactions: a comprehensive review of the literature including a Swiss perspective. J Clin Med. 2022;11(10):2859. doi: https://doi.org/10.3390/jcm11102859

18. Bharadwaj MS, Bora V. Managing fresh-frozen plasma transfusion adverse effects: allergic reactions, TACO, and TRALI. In: StatPearls [Internet]. 2024 [cited Jun 15, 2025]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK585106/

19. Simin D, Dolinaj V, Brestovački Svitlica B, Grujić J, Živković D, Milutinović D. Blood transfusion procedure: assessment of Serbian intensive care nurses' knowledge. Healthcare (Basel). 2024;12(7):720. doi: https://doi.org/10.3390/healthcare12070720

20. Hendrickson JE, Fasano RM. Management of hemolytic transfusion reactions. Hematology Am Soc Hematol Educ Program. 2021;2021(1):704-9. doi: https://dx.doi.org/10.1182/hematology.2021000308

21. Kim HJ, Ko DH. Transfusion-transmitted infections. Blood Res. 2024;59(1):14. doi: https://doi.org/10.1007/s44313-024-00014-w

22. Nitsche E, Dreßler J, Henschler R. Systematic workup of transfusion reactions reveals passive co-reporting of handling errors. J Blood Med. 2023;14:435-43. doi: https://doi.org/10.2147/JBM.S411188

23. Alencar RP, Costa AS, Fagundes APFS, Pereira DSO, Araújo CM. Avaliação do conhecimento do enfermeiro sobre hemotransfusão em um hospital de referência em trauma. Rev Cient Esc Estadual Saúde Pública Goiás. 2023;9(9f6):1-15. doi: https://doi.org/10.22491/2447-3405.2023.V9.9f6

24. Yu Y, Lian Z. Update on transfusion-related acute lung injury: an overview of its pathogenesis and management. Front Immunol. 2023;14:1175387. doi: https://doi.org/10.3389/fimmu.2023.1175387

25. Manasa K, Pattnaik G, Rao YM, Behera S, Behera A. Blood transfusion reaction reporting at a tertiary care hospital: a cross-sectional study. Chin J Appl Physiol. 2024;40:e20240013. doi: https://dx.doi.org/10.62958/j.cjap.2024.013

26. Muche Y, Gelaw Y, Atnaf A, Getaneh Z. Blood transfusion complications and associated factors among blood-transfused adult patients at Debre Markos Comprehensive Specialized Hospital, Ethiopia: a cross-sectional study. J Blood Med. 2023;14:389-98. doi: http://dx.doi.org/10.2147/JBM.S412002