REME • Rev Min Enferm. 2019;23:e-1258
DOI: 10.5935/1415-2762.20190106

RESEARCH

ADEQUACY OF THE ACTIVITIES IN "BLOOD PRODUCTS ADMINISTRATION", OF THE NURSING INTERVENTIONS CLASSIFICATION, FOR ADULT PATIENTS

ADEQUAÇÃO DAS ATIVIDADES DA INTERVENÇÃO "ADMINISTRAÇÃO DE HEMODERIVADOS" DA CLASSIFICAÇÃO DAS INTERVENÇÕES DE ENFERMAGEM PARA PACIENTES ADULTOS

ADECUACIÓN DE LAS ACTIVIDADES DE LA INTERVENCIÓN "ADMINISTRACIÓN DE HEMODERIVADOS" DE LA CLASIFICACIÓN DE INTERVENCIONES DE ENFERMERÍA PARA PACIENTES ADULTOS

Bruna Calciolari Buozi [1]
Camila Takao Lopes [2]
Eduarda Ribeiro dos Santos [1]
Ellen Cristina Bergamasco [1]
Beatriz Murata Murakami [1]

[1] Sociedade Beneficente Israelita Albert Einstein, Hospital Israelita Albert Einstein. São Paulo, SP – Brazil.
[2] Universidade Federal de São Paulo - UNIFESP, Escola Paulista de Enfermagem. São Paulo, SP – Brazil.

Corresponding author: Beatriz Murata Murakami
E-mail: beatriz.murakami@einstein.br

Author's Contribuitions:
Conceptualization: Bruna Buozi, Ellen Bergamasco, Beatriz Murakami; ***Data Collection:*** Bruna Buozi; ***Investigation:*** Bruna Buozi, Beatriz Murakami; ***Methodology:*** Bruna Buozi, Camila Lopes, Eduarda Santos, Ellen Bergamasco, Beatriz Murakami; ***Project Management:*** Bruna Buozi, Beatriz Murakami; ***Supervision:*** Ellen Bergamasco, Beatriz Murakami; ***Validation:*** Beatriz Murakami ***Writing – Original Draft Preparation:*** Bruna Buozi; ***Writing – Review and Editing:*** Camila Lopes, Eduarda Santos, Ellen Bergamasco, Beatriz Murakami.

Funding: No funding.

Submitted on: 2019/01/21
Approved on: 2019/08/20

ABSTRACT

Introduction: prevention and/or early identification of transfusion-associated reactions rely on safe, evidence-based vigilance and direct care by nurses. Blood Products Administration, an intervention in the Nursing Interventions classification (NIC), comprises 27 activities that have not been previously validated. **Objective:** to evaluate the adequacy of the activities in the NIC intervention Blood Products Administration for adult patients. **Methods:** the adequacy of Blood Products Administration activities for adult patients was evaluated by 73 critical care nurses of a private hospital. Activities with weighted ratios (WR) <0.80 but >0.50 were labeled as minor. Activities with WR ≥0.80 were classified as major. Activities with WR <0.50 were discarded. Additionally, the activities within their classifications as major or minor were typified by the researchers in six subgroups: Baseline care; Care throughout transfusion; Care after transfusion; Care throughout & after transfusion; Baseline care, care throughout & care after transfusion and Care after reaction. **Results:** 22 activities were classified as major, four were classified as minor (two were baseline care activities, one activity regarding care throughout transfusion and one regarding care after transfusion) and one was considered nonessential (Obtain blood sample and first voided urine specimen after a transfusion reaction). **Conclusions:** in the opinion of critical care nurses, the adequacy of most activities in Blood Product Administration was supported. A few changes to some activities' writing could improve clarity and accuracy. Our results can contribute to future content validation studies with larger samples of nurses from different backgrounds, such as Oncology nurses.

Keywords: Blood Transfusion; Blood Component Transfusion; Validation Studies as Topic; Nursing Care.

RESUMO

Introdução: *a prevenção e/ou identificação precoce de reações transfusionais dependem de vigilância e cuidados diretos realizados pelos enfermeiros de forma segura e baseada em evidências. A Administração de Hemoderivados, uma intervenção na Classificação de Intervenções de Enfermagem, compreende 27 atividades que não foram validadas anteriormente.* ***Objetivo:*** *avaliar a adequação das atividades da intervenção da Classificação das Intervenções de Enfermagem Administração de Hemoderivados para pacientes adultos.* ***Métodos:*** *a adequação das atividades da Administração de Hemoderivados para pacientes adultos foi avaliada por 73 enfermeiros intensivistas de um hospital particular no Brasil. Atividades com médias ponderadas <0,80 e >0,50 foram classificadas como secundárias. Atividades com médias ponderadas ≥0,80 foram classificadas como principais. Atividades com razões ponderadas <0,50 foram consideradas não essenciais. Além disso, as atividades, dentro de suas classificações como principais ou secundárias, foram tipificadas pelos pesquisadores em seis subgrupos: cuidado basal; cuidado durante transfusão; cuidado após transfusão; cuidados durante e após transfusão; cuidados basal, durante e após transfusão; e cuidado após reação.* ***Resultados:*** *22 atividades foram classificadas como principais, quatro foram classificadas como secundárias (dois cuidados basais, um cuidado durante e um cuidado após transfusão) e uma foi considerada não essencial (obter amostra do sangue*

How to cite this article:
Buozi BC, Lopes CT, Santos ER, Bergamasco EC, Murakami BM. Adequacy of the activities in "blood products administration", of the Nursing Interventions Classification, for adult patients. REME – Rev Min Enferm. 2019[cited _____ ___ ___];23:e-1258 Available from: _____ DOI: 10.5935/1415-2762.20190106

e amostra da primeira urina após a reação à transfusão). ***Conclusões:*** *na opinião dos enfermeiros intensivistas, a adequação da maioria das atividades da intervenção NIC Administração de Hemoderivados foi apoiada. Algumas mudanças na redação de algumas atividades podem melhorar a clareza e a precisão. Nossos resultados podem contribuir para futuros estudos de validação de conteúdo com maiores amostras de enfermeiros de diferentes especialidades que realizam transfusões rotineiramente, como enfermeiros oncologistas.*

Palavras-chave: *Transfusão de Sangue; Transfusão de Componentes Sanguíneos; Estudos de Validação como Assunto; Cuidados de Enfermagem.*

RESUMEN

Introducción: *la prevención y / o identificación temprana de las reacciones a la transfusión dependen de la vigilancia y de la atención segura de enfermería, en base a evidecias. La administración de hemoderivados, una intervención en la Clasificación de intervenciones de enfermería, comprende 27 actividades que no han sido validadas antes.* ***Objetivo:*** *evaluar la idoneidad de las actividades de intervención de la Clasificación de Intervenciones de Enfermería Administración de Hemoderivados para pacientes adultos.* ***Métodos:*** *73 enfermeras de cuidados intensivos de un hospital privado de Brasil evaluaron la idoneidad de las actividades de administración de hemoderivados para pacientes adultos. Las actividades con promedios ponderados <0,80 y> 0,50 se clasificaron como secundarias. Las actividades con promedios ponderados ≥0,80 se clasificaron como principales. Las actividades con relaciones ponderadas <0,50 se consideraron no esenciales. Además, las actividades dentro de sus clasificaciones como principales o secundarias fueron tipificadas por los investigadores en seis subgrupos: atención basal; precaución durante la transfusión; cuidado después de la transfusión; cuidado durante y después de la transfusión; cuidado basal durante y después de la transfusión; y cuidado después de la reacción.* ***Resultados:*** *22 actividades se clasificaron como principales, cuatro se clasificaron como secundarias (dos cuidados iniciales, uno durante y uno después de la transfusión) y uno se consideró no esencial (obtención de muestra de sangre y muestra de la primera orina después de la reacción a la transfusión).* ***Conclusiones:*** *los enfermeros de cuidados intensivos apoyan la idoneidad de la mayoría de las actividades de intervención NIC Administración de hemoderivados. Ciertas alteraciones en la redacción de algunas actividades podrían mejorar la claridad y la precisión. Nuestros hallazgos podrían contribuir a futuros estudios de validación de contenido con muestras más amplias de enfermeros de diferentes especialidades que realizan transfusiones de forma rutinaria, tales como los enfermeros oncológicos.*

Palabras clave*: Transfusión Sanguínea; Transfusión de Componentes Sanguíneos; Estudios de Validación como Asunto; Atención de Enfermería.*

INTRODUCTION

Every day, nearly 36,000 units of packed red blood cells (RBCs), 7,000 units of platelets and 10,000 units of plasma are required in the United States, accounting for around 21 million blood components transfused each year.[1] In Brazil, over 3.38 million blood products transfusions are performed annually.[2] In the intensive care unit, 14.7% to 53% of patients receive one or more blood components transfusions.[3] in order to restore or maintain the capacity for oxygen transportation, blood volume and/or hemostasis.[2]

Although it is a life-saving and life-sustaining procedure, blood transfusion can be potentially associated with adverse effects. The most common reactions are allergic and febrile- associated reactions and some less common and severe reactions include transfusion-associated acute lung injury (TRALI), transfusion-associated circulatory overload (TACO), anaphylaxis, sepsis and acute hemolytic reaction.[4,5] Based on data received from 25 countries, the International Haemovigilance Network's ISTARE, an online database for surveillance of adverse reactions and adverse events associated with donation of blood and transfusion of blood components, found an incidence of adverse events of 7.5 per 100,000 components issued, of which 25% were severe.[6]

A previous study[7] found a 1.1% prevalence (n=102) of cardiopulmonary, hemolytic, septic, hypotensive, or anaphylactic reactions to 4,857 blood products transfusions at four academic tertiary care hospitals. Nevertheless, only three cases of TACO or TRALI were reported to the transfusion service although there were clinical notes on the possibility that cardiopulmonary symptoms could be associated with the transfusion in 27 charts.

In this context, prevention and/or early identification of transfusion-associated reactions rely on safe, evidence-based care vigilance and direct care by nurses, a major segment of professionals working in the healthcare industry,[8,9] especially those working in critical care, where transfusion is a frequent practice.

In order to identify nurses' contributions to the outcomes of patients submitted to blood components transfusion, it is interesting that standardized nursing languages are used in electronic health records, including nursing diagnoses, interventions and outcomes. Standardized nursing languages facilitate data exchange in and between clinical settings, facilitates the continuity of care, thereby contributing to patient safety.[10]

Blood Products Administration (code 4030), defined by the Nursing Interventions Classification (NIC) as the *Administration of blood or blood products and monitoring of patient's response*, comprises 27 activities for that purpose. Some examples of activities are *Verify that blood products has been prepared, typed and cross-matched (if applicable) for the recipient; Monitor vital signs (e.g. baseline, throughout and after transfusion); Monitor for transfusion reactions; Avoid transfusion of more than one unit of blood or blood product at a time, unless necessitated by recipient's condition* and *Administer saline when transfusion is complete*.[11]

Uma vez que a experiência clínica em enfermagem deve ser valorizada em estudos de validação e os enfermeiros intensivistas realizam transfusão sanguínea diariamente, este estudo tem como objetivo avaliar a adequação das atividades da intervenção NIC Administração de Hemoderivados para pacientes adultos, segundo a opinião de enfermeiros assistenciais.

METHODS

This was a methodological study, which submitted the activities of the NIC intervention Blood Products Administration to evaluation by critical care nurses regarding adequacy. The study was performed from February to May 2017.

The population consisted of 120 nurses working in critical care units of a level-3 Joint Commission International-accredited private hospital located in São Paulo, SP, Brazil. The inclusion criteria were: a minimum of 2-years' experience in direct patient care and working in the hospital for more than 3 months. The exclusion criteria were: professionals who were away from their activities on vacation or due to leaves. By applying the inclusion and exclusion criteria, the sample consisted of 73 nurses (15 did not accept to participate, one was not eligible according to the inclusion criteria and 31 were on vacation or on leaves).

The variables of interest consisted of: A) the participants' profile (gender, age, time since graduation, time working in the nursing profession, time working at the institution, theoretical and practical education (classes, courses, training) on nursing prescription, NIC interventions, on NANDA-I diagnoses); B) The nurses' opinion about the adequacy of the nursing activities comprised by the NIC intervention Blood Products Administration.

The main researcher explained the objectives of the study to the nurses during their shifts and handed them a data collection instrument and an Informed Consent Form. The nurses were asked to rate each activity of Blood Product Administration on a five-point Likert scale regarding its adequacy to the intervention by using the statements 1, not at all adequate to the intervention; 2, very little adequate to the intervention; 3, somewhat adequate to the intervention; 4, considerably adequate to the intervention; or 5, very adequate to the intervention. The participants had 24h to complete the instrument.

The results were analyzed according to Fehring's Content Validation Model,[13] which was adapted for nursing interventions.[14] Weighted ratios were calculated for each activity as follows: 1 = 0; 2 = 0.25; 3 = 0.50, 4 = 0.75; and 5 = 1. Activities with weighted ratios less than 0.80 but greater than 0.50 were labeled as minor. Activities with weighted ratios equal to or greater than 0.80 were classified as major. Activities with weighted ratios less than 0.50 were discarded.

Additionally, the activities within their classifications as major or minor were typified by the researchers in six subgroups, based on their teaching and research experience and on the *Guideline on the Administration of Blood Components by the British Committee for Standards in Haematology*[15]: Baseline care (n=11); Care throughout transfusion (n=4); Care after transfusion (n=3); Care throughout & after transfusion (n=3); Baseline care, care throughout & care after transfusion (n=2); Care after reaction (n=2).

Descriptive statistics were used to analyze the nurses' characteristics.The research project was approved by the Research Ethics Committee of the Hospital (Protocol 2.047.766) and complies with the Declaration of Helsinki.

RESULTS

The nurses participating in the study had a mean age of 35.3±6.4 years (24–53 years old), a mean time since graduation of 7.8±46.0 years (2–30 years), work experience as nurses of 7.4±6.1 years (2–30 years), and 9.3±5.7 years working in the institution as nurses (1–21.3 years). Most were female (n=57, 78%), had received theoretical and practical training on the NANDA-I classification (n=71, 97.2%) and nursing prescriptions (n=71, 97.2%) and 63 (86.3%) were familiar with NIC. Fifty-five nurses (75%) also had specialist titles in addition to a baccalaureate and four (5.5%) had a master's degree.

Table 1 presents the weighted ratios of each activity of the NIC Hemoderivatives Administration intervention.

Twenty-six (96,2%) of 27 activities were considered adequate for Blood Product Administration by the critical care nurses. Twenty-two activities (81,4%) had a weighted score equal to or greater than 0.80, thereby considered as major for adult patients.

Table 1 - Weighted Ratios and classification of the activities comprising the NIC Intervention Blood Products Administration

Activities	Weighted ratio	Classification	Tipe
Verify correct patient, blood type, Rh type, unit number, and expiration date, and record per agency protocol	1.00	Major	Baseline care
Monitor vital signs (e.g. baseline, throughout and after transfusion)	1.00		Baseline care, care throughout & care after transfusion
Monitor for transfusion reactions	1.00		Care throughout & after transfusion
Verify physician's orders	0.99		Baseline care
Obtain or verify patient's informed consent	0.99		Baseline care
Instruct patient about signs and symptoms of transfusion reactions (itching, dizziness, shortness of breath, and/or chest pain)	0.99		Baseline care

Continue...

... continued

Table 1 - Weighted Ratios and classification of the activities comprising the NIC Intervention Blood Products Administration

Activities	Weighted ratio	Classification	Tipe
Monitor IV site for signs and symptoms of infiltration, phlebitis and local infection	0.99	Major	Care throughout transfusion
Obtain patient's transfusion history	0.98		Baseline care
Verify that blood products has been prepared, typed and cross-matched (if applicable) for the recipient	0.98		Baseline care
Perform venipuncture, using appropriate technique	0.98		Baseline care
Monitor and regulate flow rate during administration	0.98		Care throughout transfusion
Document volume infused	0.98		Care after transfusion
Stop transfusion if blood reaction occurs and keep veins open with saline	0.98		Care throughout & after transfusion
Document time frame of transfusion	0.97		Care after transfusion
Monitor for fluid overload	0.94		Care throughout & after transfusion
Maintain universal precautions	0.94		Baseline care, care throughout & care after transfusion
Refrain from administering IV medications or fluids, other than isotonic saline, into blood or blood product lines	0.91		Care throughout transfusion
Refrain from transfusing product removed from controlled refrigeration for more than 4 hours	0.90		Baseline care
Notify laboratory immediately in the event of a blood reaction	0.90		Care throughout transfusion
Assemble administration system with filter appropriate for blood product and recipient's immune status	0.88		Baseline care
Coordinate the return of the blood container to the lab after a blood reaction	0.87		Care after reaction
Avoid transfusion of more than one unit of blood or blood product at a time, unless necessitated by recipient's condition	0.85		Care throughout transfusion
Administer saline when transfusion is complete	0.77	Minor	Care after transfusion
Prepare an IV pump approved for blood product administration, if indicated	0.73		Baseline care
Change filter and administration set at least every 4 hours	0.66		Care throughout transfusion
Prime the administration system with isotonic saline	0.64		Baseline care
Obtain blood sample and first voided urine specimen after a transfusion reaction	0.49	Nonessential	Care after reaction

Those included most baseline care activities, all but one activity regarding Care throughout transfusion, all activities typified as Care throughout & after transfusion; all but one activity performed after transfusion; both activities focusing on Baseline care, care throughout & care after transfusion and one activity after a reaction.

Four activities (14,8%) had a weighted ratio less than 0.80 but greater than 0.50 and were therefore considered as minor activities for these patients: two were baseline care activities (*Prepare an IV pump approved for blood product administration, if indicated, Prime the administration system with isotonic saline*), one was an activity regarding care throughout transfusion (*Change filter and administration set at least every 4 hours*), and one was typified as care after reaction (*Administer saline when transfusion is complete*).

One activity (3,8%) performed after a reaction had a weighted ratio less than 0.05, which was considered nonessential for the care of adult patients: *Obtain blood sample and first voided urine specimen after a transfusion reaction.*

DISCUSSION

This study found that most activities comprised by the NIC intervention Blood Products Administration were considered adequate by critical care nurses, professionals who perform blood transfusion on a daily basis. The only activity deemed as nonessential is performed after a transfusion-associated reaction. All activities considered adequate are performed before, throughout and after transfusion and after a transfusion-associated reaction. Therefore, Blood Products Administration encompasses the importance of prevention, vigilance and action taking along the transfusion process.

Because all activities classified as major are in concordance with the Infusion Nurses Society's (INS) Infusion Therapy

Standards of Practice for transfusion therapy,[15] this section will focus on those activities deemed as minor and the one activity considered as nonessential, namely *Prepare an IV pump approved for blood product administration, if indicated, Prime the administration system with isotonic saline, Change filter and administration set at least every 4 hours, Administer saline when transfusion is complete and Obtain blood sample and first voided urine specimen after a transfusion reaction.*

Prepare an IV pump approved for blood product administration, if indicated is a controversial activity. The INS makes the following recommendation with a level four evidence strength: "Electronic infusion devices (EIDs) can be used to deliver blood or blood components without significant risk of hemolysis of RBCs. EIDs that have a labeled indication for blood transfusion should be used. Follow the manufacturers' directions for use."[16] This recommendation is based on The American Association of Blood Banks Technical Manual[17] and on a laboratory study.[18]

However, a recent integrative literature review found that RBCs can be damaged when packed RBCs and whole blood are delivered through infusion pumps, especially linear peristaltic pumps.[19] No EIDs are used for blood transfusion in the institution where this study was carried out.

Priming the administration system with isotonic saline is also a controversial activity, tradition-guided rather than an evidence-based practice. According to Kessler,[4] those in favor of priming argue that there is an easier evacuation of air bubbles, prevention of damage to blood cells falling upon the mesh filter and quicker saline-diluted blood flow. Nevertheless, the author argues that "correct filling of the drip chamber and tubing should prevent bubbles from forming, and the mesh filter causes little damage to RBCs and other blood components" and "*[...] RBCs are sufficiently diluted to flow readily through the tubing without further saline dilution*". Also, some detriments are also pointed out, such as delays, increase in infused fluid volume, and a possible increase in cost.

Although it is widely used in hospital settings, priming of the infusion system is advocated neither by the INS[16] nor by the British Committee for Standards in Haematology.[19] The hospital where this study was performed does not use any priming solutions for transfusions.

Change filter and administration set at least every 4 hours was possibly considered a minor activity because changing filter and changing the administration set might need to be recommended as two different activities. Blood transfusion tubing is not currently used for more than four hours after removal of the blood component of a controlled temperature environment due to the risk of bacterial growth.[15] However, multiple, consecutive packs of compatible blood can be transfused with the same set, whereas filters should be changed after two or as much as four transfused units because of retained micro aggregates and cell debris.[18,20] Therefore, e.g., when five packs of fresh frozen plasma are to be transfused, the same infusion set could be used for up to four hours, but the filter could not be used more than four times, as per institution policy.

Administering a small amount of saline when transfusion is complete is recommended in order to ensure full blood delivery and maintain venous access patency.[4] Because of this indication, we believe that *Administer saline when transfusion* is complete should be changed to "Flushing venous access device with saline when transfusion is complete" to be more accurate.

Obtain blood sample and first voided urine specimen after a transfusion reaction was considered a nonessential activity by the nurses, possibly because the Brazilian Ministry of Health requires these actions only when a hemolytic reaction, TRALI, anaphylaxis or sepsis are suspected. When an urticarial reaction or fluid overload occur – which happens more commonly – there is no indication for specimen collection.[2] Therefore, "if indicated" should be added to this activity for accuracy.

Finally, an observation of the authors regarding the intervention label in Brazilian Portuguese should be made. The translation that would be conceptually more adequate to the original "Blood Products Administration" is *Administração de Produtos Sanguíneos*, because it can include both the transfusion of blood derivates and blood components. Blood derivates include products generated by plasma fractioning through physical-chemical processes (e.g., albumin and coagulation factors concentrate). Blood components, on the other hand, are obtained through total blood, one by one, through physical processes, such as centrifuging and freezing (e.g., packed red blood cells, frozen fresh plasma, platelet concentrate).[21]

Our results are limited due to the exclusive evaluation of the current NIC content. No other possible activity in the literature was submitted to evaluation. Nevertheless, the critical care nurses frequently perform blood products transfusion in a JCI-accredited hospital, which is a high-achieving organization regarding excellence.

CONCLUSION

In the opinion of critical care nurses, the adequacy of most activities in Blood Product Administration was supported. A few changes to some activities' writing could improve clarity and accuracy. Our results can contribute to future content validation studies with larger samples of nurses from different backgrounds, such as Oncology nurses.

REFERENCES

1. American Red Cross. Facts about blood needs. 2019[cited 2019 Jan 21]. Available from: https://www.redcrossblood.org/donate-blood/how-to-donate/how-blood-donations-help/blood-needs-blood-supply.html

2. Ministério da Saúde (BR). Secretaria de Atenção à Saúde. Departamento de Atenção Especializada. Caderno de informação: sangue e hemoderivados - dados de 2015. Brasília: MS; 2017[cited 2018 Dec 13]. Available from: http://bvsms.saude.gov.br/bvs/publicacoes/caderno_informacao_sangue_hemoderivados_2015.pdf
3. Lelubre C, Vincent JL. Red blood cell transfusion in the critically ill patient. Ann Intensive Care. 2011[cited 2018 Nov 21];1:43. Available from: https://annalsofintensivecare.springeropen.com/articles/10.1186/2110-5820-1-43
4. Kessler C. Priming blood transfusion tubing: a critical review of the blood transfusion process. Crit Care Nurse. 2013[cited 2018 Nov 21];33(3):80-4. Available from: https://doi.org/10.4037/ccn2013417
5. Frazier SK, Higgins J, Bugajski A, Jones AR, Brown MR. Adverse reactions to transfusion of blood products and best practices for prevention. Crit Care Nurs Clin North Am. 2017[cited 2018 Nov 21];29(3):271-90. Available from: https://doi.org/10.1016/j.cnc.2017.04.002
6. Politis C, Wiersum JC, Richardson C, Robillard P, Jorgensen J, Renaudier P, *et al*. The international haemovigilance network database for the surveillance of adverse reactions and events in donors and recipients of blood components: technical issues and results. Vox Sang. 2016[cited 2018 Nov 21];111(4):409-17. Available from: https://doi.org/10.1111/vox.12447
7. Hendrickson JE, Roubinian NH, Chowdhury D, Brambilla D, Murphy EL, Wu Y, *et al*. Incidence of transfusion reactions: a multicenter study utilizing systematic active surveillance and expert adjudication. Transfusion. 2016[cited 2018 Nov 21];56(10):2587-96. Available from: https://doi.org/10.1111/trf.13730
8. World Health Organization (WHO). World Health Statistics 2013. Geneva: WHO; 2013[cited 2018 Oct 13]. Available from: http://apps.who.int/iris/bitstream/10665/81965/1/9789241564588_eng.pdf?ua=1
9. Murphy DJ, Pronovost PJ, Lehmann CU, Gurses AP, Whitman GJR, Needham DM, *et al*. Red blood cell transfusion practices in two surgical intensive care units: a mixed methods assessment of barriers to evidence-based practice. Transfusion. 2014[cited 2018 Nov 21];54(10):2658-67. Available from: https://doi.org/10.1111/trf.12718
10. Saranto K, Kinnunen UM, Kivekäs E, Lappalainen AM, Liljamo P, Rajalahti E, *et al*. Impacts of structuring nursing records: a systematic review. Scand J Caring Sci. 2014[cited 2018 Nov 21];28(4):629-47. Available from: https://doi.org/10.1111/scs.12094
11. Bulechek GM, Butcher HK, Dochterman JM, Wagner CM. Nursing Interventions Classification (NIC). 6th ed. St. Louis: Mosby; 2013.
12. Guimarães HCQCP, Pena SB, Lopes JL, Lopes CT, Barros ALBL. Experts for validation studies in nursing: new proposal and selection criteria. Int J Nurs Knowl. 2016[cited 2018 Nov 21];27(3):130-5. Available from: https://doi.org/10.1111/2047-3095.12089
13. Fehring RJ. Methods to validate nursing diagnoses. Heart Lung. 1987[cited 2018 Nov 21];16(6):625–9. Available from: https://pdfs.semanticscholar.org/11f7/d8b02e02681433695c9e1724bd66c4d98636.pdf
14. Sánchez-Ayllón F, Oliveira ACS, Morales I, Sá JD, Pérez PE. Content validation of the nursing intervention called environmental control: worker safety. Acta Paul Enferm. 2014[cited 2018 Nov 21];27(2):173–8. Available from: http://www.scielo.br/pdf/ape/v27n2/en_0103-2100-ape-27-02-0173.pdf
15. Harris AM, Atterbury CLJ, Chaffe B, Elliott C, Hawkins T, Hennem SJ, *et al*. Guideline on the Administration of Blood Components British Committee for Standards in Haematology. 2012[cited 2018 Nov 21]. Available from: http://www.b-s-h.org.uk/media/5152/admin_blood_components-bcsh-05012010.pdf
16. Infusion Nurses Society. Infusion therapy standards of practice. J Infusion Nurs. 2016[cited 2018 Aug15];39(15):S1-159. Available from: https://source.yiboshi.com/20170417/1492425631944540325.pdf
17. Maynard K. Administration of blood components. In: Fung MK, Grossman BJ, Hillyer CD, Westhoff CM. AABB Technical Manual. 18th ed. Bethesda: AABB; 2014[cited 2018 July 21];45-59. Available from: https://archive.org/details/AABBTechnicalManual18thEd2014
18. Frey B, Eber S, Weiss M. Changes in red blood cell integrity related to infusion pumps: a comparison of 3 different pump mechanisms. Pediatr Crit Care Med. 2003[cited 2018 Nov 15];4(4):465-70. Available from: https://doi.org/10.1097/01.PCC.0000090292.39700.B5
19. Wilson AM, Peterlini MA, Pedreira ML. Infusion pumps and red blood cell damage in transfusion therapy: an integrative revision of the academic literature. Rev Latino-Am Enferm. 2016[cited 2018 Nov 21];15(24):e2763. Available from: http://www.scielo.br/pdf/rlae/v24/0104-1169-rlae-24-02763.pdf
20. Kusahara DM, Chanes DC. Administração de hemocomponentes. In: Harada MJ, Pedreira MLG, organizadores. Terapia intravenosa e infusões. São Paulo: Yendis; 2011. p.383-99.

This is an open-access article distributed under the terms of the Creative Commons Attribution License.