Transfusion:

Practical Aspects & Hemovigilance

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Belgian Hematology Society
www.bhs.be

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02/03/2024

Pr H. El Kenz

Plan

- Transfusion of blood components
  - Transfusion of packed red blood cells (PRBC)
    - Description of component
    - Pretransfusion Compatibility testing
  - Transfusion of fresh frozen plasma (FFP)
    - Description of component
    - Pretransfusion Compatibility testing
  - Transfusion of platelets
    - Description of component
    - Pretransfusion Compatibility testing
- Hemovigilance

Transfusion of blood components

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Transfusion of packed red blood cells (PRBC)
Description of component

- Centrifugation of whole blood (removal of plasma and buffy-coat) or red cell apheresis
- Primary citrated anticoagulant (red cells shelf life ± 21 days)
- Additive solutions (extension of shelf life to 42-49 days)
- PRBC volume is depending on the method of preparation
- PRBC (Council of Europe)
  - HCT of 0,50-0,70
  - Hb of minimum 40g/unit
  - Haemolysis at the end of the storage <0,8% of red cell mass
  - Leucocyte count < $1x10^6$ per unit
- Conservation at +2°C to +6°C
- Administration through a 170-200µm filter

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Transfusion of packed red blood cells (PRBC)
Description of component

- PRBC
- PRBC Irradiated
- PRBC CMV negative

- PRBC cryopreserved (-60°C to -80°C)
- PRBC washed
- PRBC for neonates or baby packs (O-; CMV-)
- PRBC for intra-uterine transfusion (O-; CMV-; irradiated; <7days; HCT: 0,75-0,85)

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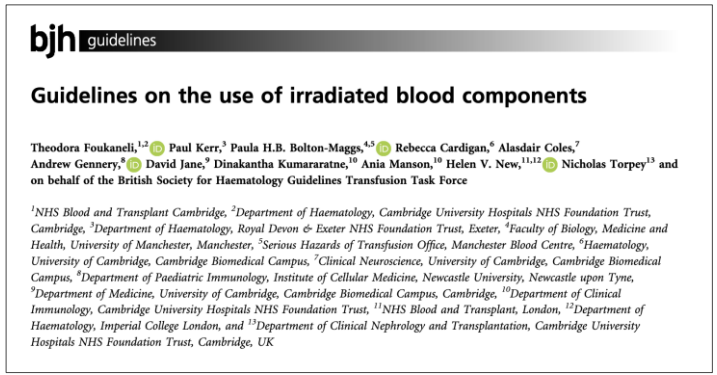
Transfusion of packed red blood cells (PRBC)
Description of component

- **Irradiation of PRBC:**
  - TA-GVHD (Transfusion-associated graft-versus-host disease) is a very rare complication following transfusion of viable allogeneic lymphocytes into immunosuppressed recipients
  - Irradiation of PRBC for the prevention of TA-GVHD by inactivating residual lymphocytes with gamma rays or X-rays at a minimum dose of 25 Gy


bjh guidelines

Guidelines on the use of irradiated blood components

Theodora Foukaneli,[1,2] Paul Kerr,[3] Paula H.B. Bolton-Maggs,[4,5] Rebecca Cardigan,[6] Alasdair Coles,[7] Andrew Gennery,[8] David Jane,[9] Dinakantha Kumararatne,[10] Ania Manson,[10] Helen V. New,[11,12] Nicholas Torpey[13] and on behalf of the British Society for Haematology Guidelines Transfusion Task Force

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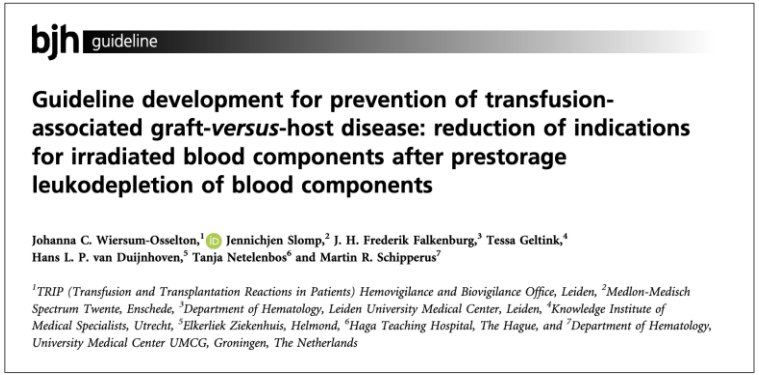
BSH updated UK guidelines 2020


bjh guideline

Guideline development for prevention of transfusion-associated graft-*versus*-host disease: reduction of indications for irradiated blood components after prestorage leukodepletion of blood components

Johanna C. Wiersum-Osselton,[1] Jennichjen Slomp,[2] J. H. Frederik Falkenburg,[3] Tessa Geltink,[4] Hans L. P. van Duijnhoven,[5] Tanja Netelenbos[6] and Martin R. Schipperus[7]

[1]TRIP (Transfusion and Transplantation Reactions in Patients) Hemovigilance and Biovigilance Office, Leiden, [2]Medlon-Medisch Spectrum Twente, Enschede, [3]Department of Hematology, Leiden University Medical Center, Leiden, [4]Knowledge Institute of Medical Specialists, Utrecht, [5]Elkerliek Ziekenhuis, Helmond, [6]Haga Teaching Hospital, The Hague, and [7]Department of Hematology, University Medical Center UMCG, Groningen, The Netherlands

Dutch updated guidelines 2021

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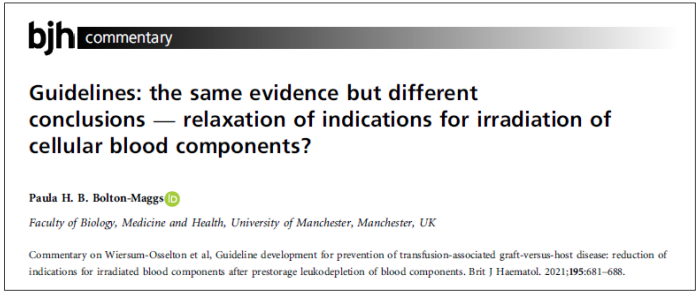
Transfusion of PRBC

Description of component

Table I. Indications for irradiation: key differences between the BSH and Dutch guidelines.

BSH updated UK guidelines 2020[2]	Dutch updated guidelines 2021[1]
Hodgkin lymphoma at any stage of the disease should receive irradiated components **indefinitely**	Hodgkin lymphoma stage III or IV (with bone marrow infiltration) **not routinely required** (depends on medications)
All patients treated with purine analogue drugs should receive irradiated components **indefinitely**	Use of purine/pyrimidine agonists Patients with long-lasting T-cell suppression after medication: fludarabine or other T-cell-depleting medication if the approved product information warns of TA-GVHD risk, for **six months** after cessation of the therapy
Stem cell transplants	**Stem cell transplants** (time increased from earlier guidelines)
Allografts: to receive irradiated components from start of conditioning and be continued until defined criteria are met[2] rather than a fixed time.	**Allogeneic** stem cell transplantation: until **one year** after last medication/intervention
Autografts for **three months** (six months if total body irradiation was part of conditioning)	**Autologous** stem cell transplantation: until **six months** after transplantation
Irradiation required from **seven days before and during** bone marrow/stem cell harvest	Peripheral blood stem cell apheresis and bone marrow collection: **no longer required**
Patients with aplastic anaemia undergoing treatment with antithymocyte globulin or alemtuzumab (anti-CD52) should receive irradiated components **duration not defined**	Medication which in combination with patient's illness gives a long-lasting T-cell suppression, such as anti-CD52 treatments for haematological diseases and antithymocyte treatment for aplastic anaemia: from the initiation of treatment till **six months** after completing treatment
Routine irradiation of red cells to preterm or term infants **not required** unless there was a previous intrauterine transfusion	Premature babies and/or pregnancy <32 weeks (previously up to **six months** after due date) **No longer required**
Both: Intra-uterine transfusions (IUT), thereafter until **six months** after the due date	



bjh commentary

Guidelines: the same evidence but different conclusions — relaxation of indications for irradiation of cellular blood components?

Paula H. B. Bolton-Maggs

Faculty of Biology, Medicine and Health, University of Manchester, Manchester, UK

Commentary on Wiersum-Osselton et al, Guideline development for prevention of transfusion-associated graft-versus-host disease: reduction of indications for irradiated blood components after prestorage leukodepletion of blood components. Brit J Haematol. 2021;**195**:681–688.

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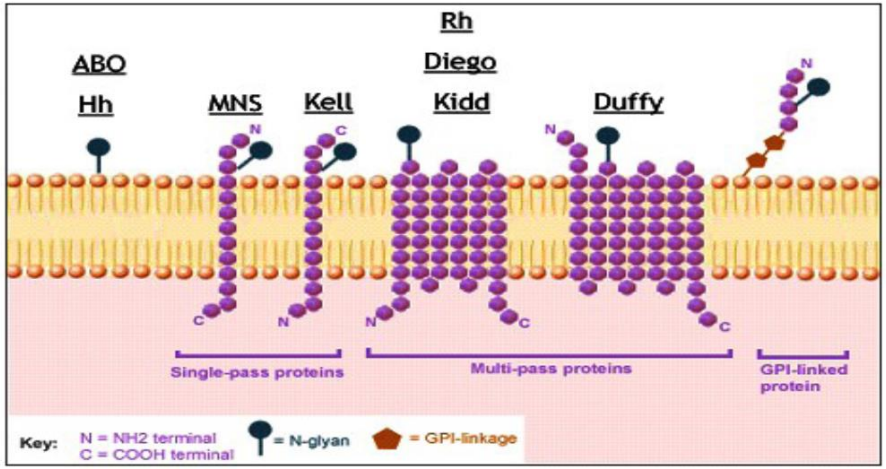
Transfusion of packed red blood cells (PRBC)

Pretransfusion Compatibility testing



Currently recognized antigens classification:

- Systems
- Collections
- Low incidence antigens
- High incidence antigens

http://www.isbtweb.org/working-parties/red-cell-immunogenetics-and-blood-group-terminology/

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Transfusion of packed red blood cells (PRBC)

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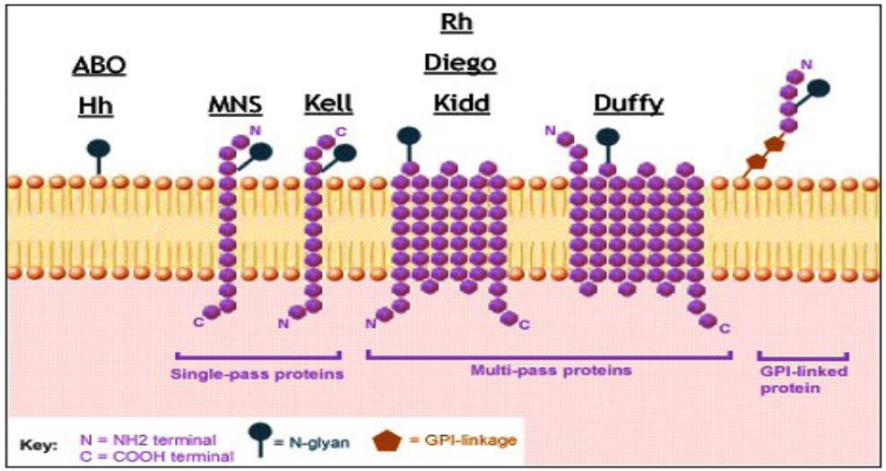

Patient antibodies:

- Natural antibodies
- Immune antibodies
- Auto-antibodies

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Transfusion of packed red blood cells (PRBC)

Pretransfusion Compatibility testing

- Pre-transfusion tests:
  - Major Crossmatch
    - Patient's ABO/Rh types (2x) and crossreaction of serum's patient with ABO compatible PRBC
    - If negative: PRBC are reserved to the patient
    - If positive: red cell antibody identification and major crossmatch; information of the physician in case of short blood supply
  - Type and Screen
    - Patient's ABO/Rh types (2x) and Indirect Antiglobulin Test (IAT)
    - If positive IAT: Antibody identification and Crossmatch of antigen-negative PRBC; information of the physician in case of short blood supply
    - If negative IAT: labelling of the ABO compatible PRBC at the moment of the blood order

Transfusion of packed red blood cells (PRBC)

Pretransfusion Compatibility testing

TRANSFUSION MEDICINE
Official Journal of the British Blood Transfusion Society
Transfusion Medicine | GUIDELINES

Guidelines for pre-transfusion compatibility procedures in blood transfusion laboratories*

British Committee for Standards in Haematology
C. Milkins,[1] J. Berryman,[2] C. Cantwell,[3] C. Elliott,[4] R. Haggas,[5] J. Jones,[6] M. Rowley,[3,7] M. Williams[8] & N. Win[9]

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Key Recommandation 12:

Unless secure electronic patient identification systems are in place, a second sample should be requested for confirmation of the ABO group of a first time patient prior to transfusion, where this not impede the delivery of urgent red cells or other components

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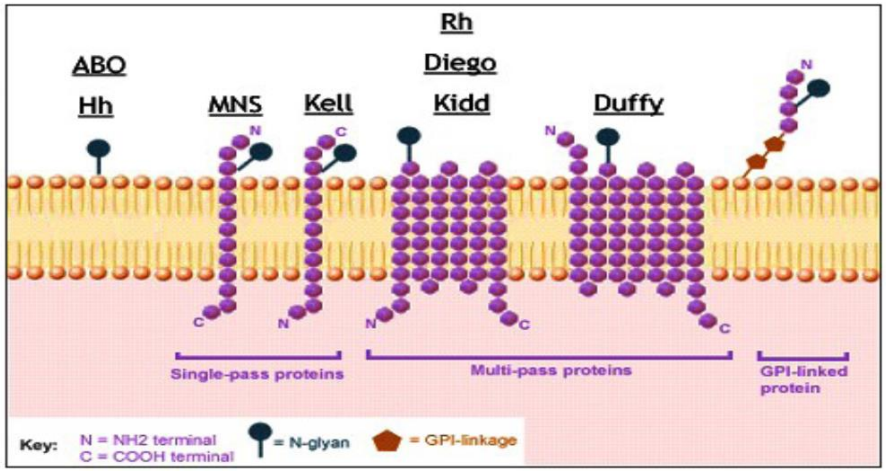
Transfusion of packed red blood cells (PRBC)

Pretransfusion Compatibility testing



Alloimmunization through transfusion or pregnancy

Incidence of alloimmunization in the general population: 2% to 5%
Incidence alloimmunization in patients with SCD: 30% to 40%

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Administration of PRBC to SCD patients

- Alloimmunization to red blood cell remains a serious complication
- Risk factors associated with alloimunization:
  - Antigenic differences between donors and SCD patients
  - HLA II genotype influence predisposition to the RBC antibody responder status
  - Inflammatory state of SCD patients

Administration of PRBC to SCD patients

Antigenic differences between donors and SCD patients

- Polymorphic differences in immunogenic RBC antigens between caucasian donors and african transfusion recipients
  I. Significantly different RBC antigen frequencies of some common blood groups (RH, KEL, FY, JK, MNS,…)
  II. RH variants
  III. Loss of High-incidence antigens → Rare blood groups
  IV. Low-incidence antigens → Alloimmunization in intra-ethnic transfusions

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Administration of PRBC to SCD patients

Antigenic differences between donors and SCD patients

	Caucasian frequency %	African frequency %	BRU+HUDE %
Fya –	34	90	92
Fy(a –b –)	Very rare	68	92
Jkb -	26	50	67
S -	45	70	67
Kell 6 ou Jsa	< 1	20	NT

Phenotype C-,E-,K-, Fy^a-, Jk^b-: 26% of Africans; <2% of Caucasians

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Administration of PRBC to SCD patients

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Administration of PRBC to SCD patients

Antigenic differences between donors and SCD patients

- Loss of a High-incidence antigens:

➢ RH:-18, RH:-34, RH:-46 → 0,1% in Africans

➢ KEL:-7 → 1% in Africans

➢ MNS:-5 → 1% in Africans

➢ …..

Short blood supply in Europe

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Administration of PRBC to SCD patients

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Administration of PRBC to SCD patients

HLA II genotype influence predisposition to the RBC antibody responder status

- Some patients develop alloantibodies following initial RBC transfusions while others do not even after multiple transfusions
- RBC antibody responder and RBC antibody non-responder

HLA type and risk of alloimmunization in sickle cell disease

Carolyn Hoppe,[1]* William Klitz,[2,3] Elliott Vichinsky,[1] and Lori Styles[1]

Red blood cell (RBC) transfusions are frequently required to treat patients with sickle cell disease (SCD) [1]. One of the most serious complications of repeat transfusion is alloimmunization to RBC antigens [2]. Because human leukocyte antigen (HLA) genes mediate the response to foreign antigens, particular HLA alleles may predispose to the development of alloimmunization in patients with SCD who receive multiple transfusions. We conducted a case-control study to determine if particular HLA alleles are associated with alloimmunization and whether HLA homozygosity influences the risk of developing RBC alloantibodies. High-resolution HLA genotyping was performed on DNA samples from 159 multiply transfused patients with SCD. HLA allele frequencies were compared between alloantibody-positive and alloantibody-negative groups. The ***HLA-DRB1*1503*** allele was associated with an increased risk (P = 0.039), while ***HLA-DRB1*0901*** conferred protection from alloimmunization (P = 0.008). HLA Class II locus homozygosity was more frequently observed in the alloantibody-negative group (P = 0.01). These preliminary findings suggest that particular ***HLA-DRB1*** alleles and overall homozygosity at HLA class II loci are associated with alloimmunization risk in SCD. If confirmed, HLA type may serve as a useful genetic predictor of alloimmunization risk, and permit a targeted approach to the use of phenotypically matched blood.

American Journal of Hematology

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Administration of PRBC to SCD patients

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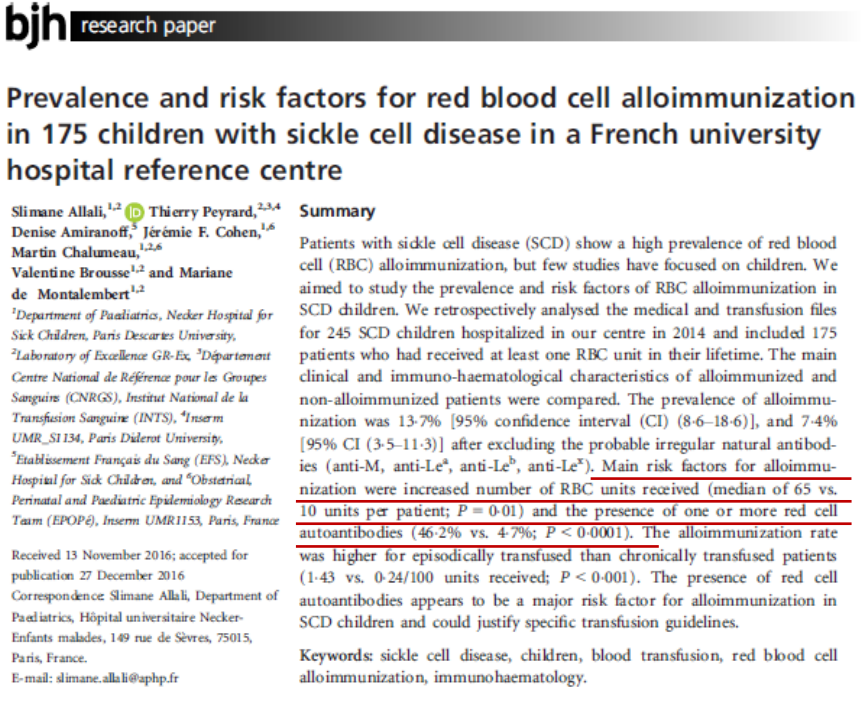
Administration of PRBC to SCD patients

- SCD is characterized by chronic inflammation
- Hypothesis: “Inflammation may play a role in the high rate of alloimmunization”



bjh research paper

Prevalence and risk factors for red blood cell alloimmunization in 175 children with sickle cell disease in a French university hospital reference centre

Slimane Allali,[1,2] Thierry Peyrard,[2,3,4] Denise Amiranoff,[5] Jérémie F. Cohen,[1,6] Martin Chalumeau,[1,2,6] Valentine Brousse[1,2] and Mariane de Montalembert[1,2]

[1]Department of Paediatrics, Necker Hospital for Sick Children, Paris Descartes University, [2]Laboratory of Excellence GR-Ex, [3]Département Centre National de Référence pour les Groupes Sanguins (CNRGS), Institut National de la Transfusion Sanguine (INTS), [4]Inserm UMR_S1134, Paris Diderot University, [5]Etablissement Français du Sang (EFS), Necker Hospital for Sick Children, and [6]Obstetrical, Perinatal and Paediatric Epidemiology Research Team (EPOPé), Inserm UMR1153, Paris, France

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E-mail: slimane.allali@aphp.fr

Summary

Patients with sickle cell disease (SCD) show a high prevalence of red blood cell (RBC) alloimmunization, but few studies have focused on children. We aimed to study the prevalence and risk factors of RBC alloimmunization in SCD children. We retrospectively analysed the medical and transfusion files for 245 SCD children hospitalized in our centre in 2014 and included 175 patients who had received at least one RBC unit in their lifetime. The main clinical and immuno-haematological characteristics of alloimmunized and non-alloimmunized patients were compared. The prevalence of alloimmunization was 13·7% [95% confidence interval (CI) (8·6–18·6)], and 7·4% [95% CI (3·5–11·3)] after excluding the probable irregular natural antibodies (anti-M, anti-Le^a, anti-Le^b, anti-Le^x). Main risk factors for alloimmunization were increased number of RBC units received (median of 65 vs. 10 units per patient; $P = 0·01$) and the presence of one or more red cell autoantibodies (46·2% vs. 4·7%; $P < 0·0001$). The alloimmunization rate was higher for episodically transfused than chronically transfused patients (1·43 vs. 0·24/100 units received; $P < 0·001$). The presence of red cell autoantibodies appears to be a major risk factor for alloimmunization in SCD children and could justify specific transfusion guidelines.

Keywords: sickle cell disease, children, blood transfusion, red blood cell alloimmunization, immunohaematology.

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Transfusion of blood components

- Transfusion of blood components
  - Transfusion of packed red blood cells (PRBC)
    - Description of component
    - Pretransfusion Compatibility testing
  - **Transfusion of fresh frozen plasma (FFP)**
    - **Description of component**
    - **Pretransfusion Compatibility testing**
  - Transfusion of platelets
    - Description of component
    - Pretransfusion Compatibility testing
- Hemovigilance

Transfusion of fresh frozen plasma (FFP)
Description of component

- Prepared from whole blood or from plasma collected by apheresis
- Contains normal plasma levels of stable coagulation factors, albumin and immunoglobulins
- ≥ 70IU Factor VIIIc level per 100ml and at least similar amounts of the other labile coagulation factors and naturally occurring inhibitors
- Conservation at -30°C or lower
- Administration through a 170-200µm filter

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Transfusion of fresh frozen plasma (FFP)

- Pathogen reduction treatment
  - Active on known viruses, bacteria, protozoa and contaminating leukocytes but also on unknown transfusion-transmissible agents, they are not active on prions
  - Current methods: solvent-detergent, methylene blue, amotosalen, and riboflavin
- **Pretransfusion Compatibility testing**
  - Patient's ABO blood group determined on two different blood samples collected at different times

Transfusion of blood components

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  - **Transfusion of platelets**
    - **Description of component**
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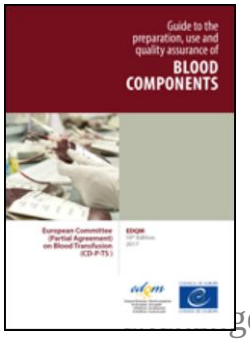
- Hemovigilance

Transfusion of platelet concentrates (PCs)

Description of component

- PCs
  - Apheresis platelets (prepared by apheresis from single donors)
  - Recovered platelets (prepared by separation and pooling of units of platelets from whole blood of multiple donors)
- No difference in haemostatic effect; platelet survival and post-transfusion increment for both preparations
- Storage: max 5 days after collection at 22±2°C
- Specific preservative solutions bags permitting O_2 and CO_2 ge so that the pH during storage stays continuously between 6.4 and 7.4



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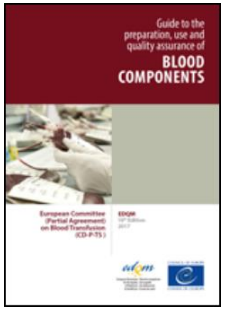
Transfusion of platelet concentrates (PCs)



- Leukodepleted: decreased incidence of alloantibody mediated refractoriness to PC transfusion, CMV transmission and FNHTRs
- Pathogen reduction treatment
  - Maximum storage time could be extended to 7 days with equivalent safety and clinical efficacy *(Lozano et al, 2011; Schlenke et al, 2011)*
  - But belgian law 6/2/2018: 5 days
- **Pretransfusion Compatibility testing:**
  - Patient's ABO/ RhD blood groups
  - Contamination of PCs by red cells

    → prevention of RhD immunisation by the use of RhD-immune globulin if RhD+ PC are transfused to RhD- patients of child-bearing age or younger

Platelet express on their surface:
- ABO antigens
- Class I HLA antigens
- HPA antigens

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Transfusion of platelet concentrates (PCs)

Response to platelet transfusion

- **Platelet recovery or CCI**

- Absolute Increment =

  (Post-transfusion platelet count) – (pre-transfusion platelet count)

- Corrected Count Increment (CCI) =

  Absolute Increment X Body surface area / number of platelets transfused (10^{11})

  CCI : 10-60 minutes after transfusion (Mc Farland, AABB, 2008)

Transfusion of PCs: Response to platelet transfusion

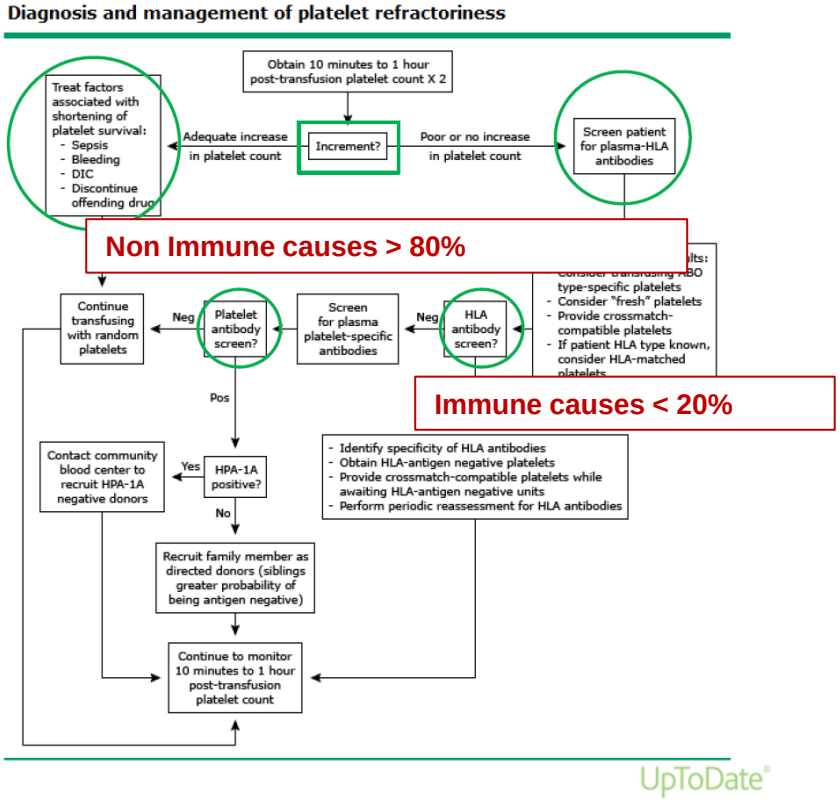
❑ Transfusion platelet refractoriness

- ✓ Only when at least two ABO-compatible transfusions, stored for <72 hours result in poor increments
- ✓ Defined in a clinically stable patient when two sequential platelet transfusions lead to 1 hour post-transfusion CCIs of less than 5000 platelets x m2 per µl

- ✓ If ↓ 1h and 24h: Immune cause (antibodies against HLA class I and/or HPA antigens)
- ✓ If N 1h and ↓ 24h: Non immune cause (sepsis, splenomegaly, DIC, GvHD, bleeding, medications,…)
- ✓ ***« Non immune causes are the most likely and the first that should be explored in the diagnosis of platelet refractoriness »***

Management of the platelet refractory patient. S.K.Forest, E.A.Hod.

Transfusion of platelet concentrates (PCs)



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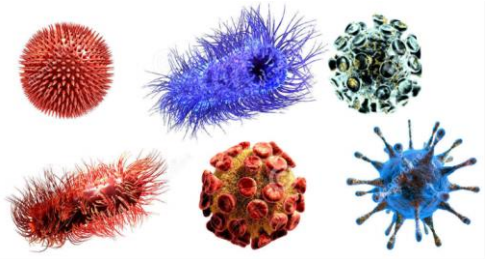
Hemovigilance

- Hemovigilance = Hema (blood in Greek) + Vigilans (watchful in Latin)
- Hemovigilance system improve the safety of blood transfusion by applying a set of surveillance procedures covering whole transfusion chain from the collection of blood and its components to the follow up of its recipients, intended to collect and access information on unexpected or undesirable effects resulting from the therapeutic use of labile blood products, and to prevent their occurrence and recurrence.

Early 1980s…

Mistransfusions



Infectious diseases

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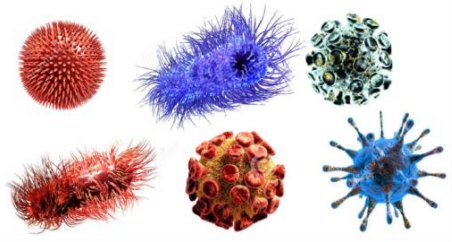
Today…



Infectious diseases

Mistransfusions

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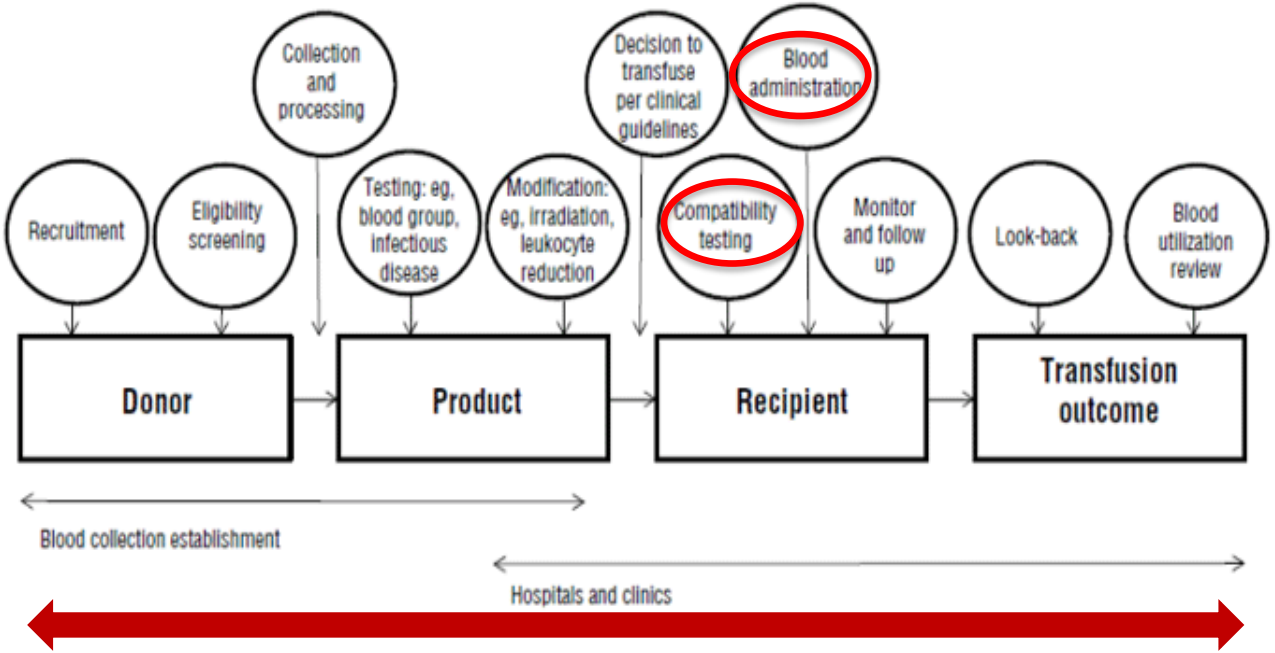
Transfusion process



Hemovigilance surveillance programme

http://www.aabb.org/tm/Pages/default.aspx

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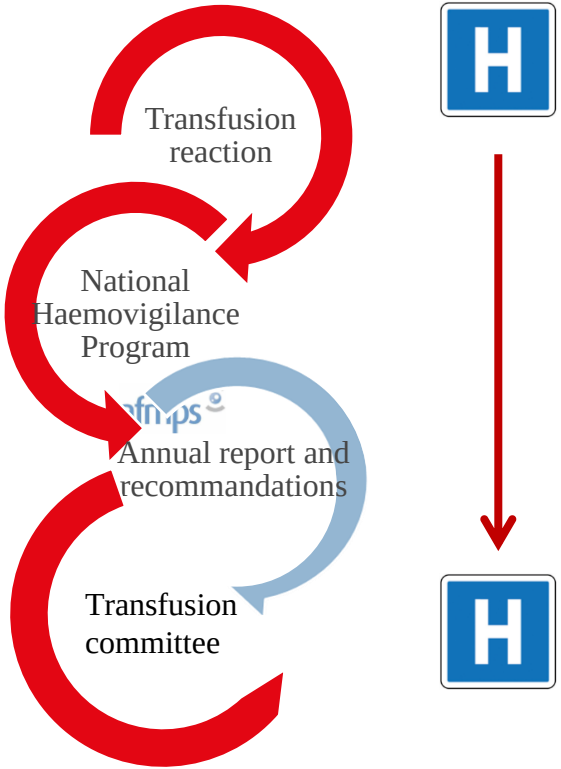
Hemovigilance (recipient)



Goal of Hemovigilance:
Improve blood transfusion safety

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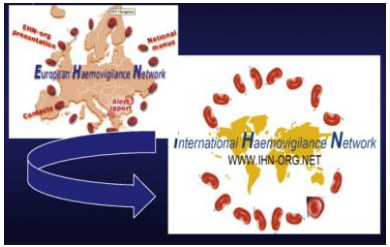
Hemovigilance (recipient)

Notification of Serious Adverse Events (SAE) that may have an influence on the recipient; and Serious Adverse Reactions (SAR) that may be attributed to the quality and safety of blood and blood components

afmps
agence fédérale des médicaments et des produits de santé



Transfusion committee

Transfusion policy
National recommandations and Belgian Law
European directives
International recommandations
Bequint (National Platform for Transfusion Policy)

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Hemovigilance: notification form

Agence Fédérale des Médicaments et Produits de Santé

Département Vigilance
Centre d'hémovigilance

FORMULAIRE DE NOTIFICATION/CONFIRMATION D'UNE REACTION TRANSFUSIONNELLE INDESIRABLE GRAVE OU D'UN INCIDENT INDESIRABLE GRAVE EN RAPPORT AVEC UN COMPOSANT SANGUIN

Code Hôpital / Année — Nom Hôpital / Numéro d'ordre — ☐ Notification ☐ Confirmation

A. NOTIFICATION

1. Patient 1.1. date de naissance: 1.2. sexe : H ☐ F ☐

2. Composant sanguin transfusé

☐ Concentré érythrocytaire (CE) ; numéro d'unité: ☐ Allogénique ☐ Autologue

☐ Concentré plaquettaire (CP) ; numéro d'unité: ☐ CP d'aphérèse (donneur unique) ☐ CP standard

☐ Plasma frais congelé, viro-inactivé (PFCVI) ; numéro d'unité:

☐ Autre: ☐ plusieurs/différents composants; numéro(s) d'unité:

3.Réaction transfusionnelle

3.1. Date et heure : Date et heure du début de la transfusion (en cas de réaction transfusionnelle): à (hr:min)
Date et heure de la réaction ou de l'incident : à (hr:min)

3.2. Lieu de la transfusion : ☐ Bloc opératoire ☐ Soins intensifs ☐ Chirurgie ☐ Hémato-oncologie ☐ Médecine interne ☐ Pédiatrie ☐ Hôpital de jour ☐ Autre :

3.3. Symptômes

☐ malaise	☐ tachycardie	☐ oligurie, anurie
☐ frissons	☐ hypertension	☐ hypotension
☐ fièvre	☐ arythmie cardiaque	☐ choc
☐ démangeaison	☐ lombalgie	☐ perte de connaissance
☐ urticaire	☐ douleur thoracique/abdominale	☐ hémorragie diffuse
☐ rougeur	☐ nausées/vomissements	☐ autre:
☐ éruption	☐ dyspnée	☐ autre:
☐ ictère	☐ hémoglobinurie	☐ autre:

4. Diagnostic ou syndrome/incident

☐ 4.1. Réaction fébrile non hémolytique (RFNH)
☐ 4.2. Hémolyse immunologique due à une incompatibilité ABO
☐ 4.3. Hémolyse immunologique due à un autre allo-anticorps
☐ 4.4. Hémolyse non immunologique
☐ 4.5. Purpura post-transfusionnel
☐ 4.6. Réaction allergique grave
☐ 4.7. Réaction anaphylactique
☐ 4.8. Lésion pulmonaire aiguë post-transfusionnelle (TRALI)
☐ 4.9. Maladie du greffon contre l'hôte
☐ 4.10. Infection bactérienne post-transfusionnelle (bactériémie, sepsis, choc endotoxinique).
Microorganisme(s):

☐ 4.11. Infection virale transmise par transfusion :
☐ VIH1,2 ☐ VHB ☐ VHC ☐ CMV ☐ Autre
☐ 4.12. Infection parasitaire transmise par transfusion:
☐ Malaria ☐ Autre:
☐ 4.13 Oedème pulmonaire aigu (défaillance cardiaque, surcharge volémique)
☐ 4.14. Autres réactions indésirables graves:

Incident : remplir aussi la section 10.
☐ 4.15. Administration erronée d'un composant sanguin (veuillez aussi remplir la section 10)
☐ 4.16. Near miss (veuillez aussi remplir la section 10)

information complémentaire:

5. Gravité
☐ 0: absence de manifestation clinique
☐ 1: absence de menace vitale, y compris à long terme
☐ 2: morbidité sévère à long terme
☐ 3: menace vitale immédiate
☐ 4: décès

6. Imputabilité de l'incident transfusionnel
☐ 0. exclu
☐ 0. improbable
☐ N. non évaluable
☐ 1. possible, douteux
☐ 2. probable
☐ 3. certain, prouvé

7. Enquête transfusionnelle
☐ en cours
☐ terminée
☐ non réalisée
☐ non réalisable

8. Evolution du patient après l'incident (si connue)
☐ rétablissement complet
☐ séquelles mineures, lesquelles:
☐ séquelles graves, lesquelles:
☐ décès

9. Personne de contact de l'hôpital pour l'hémovigilance
Validé/signé par la personne de contact (cliquez le champ suivant):
Nom prénom:
Date (J/M/AAAA):

☐ La réaction peut être imputable à un problème de qualité ou à la sécurité du composant sanguin.
☐ La réaction est/a aussi (été) notifiée au centre de transfusion sanguine

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Hemovigilance: AFMPS annual reports

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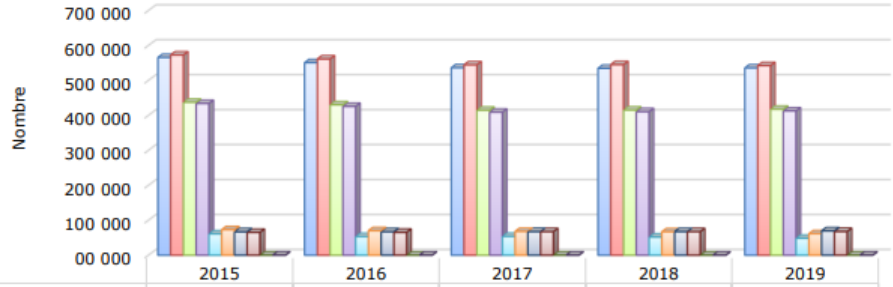
4.2. Composants sanguins distribués et administrés

La figure 4 montre l'évolution du nombre de composants sanguins distribués et administrés sur la période 2015-2019. La distribution et l'administration globales des composants sanguins en 2019 sont similaires à l'année précédente.



	2015	2016	2017	2018	2019
Total distribué	565 708	550 879	536 397	534 745	535 885
Total administré	572 874	561 512	544 654	545 269	542 296
CE distribué	437 532	430 389	414 899	415 343	417 706
CE administré	434 145	425 824	409 192	410 614	412 848
PFVI distribué	60 981	53 297	53 856	51 885	48 437
PFVI administré	73 152	70 179	68 055	67 224	61 545
CP distribué	67 100	67 184	67 634	67 478	69 672
CP administré	65 482	65 501	67 398	67 395	67 835
CG distribué	95	9	8	39	70
CG administré	95	8	9	36	68

(PFVI = plasma frais viro-inactivé, CG = concentré granulocytaire, CP = concentré plaquettaire)

Figure 4 – Nombre de composants sanguins distribués et administrés (2015-2019)

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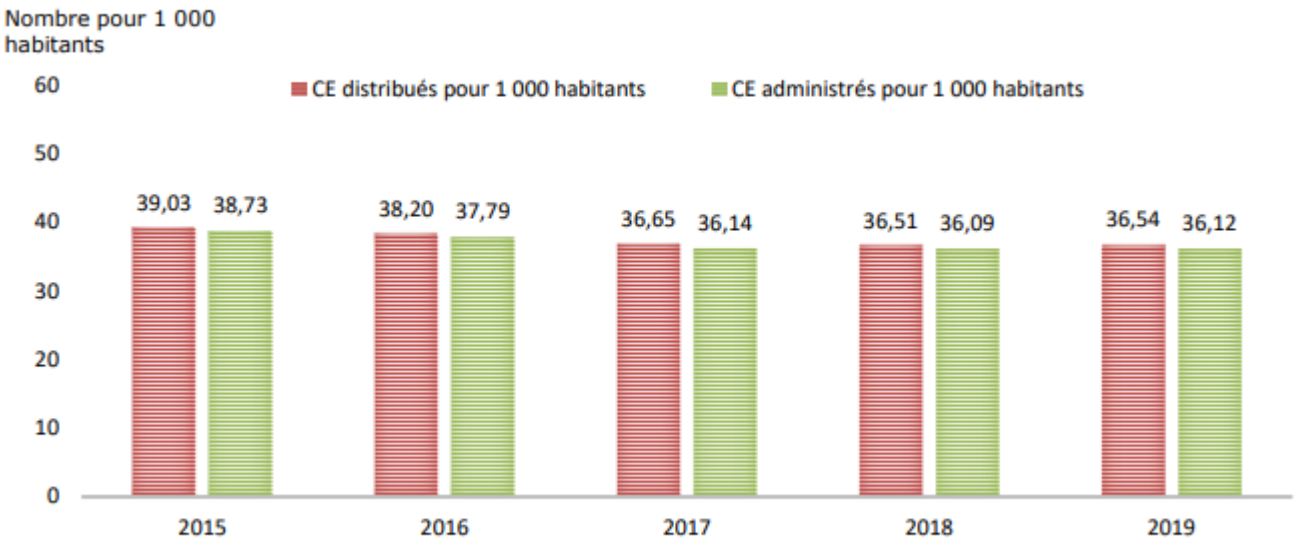

Figure 5 – Nombre de CE distribués et administrés pour 1 000 habitants (2015-2019)

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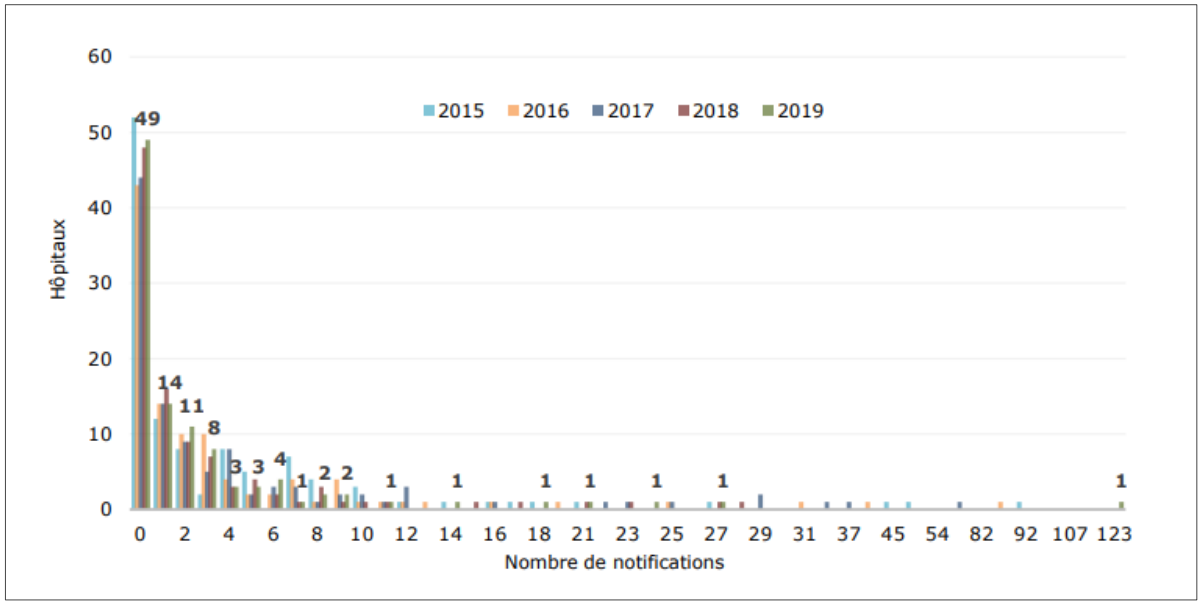

En 2019, 55 hôpitaux ont notifié au moins 1 incident ou réaction indésirable grave et 49 hôpitaux n'ont notifié aucun incident ou réaction. Le nombre de notifications par hôpital varie de 0 à 123 et le nombre total de notifications par hôpital pour 1 000 composants sanguins administrés varie de 0 à 5,05 (médiane : 0,15).

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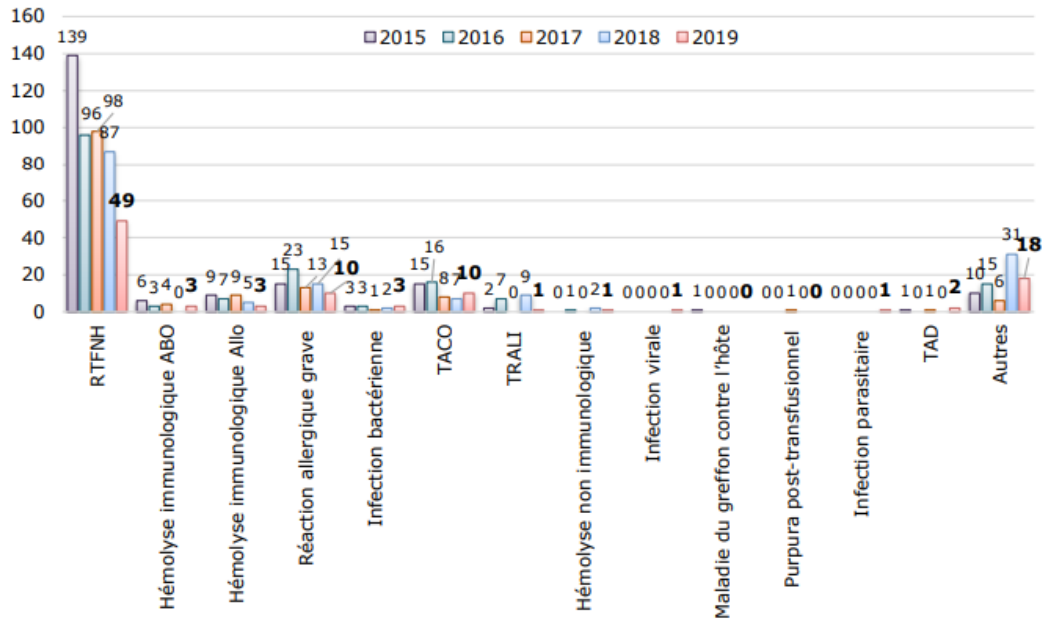

Figure 19 – Nombre annuel de réactions transfusionnelles graves (2015-2019)

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Thank you for your attention

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