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INTERNATIONAL FORUM

Vox Sanguinis International Forum on paediatric indications for blood component transfusion

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Meghan Delaney

United States of America

Subject 1. Hospital and transfusion service demographics:

Question 1
United States of America.

Question 2
Yes.

Question 3
Both.

Question 4
Neonate is defined by transfusion service as <4 months according to US regulations (FDA, AABB) that is built around being able to waive additional cross-matching to avoid iatrogenic phlebotomy by using Group O red blood cells during this time period (birth to chronological 4 months of age). All of the patients at our facility would be considered 'pediatric' since we are a stand-alone tertiary/quaternary paediatric referral centre. We do not have 'adult' protocols, even though we may treat patients >18 years, they would fall under regular transfusion approach. The only exception to this may be if there is a patient >18 years who is refusing transfusion due to their wishes, if the patient is a legal minor (<18 years) or not (>18 years), the hospital would proceed differently.

Question 5
Yes, it is paediatric specialty hospital that has a NICU as well. We have 313 beds.

Question 6
No, only neonates and paediatrics. We do treat young adults as well when there is a reason for the patient to see a physician with specialty in paediatric geared specialties (paediatric cancers, genetics, congenital heart disease, etc).

Question 7a
Yes.

Question 7b
Yes.

Question 7c
Yes.

Question 7d
Yes.

Question 7e
Yes.

Question 7f
Yes.

Question 7g
Yes.

Question 7h
Yes.

Question 7i
Yes.

Question 7j
Yes.

Question 7k
Yes.

Question 7l
Yes.

Question 7m
Yes.

Question 7n
Yes.

Question 7o
Yes.

Question 7p
Yes.

Question 8a
RBCs: 8057 units (in 2017).

Question 8b
I am not able to get this information without a long wait and IT request.

Question 9a
Plasma: 1760 (in 2017).

Question 9b
I am not able to get this information without a long wait and IT request.

Question 10
Platelets: 3525/year (Full-size units. We aliquot them into smaller doses for smaller patients.) (in 2017).

Subject 2. Transfusion Indications for paediatric and neonatal patients:

Question 1
The United States does not have a national transfusion policy for neonates or pediatrics (or adults). The United States has never really had national-level guidelines on transfusion. There are initiatives through various networks and professional societies to create guidelines, but these are typically in specific populations or according to certain practices.

For instance, the PALISI network created a set of 10 manuscripts focused on evidence-based review and areas needed for research on transfusion indications and thresholds in paediatric critical care patients only (called the TAXI project). There are other AABB and ASCO guidelines, some of which mention paediatric patients and some do not.

Question 2
Our hospital specialties do have transfusion thresholds for neonatal and/or paediatric transfusions based on diagnosis that are kept at the local level. My plan is to collate these empiric approaches into one transfusion policy at the hospital level. I was able to do this at Seattle Children's Hospital when I was Transfusion Medicine Director there.

Question 3
Our hospital specialties do have transfusion thresholds for ordering RBC/plasma/platelets based on diagnosis that are kept at the local level. My plan is to collate these empiric approaches into one transfusion policy at the hospital level. I was able to do this at Seattle Children's Hospital when I was Transfusion Medicine Director there.

Question 4
Yes. Providers that are ordering blood product transfusion must electronically complete the 'Justification for transfusion' to order the blood.

Question 5
All outpatient visits require a diagnosis, thus this is linked to transfusion in that setting. All transfusions (inpatient and outpatient) require the provider to enter 'Justification for transfusion.'

Question 6
Our hospital specialties do have transfusion thresholds for RBC transfusion based on diagnosis that are kept at the local level. My plan is to collate these empiric approaches into one transfusion policy at the hospital level. I was able to do this at Seattle Children's Hospital when I was Transfusion Medicine Director there.

Our transfusion data card states, 'Increase oxygen- carrying capacity'

Question 7
Our hospital specialties do have transfusion thresholds for platelet transfusion based on diagnosis that are kept at the local level. My plan is to collate these empiric approaches into one transfusion policy at the hospital level. I was able to do this at Seattle Children's Hospital when I was Transfusion Medicine Director there.

Our transfusion data card states, 'Correct/prevent bleeding due to thrombocytopenia'

Question 8
Somewhat. Our hospital specialties do have transfusion thresholds for plasma transfusion based on diagnosis.

Our hospital specialties do have transfusion thresholds based on diagnosis that are kept at the local level. My plan is to collate these empiric approaches into one transfusion policy at the hospital level. I was able to do this at Seattle Children's Hospital when I was Transfusion Medicine Director there.

Our transfusion data card states, 'Coagulation factor replacement for which there is no specific factor concentrate'

Subject 3. Product manipulations for paediatric and neonatal patients

Question 1
Yes, all platelets and RBCs are irradiated. This policy was put in place because of missed irradiation events in our population that is heavily enriched for patients that have a medical indication for irradiation. The only exception is if they are ordering emergency release blood when the provider signs to waive irradiation.

Question 2
Yes, all red blood cells are leucocyte reduced.

Question 3
Yes, this is by transfusion medical director approval and typically only for prevention of severe allergic reactions.

Question 4
No, not at this time, but we plan to in the future.

Question 5
No, not at this time.

Question 6
Yes. We have a large and active sickle cell disease treatment programme and provide Rh/K for these patients. We also default to antigen-matched cells when a patient has certain serological findings, such as panagglutinin, but this is on the case-by-case basis by the transfusion medical and technical laboratory specialists (SBB).

Question 7
No.

Question 8
Yes, we have multiple infants assigned to one red blood cell parent unit and we draw multiple aliquots off of them. We put up to five babies on Group O, RhD-positive or RhD-negative RBC unit. We select the unit that is ≤10 days of storage at the time of assignment.

Question 9
We do use small paediatric tubes whenever we can.

Question 10
Yes, this is based on age of RBC product and time from irradiation. In general, this is what we follow:

Patient age	Maximum storage after irradiation	Additional attributes
Neonates (<4 months)	24 h	Fresh units ≤10 days old at time of transfusion O positive or negative
Infants and young children (4 months to 5 years)	72 h after day of irradiation (day 0)	
Older children and adolescents/ adults (>5 years)	28 days post-irradiation or original expiration date, whichever is first	
Any age patient: ECMO, cardiac surgery pump prime units	Age-dependent Minimize postirradiation storage time whenever possible	Fresh units ≤10 days old at time of transfusion Select <7-day-old units for cardiac surgery pump prime whenever inventory allows

Subject 4. Blood product dosing

Question 1
Patients <50 kg and sickle cell pts: 10–15 ml/kg
Patients ≥50 kg: 1–2 units (5–10 ml/kg)

Question 2
Patients <5 kg: 1 EU.
Patients ≥5 kg: 1 EU/5 kg (oncology/BMT/bleeding patient).
1 EU/10 kg.
Apheresis derived: 1 EU = equivalent to 1 random donor platelet or $5{\cdot}5 \times 10^{10}$ platelets in 25–50 ml plasma).

Question 3
Patients <50 kg: 10–15 ml/kg
Patients ≥50 kg: 2 units (5–10 ml/kg)

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Subject 1. Hospital and transfusion service demographics

Question 1
Czech Republic.

Question 2
Yes.

Question 3
In our facility.

Question 4
neonate: 30 days old.
paediatric: under 19 years old.

Question 5
A pediatric specialty hospital is a part of University Hospital Brno

Question 6
Yes, we treat both adult and paediatric patients and we have 400 inpatient beds.

Question 7a
Yes.

Question 7b
Yes.

Question 7c
Yes.

Question 7d
Yes.

Question 7e
Yes.

Question 7f
Yes.

Question 7g
Yes.

Question 7h
Yes.

Question 7i
Yes.

Question 7j
Yes.

Question 7k
Yes.

Question 7l
Yes.

Question 7m
Yes.

Question 7n
Yes.

Question 7o
Yes.

Question 7p
Yes.

Question 8a
1671 T.U.

Question 8b
(a) 216 T.U.
(b) 231 T.U.
(c) 1224 T.U.

Question 9a
182 T.U. + 61 Octaplas.

Question 9b
(a) 24 T.U.
(b) 29 T.U.
(c) 129 T.U.

Question 10a
921 T.D.

Question 10b
(a) 40 T.D.
(b) 24 T.D.
(c) 857 T.D.

Subject 2. Transfusion indications for paediatric and neonatal patients

Question 1
No. (There is only a chapter in the national guidelines. There is information about intrauterine or intraumbilical transfusions and doses for children.)

Question 2
No. (There is only a chapter about children and neonates indications of the blood components in the hospital recommendation).

Question 3
No.

Question 4
No.

Question 5
No.

Question 6
Yes. The threshold for adults is 70–80 g/l. We have no exact recommendation for children.

Question 7
Yes. Recommendation for adults: prophylactic application: usually under 20×10^9/l, therapeutic application: under 80–100 $\times$ 10^9/l – massive bleeding, cerebral insurance, under 50×10^9/l – serious bleeding gastrointestinal or urological, under 30×10^9/l – bleeding in muscles or skin. There is no special recommendation for children.

Question 8
No. We have a clinical definition.

Subject 3. Product manipulations for paediatric and neonatal patients

Question 1
Yes. Children under 1 year old, haemato oncology patients, immunodeficits.

Question 2
Yes. All RBCs for paediatric and neonatal patients are leucodepleted.

Question 3
Yes. IgA selective immunodeficit, serious allergic adverse events after application of blood components.

Question 4
No.

Question 5
No.

Question 6
Yes. haematoonkology patients.

Question 7
No.

Question 8
No.

Question 9
Yes.

Question 10
Yes. Polytraumatic patients maximally 14 days old, neonates 5 days old, paediatric 14 days old.

Subject 4. Blood product dosing

Question 1
5–10 ml/kg.

Question 2
Standard paediatric dose (about 80–100 ml). Children under 15 kg – 10–20 ml/kg.

Question 3
10–15 ml/kg. We applicate preferentially Octaplas to paediatrics and neonates.

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Subject 1. Hospital and transfusion service demographics

Question 1
Russia, Moscow

Question 2
No.

Question 3
We prepare blood in our own facility.

Question 4a
Yes.

Question 5
Our hospital is a paediatric specialty hospital.
(a) 574 (24 reanimatology).

Question 6
No.

Question 7a
Yes.

Question 7b
Yes.

Question 7c
Yes.

Question 7d
No.

Question 7e
Yes.

Question f
No.

Question 7g
Yes.

Question 7h
No.

Question 7i
Yes.

Question 7j
Yes.

Question 7k
Yes.

Question 7l
Yes.

Question 7m
Yes.

Question 7n
Yes.

Question 7o
Yes.

Question 7p
Yes.

Question 8
RBC
(a) 96.9 l, 651 packages.

Question 9
Yes, One packages from 70 to 100 ml.

Question 10
Platelet.
(a) 5.5 l, 64 packages.

Subject 2. Transfusion indications for paediatric and neonatal patients

Question 1b
Yes (There are restrictions on the time storages from the moment of donation: for children under 1 month not more than 10 days, for a replacement transfusion no more than 5 days, 100% individual selection taking into account 10 red cell antigens, recommended leucofiltration, irradiation, virus inactivation and selection of CMV-negative donors. Analysing haemoglobin level in children different age.)

Question 2b
Yes.
(a) In accordance with national principles.

Question 3b
Yes.
(a) See application in attached table.

Question 4b
Yes.
(a) No.

Question 5
Yes.

Question 6b
Yes.
(a) See application in attached table.

Question 7b
Yes.
(a) See application in attached table.

Question 8b
Yes.
(a) See application in attached table.

Subject 3. Product manipulations for paediatric and neonatal patients

Question 1a
No.

Question 2b
Yes.
(a) Leucofiltration in the preparation of whole blood.

Question 3b
Yes.
(a) With transfusions of another blood group, an allergic anamnesis.

Question 4a
No.

Question 5a
No.

Question 6a
No.

Question 6b
Yes.
(a) Since 1999, we have been selecting erythrocytes with antigens – A, B, C, Cw, c, E, e, K, k.

Question 7
Yes. We make individual selection of red blood cells, thromboelastography, thrombodynamics.

Question 8
Yes. We do a division of a large dose into several paediatric packages.

Question 9
Yes.

Question 10b
Yes.
(a) Erythrocytes can be used for children under 1 month for not more than 10 days of storage, for a transfusion no more than 5 days of storage.

Subject 4. Blood product dosing

Question 1
10–15 ml/kg.

Question 2
5–10 ml/kg.

Question 3
10–15 ml/kg.

Formation of indications for blood transfusions

Erythrocyte-containing media

Nosology	Newborns and children up to 4 months	Older age
Routine transfusions		
Anaemia without signs of bleeding	Up to 14 days: Hb < 100 g/l, Ht < 30%, RBC < 3.0×10^6 14–30 days: Hb < 96 g/l, Ht < 25%, RBC < 2.5×10^6 1–4 months: Hb < 85 g/l, Ht < 25%	Hb < 70 Calculation of the volume of erythrocyte-containing media: V = (Hb desired − Hb true) × 0·6 × m/2
Anaemia with signs of respiratory failure	Up to 1 month: Hb < 120 g/l, Ht < 40%, RBC < 3.9×10^6	Hb < 80 g/l
Anaemia and preparation for surgery	Up to 1 month: Ht < 40% 1–4 months: Ht < 30%	Hb < 100 g/l, PLT < 100×10^9
Emergency transfusion		
Anaemia in critical conditions	Of ventilation: FiO_2 > 0·4 Hb < 110 g/l, Ht < 35% Auxiliary ventilation: FiO_2 < 0·4 Hb < 100 g/l, Ht < 30%	Taking into account transport O_2

(Continued)

Nosology	Newborns and children up to 4 months	Older age
	Self-breathing: breathing rate 85/min 24 h Hb < 80 g/l, Ht < 25%	
Intraoperative blood loss	In children under 4 months, the loss of more than 10% volume of circulating blood is replenished first of all by erythrocytes	Loss >15% volume of circulating blood (VCB): erythrocyte 1 dose + plasma 10% volume of circulating plasma loss >25% volume of circulating blood: erythrocyte 2 doses + plasma 50% volume of circulating plasma + platelet 5–6 doses loss >40% volume of circulating blood: erythrocyte – 30% VCB + plasma – 100% volume of circulating plasma + platelet 5–6 doses + albumin 20% 1 g/kg body mass

Thrombose concentrate

Platelet level	Indications
Any baseline level of platelets	Acute massive blood loss (absolute indications, included in the list of mandatory components for replenishment of blood loss). Ratio of erythrocytes/plasma/platelets = 1/1/1
>100 × 10^9	Transfusion not shown It is possible to make a decision in favour of transfusion with functional insufficiency of platelets (thrombocytopathy)
50–100 × 10^9	Intraventricular haemorrhage III–IV st, Continued bleeding, Surgical interventions of a large volume, including neurosurgical
20–49 × 10^9	Minimally invasive interventions and operations (biopsy, puncture, epidural anaesthesia, replacement blood transfusion, etc.) The first 7 days after birth, Premature babies with extremely low body weight (less than 1000 g), Concomitant coagulopathy without marked bleeding, Ongoing bleeding, skin-haemorrhagic syndrome Septicaemia
<20 × 10^9	Absolute indications, even without clinical manifestations

Contraindications to the use of thrombocyte concentrate:

- Immune thrombocytopaenia,
- Heparin-induced thrombocytopaenia,
- Thrombotic thrombocytopaenic purpura,
- Haemolytic-uraemic syndrome

Freshly frozen plasma (FFP)

- Multifactorial coagulation deficiency, confirmed laboratory and associated with the following:
  - cutaneous haemorrhagic and haemorrhagic manifestations and ICE (Caution: DIC without bleeding is not an absolute indication for transfusion, nor is transfusion indicated for prophylactic purposes),
  - liver disease (liver failure),
  - haemolytic disease of newborns – up to 20 ml/kg, with simultaneous administration of vitamin K,
  - intraoperative haemodilution (dilution coagulopathy)
- Hereditary deficiency of coagulation factors, in the absence of a virus-safe preparation (including atypical haemolytic-uraemic syndrome),
- Thrombotic thrombocytopaenic purpura (plasma exchange),
- Elimination of the effect of warfarin, in case of bleeding,
- Operational haemorrhage of more than 15% volume of circulating blood

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Subject 1. Hospital and transfusion service demographics

Question 1
Hospital located in Moscow, Russian Federation.

Question 2
Yes, an academic hospital.

Question 3
No, all blood components provided by hospital-based blood bank.

Question 4a
Neonate – less than 28 days old.

Question 4b
Paediatric – less than 18 years old.

Question 5
Yes.
(a) Hospital has 220 inpatient beds.

Question 6
No, only paediatric patients.

Question 7a
Yes.

Question 7b
No.

Question 7c
No.

Question 7d
No.

Question 7e
No.

Question 7f
Yes.

Question 7g
No.

Question 7h
Yes.

Question 7i
No.

Question 7j
Yes.

Question 7k
No.

Question 7l
No.

Question 7m
Yes.

Question 7n
No.

Question 7o
No.

Question 7p
No.

Question 8a
6000 RBC transfusions per year.

Question 8b
(a) 30 transf.
(b) 278 transf.
(c) 5692 transf.

Question 9a
1700 units of FFP per year.

Question 9b
(a) 10 un.
(b) 104 un.
(c) 1586 un.

Question 10a
6300 units per year (1 unit = 2×10^{11} plt).

Question 10b
(a) 29 un.
(b) 69 un.
(c) 6202 un.

Subject 2. Transfusion indications for paediatric and neonatal patients

Question 1b
Yes. Main differences are restrictions of the storages period for RBC: for children under 1 month not more than 10 days, for a replacement transfusion no more than 5 days, match for 10 red cell antigens, recommended leucofiltration.

Question 2b
Yes. In accordance with national guideline (see above).

Question 3a
No.

Question 4b
Yes.
(a) The indication is entered electronically.

Question 5
Yes.

Question 6b
Yes.
(a) For neonatal Hb <10 g/dl, Ht <29%; for paediatric Hb <7 g/dl, Ht <20%.

Question 7b
Yes.
(a) For neonatal PLT <40, for paediatric PLT <10 or <40 before invasive procedure or <100 before neurosurgery.

Question 8b
Yes
(a) Multifactorial coagulation deficiency, confirmed laboratory.

Subject 3. Product manipulations for paediatric and neonatal patients

Question 1b
Yes.
(a) All patients receive only irradiated RBC and platelets.

Question 2b
Yes.
(a) Uniform leucodepletion of all transfused products.

Question 3b
Yes.
(a) Patients with severe repeated PTR, patients with positive DAT, patients with unidentified haemolysis.

Question 4a
No.

Question 5b
Yes.
(a) Plasma, platelets, and whole blood are inactivated with MIRASOL PRT (Terumo).

Question 6b
Yes.
(a) For all patients: k and Cw.

Question 7
We are providing CMV-neg blood components upon request.

Question 8
No.

Question 9
Yes.

Question 10b
Yes.
(a) For neonatal patients' maximum storage period of RBC do not exceed 5 days.

Subject 4. Blood product dosing

Question 1
Millilitres/kg.

Question 2
Millilitres/kg.

Question 3
Millilitres/kg.

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Subject 1. Hospital and transfusion service demographics

Question 1
Russia.

Question 2
Yes, my hospital is a teaching/academic hospital.

Question 3
We receive the blood components from 3 blood centres.

Question 4a
Neonate – less than 30 days old.

Question 4b
Paediatric – less than 18 years old.

Question 5
No, a paediatric specialty works only for outpatients.

Question 6
NA.

Question 7
NA.

Question 8
NA.

Question 9
NA.

Question 10
NA.

Subject 2. Transfusion indications for paediatric and neonatal patients

Question 1
Yes.
(a) Reverse ABO typing starts since 4 months of age. Typing of C, c, E, e, Cw, K and k is mandatory. Newborn blood tube is labelled with mother surname and initials. Threshold for RBC transfusions: 85 g/l – before 1 year, 70 g/l – >1 year. For newborns: (i) RBCs should be stored <10 days; (ii) volume of transfused RBCs is 10–15 ml/kg; (iii) rate of RBCs transfusion is 5 ml/kg/h; and (iv) transfused product should be warmed to 36–37°C. For intrauterine transfusion, RBC should be 0 RhD-negative with a period of storage no more than 5 days.

Question 2
NA.

Question 3b
Yes.
(a) NA.

Question 4b
Yes.
(a) No.

Question 5
Yes.

Question 6b
Yes.
(a) NA.

Question 7b
Yes.
(a) NA.

Question 8b
Yes.
(a) NA.

Subject 3. Product manipulations for paediatric and neonatal patients:

Question 1b
Yes.
(a) Allogeneic stem cell transplantation.

Question 2b
Yes.
(a) 100%.

Question 3a
No. Not necessary.

Question 4a
No.

Question 5b
Yes.
(a) MB-plasma and amotosalen platelets.

Question 6
NA.

Question 7
NA.

Question 8
Jumbo plasma apheresis bags

Question 9
No.

Question 10
No.

Subject 4. Blood product dosing

Question 1
For neonatal patients – 10–15 ml/kg.

Question 2
50–70 × 10^9 platelets per 10 kg.

Question 3
15 ml/kg

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The Netherlands

Subject 1. Hospital and transfusion service demographics

Question 1
The Netherlands.

Question 2
Academic.

Question 3
We receive them from the national blood centre (Sanquin).

Question 4
Neonate is less than 28 days, but for transfusion, we 'stretch' this till the age of 3 months.

Paediatric is indeed <18 years.

Question 5
It is a university paediatric hospital, a university adult hospital and a specialized adult oncology hospital. Total amount of paediatric beds = ?

Question 6
See question 5.

Question 7a
Yes.

Question 7b
Yes.

Question 7c
Yes.

Question 7d
Yes.

Question 7e
Yes.

Question 7f
Yes.

Question 7g
Yes.

Question 7h
Until 1st of June yes, from 1-6-2018 only shared care paediatric oncology. Paediatric (benign) haematology still is available. But paediatric stem cell transplantations occur in another academic hospital, only pre- and post-transplantation care occurs again in our hospital.

Question 7i
Yes.

Question 7j
Yes, both. ECMO, LVAD also.

Question 7k
Yes.

Question 7l
Yes.

Question 7m
Yes.

Question 7n
Yes.

Question 7o
Yes

Question 7p
Yes and chronic ventilation care.

Question 8a
The total for both is 1468.

Question 8b
(a) 31, younger than 1 month.
(b) 50, 1–4 months.
(c) 1387, older than 4 months.

Question 9a
The total for both is 551.

Question 9b
(a) 21, younger than 1 month.
(b) 21, 1–4 months.
(c) 509, older than 4 months.

Question 10a
The total of both is 816.

Question 10b
(a) 26, younger than 1 month.
(b) 19, 1–4 months.
(c) 771, older than 4 months.

Subject 2. Transfusion indications for paediatric and neonatal patients

Question 1
Yes, there is (2011, update expected 2019/20), it is embedded in the general (adult) guideline with special chapters if needed. Extra attention is given to:

- Intrauterine blood transfusions
- HPA (e.g. 1a) negative platelets if indicated in FNAIT
- Exchange transfusion (e.g. with hyperbilirubinemia)
- Specific blood transfusions (e.g. apheresis for neonates) or regulations (e.g. irradiated if <32 weeks GA, HLA matched, and PvB19)
- Laboratory tests (for neonates test mother and child)
- Thresholds differ for transfusions per age group

Question 2
No, we follow the national guideline. Rarely exceptions are made, for example FF-plasma extended till age of 1 year in case of large cardiothoracic surgery with ECMO.

Question 3
Yes, there is. Indications

- Acute or chronic anaemia (threshold depends on clinical situation/ventilation etc), or during sickle cell crisis with complications, sporadic prophylactic in sickle cell disease.
- Platelets if (prophylactic in neonates <20, <10 in paediatric haemato-oncology, preoperative if regenerative thrombocytopaenia or functional platelet disorder), otherwise indications depend on stability of clinical state/correction of bleeding in thrombocytopaenic/-pathic patients
- Plasma, when bleeding tendency on ECMO, when F VI deficiency, when F XI deficiency, when plasmapheresis

Question 4a
No, in general, but yes when a specific product is needed (PvB19/irradiated/HLA identical platelets, etc, this is only once at the beginning of the specification via paper- + electronic order. After that, it is automatically continued, also in electronic patient file, unless physician confirms that indication is no longer needed).

Question 4b
Yes, see 4.a

Question 5
Only when it means that there are specific laboratory or product requirements. For example, sickle cell (extended blood group typing, use of ATG, SCTx or MDS → irradiation, etc).

Question 6
Yes.

Neonates.

- <7 days and born <32 weeks and/or <1500 g and with respiratory or circulatory support: Hb 8 mmol/l = 12.8 g/dl
- <7 days and born <32 weeks and/or <1500 g and no respiratory or circulatory support: Hb 7 mmol/l = 11.2 g/dl
- <7 days, born >32 weeks and/or >1500 gram and with respiratory or circulatory support: Hb 7 mmol/l = 11.2 g/dl
- <7 days, born >32 weeks and/or >1500 g and no respiratory or circulatory support: Hb 6 mmol/l = 9.6 g/dl
- >7 days, regardless of gestational age or birthweight and with respiratory or circulatory support: Hb 5 mmol/l = 8 g/dl
- >7 days, regardless of gestational age or birthweight and no respiratory or circulatory support: Hb 4 mmol/l = 6.4 g/dl

Children.

- In need of ventilator or circulatory support: Hb 6 mmol/l = 9.6 g/dl
- In need of oxygen or otherwise critically ill but no (not yet) ventilator or circulatory support: Hb 5 mmol/l = 8 g/dl
- Stable clinical condition and anaemia secondary to regeneration (chemo/bone marrow failure: Hb 4.3 mmol/l = 7 g/dl
- Stable clinical condition, able to compensate for anaemia and acute or chronic anaemia (for other reasons than regeneration, e.g. iron deficiency): Hb 3.5–4 mmol/l = 5.6–6.4 g/dl
- Stable condition, but autoimmune haemolytic anaemia, able to compensate: Hb 3.5 mmol/l = 5.6 g/dl
- Presurgery and stable condition Hb 4 mmol/l = 6.4 g/dl

Question 7
Yes

Neonates.

- < or >7 days independent for gestational age or birthweight and with major bleeding (e.g. IVH/pulmonary haemorrhage): platelets >50, first 48 h try >100
- <7 days and born <32 weeks and/or <1500 g and with respiratory or circulatory support or with major bleeding (e.g. IVH/pulmonary haemorrhage): platelets >50
- < or >7 days independent for gestational age or birthweight but with no respiratory or circulatory support: platelets >20
- Presurgery (large surgery) independent for gestational age or birthweight: platelets >50
- In case of maternal IgG auto-antibodies (maternal ITP): platelets >20, preferably with IVIG, otherwise in first 5 days of life with platelet transfusion

Children.

- In need of major bleedings (e.g. intracranial and trauma): platelet >100
- In need of ventilator or circulatory support: platelets >50
- In need of ECMO or LVAD and bleeding: platelets >80
- In need of ECMO or LVAD and not bleeding: platelets >50
- In need of regenerative thrombocytopaenia and with bleeding and/or major surgery and/or: platelets >50
- In need of regenerative thrombocytopaenia and no bleeding nor major surgery nor anticoagulative therapy: platelets >10 if also on chemotherapy, >5 if secondary to bone marrow failure
- In case of surgery (preventive) or in case of bleeding in patients with thrombocytopathy: 20 ml/kg, with maximum of 1 unit
- Stable condition, but autoimmune thrombocytopaenia (ITP): none unless acute, major bleeding

Question 8
No, indications to diffuse.

Subject 3. Product manipulations for paediatric and neonatal patients

Question 1
Yes.

- Neonates <32 weeks or <1500 g BW for 6 months
- Intrauterine transfusions, for 6 months postnatally
- Autologous stem cell transplantation
- Allogenic stem cell transplantation
- Use of ATG/Fludarabin/Campath
- Severe combined immune deficiency or selective severe T-cell defects elevating the risk on TA-GvH

Question 2
Yes, all blood component transfusions are LD; this is the standard of the Dutch Blood Supply Company Sanquin

Question 3
Yes, rarely used, but possible indications are severe allergic reactions, pneumococcal-mediated HUS (T-antibody involvement) and only in PNH when routine blood products clearly lead to aggravation of haemolysis, not routinely.

Question 4
No, we do not, it will take a minimum of 30–45 min before it is thawed.

Question 5
No.

Question 6
Yes.

All girls and patients with MDS and auto-antibodies against red blood cells: also cEK

All haemoglobinopathies: cEK, Fy a/b, Jk a/b, MNSs.

Question 7
Yes, but this is not specific for our hospital laboratory, it is arranged but the Dutch blood Supply Company

Sanquin: routinely in case of intrauterine blood transfusion and on indication for individual needs (e.g. critically sick child with SCID pretransplantations, still CMV negative).

Subject 4. Blood product dosing

Question 1
10–15 ml/kg, maximum 2 units.

Question 2
15–20 ml/kg, maximum 1 unit.

Question 3
10–15 ml/kg, amount of units depend, usually maximum one, but for the children on ECMO, we sometimes provide continuously for 24 h (4 × 6 h).

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Brazil

Subject 1. Hospital and transfusion service demographics

Question 1
We are a tertiary care facility located in São Paulo city, SP, Brazil.

Question 2
We are a teaching/academic hospital with a Nursing college, a Medical College, a Research Institute, Medical Internship programmes and a Graduate Program in Health Sciences.

Question 3
All the blood components are collected, tested and prepared at our own facility.

Question 4
The following age thresholds are used to define our paediatric population:
(a) Neonate patient: less than 28 days old.
(b) Paediatric patient: 29 days old to less than 18 years old.

Question 6
We are a 650-bed hospital for both adult and paediatric patients.

A total of 106 inpatient beds are available for paediatric patients with the following distribution:
(a) Paediatric Ward: 20 beds;
(b) Paediatric Intensive Care Unit: 18 beds;
(c) Neonatal Ward: 46 beds;
(d) Neonatal Intensive Care Unit: 22 beds.

Question 7a
Yes.

Question 7b
Yes.

Question 7c
Yes.

Question 7d
Yes.

Question 7e
Yes.

Question 7f
Yes.

Question 7g
Yes.

Question 7h
Yes.

Question 7i
Yes.

Question 7j
Yes.

Question 7k
Yes.

Question 7l
Yes.

Question 7m
Yes.

Question 7n
Yes.

Question 7o
Yes.

Question 7p
Yes.

Additionally, we provide specialties for paediatric and neonatal patients for Orthopedics and Fetal Medicine.

Question 8a
We define paediatric transfusion dose according to a patient's body weight.

Seven hundred and eight RBCs transfusions are done per year in both paediatric and neonatal patients at our facility.

Question 8b
The transfused RBCs distribution according to patient's age is described below:
(a) Younger than 1 month: 114 transfusions
(b) 1–4 months: 98 transfusions
(c) Older than 4 months: 496 transfusions (4 months to 1 year old: 64 transfusions; >1 year old: 432 transfusions)

Question 9a
Eighty-six FFP transfusions are done per year in both paediatric and neonatal patients.

Question 9b
The transfused FFP distribution according to patient's age is described below:
(a) Younger than 1 month: 28 transfusions
(b) 1–4 months: 17 transfusions
(c) Older than 4 months: 41 transfusions (4 months to 1 year old: 10 transfusions; >1 year old: 31 transfusions)

Question 10a
Five hundred and four platelet transfusions are done per year in both paediatric and neonatal patients.

Question 10b
The transfused platelet distribution according to patient's age is described below:
(a) Younger than 1 month: 58 transfusions
(b) 1–4 months: 39 transfusions
(c) Older than 4 months: 407 transfusions (4 months to 1 year old: 32 transfusions; >1 year old: 375 transfusions)

Subject 2. Transfusion indications for paediatric and neonatal patients

Question 1
Brazil does not have specific guidelines for neonatal and paediatric populations regarding transfusion thresholds. However, we do have specific recommendations for irradiation and leukorredution of red blood cell units for the paediatric population, as mentioned in Subject 3, questions 1 and 2.

Questions 2 and 3
Our hospital has a list of indications for RBC, plasma and platelet transfusion [1–4], as follows:
(a) RBC:
  (i) Infants younger than 4 months:
  Haematocrit <20% with low reticulocyte count and symptomatic anaemia (tachycardia, tachypnea, poor feeding)
  Haematocrit <30% and either of the following:
  Tachypnea (respiratory rate >80 beats/min), tachycardia (heart rate >180 beats/min) for at least 24 h
  Significant bradycardia or apnoea
  Oxygen support by nasal cannula
  Continuous positive airway pressure support or mandatory ventilation on mechanical ventilation with mean airway pressure under 6 cm of water
  Low weight gain (<10 g/day observed over 4 days, provided that there is adequate calories intake)
  On <35% oxygen hood
  Haematocrit <35% and either of the following
  Continuous positive airway pressure support or mandatory ventilation on mechanical ventilation with mean airway pressure >6 cm of water
  On >35% oxygen hood
  Haematocrit <45% and either of the following:
  Congenital cyanotic heart disease
  Extracorporeal membrane oxygenation support
  (ii) Paediatric patients:
  Haemoglobin<7 g/dl (Haematocrit <21%) in:
  Stable, noncyanotic patients. Unstable children will be transfused at their physician's discretion
  Active bleeding with evidence of inadequate oxygen tissue delivery
  Haematocrit <24% and either of the following:
  Symptomatic anaemia
  Under chemotherapy or radiotherapy
  Acute blood loss nonresponsive to volume replacement
  Haematocrit <40% and either of the following:
  Severe pulmonary disease

Extracorporeal membrane oxygenation support

(b) FFP:
  (i) Neonates and children:
  Clinically significant bleeding or prior to invasive procedures with a significant bleeding risk with abnormal coagulation profile defined by APTT or PT above the normal gestational and postnatal age-related reference range.

(c) Cryoprecipitate:
  (i) Neonates and children:
  Fibrinogen <1 g/l for surgery with significant bleeding risk or at critical sites;
  Dysfibrinogenaemia with active bleeding or undergoing invasive procedures.
  Factor XIII deficiency with active bleeding or while undergoing invasive procedures in the absence of factor XIII concentrate
  Patients on ECMO with fibrinogen levels < 0.25 g/l

(d) Platelets:
  (i) Prophylactic transfusion:
  Platelet count <10–20 $\times$ 10^9/l in stable paediatric patients
  Platelet count <30 $\times$ 10^9/l in stable neonates
  Platelet count <50 $\times$ 10^9/l before invasive procedure
  Platelet count <100 $\times$ 10^9/l before neurosurgery
  (ii) Therapeutic transfusion:
  Platelet count <50 $\times$ 10^9/l and active bleeding in stable neonates
  Platelet count <100 $\times$ 10^9/l in neonate with disseminated intravascular coagulation or unstable premature neonates
  Platelet dysfunction
  Patients on ECMO support with active bleeding or platelet count <50 $\times$ 10^9/l or <100 $\times$ 10^9/l if intracranial bleeding

Question 4

It is not mandatory that the physician ordering the transfusion provides the indication by the time the blood products are ordered. However, transfusion staff does perform a critical analysis before preparing blood components to check compliance with our guidelines. If the transfusion is considered not appropriate, a Blood Bank physician will contact the physician who prescribed the blood component so that the latter can provide the reasons why the transfusion was ordered.

Question 5

It is mandatory that the person ordering transfusion provides patient's diagnosis when blood products are prescribed.

Question 6

Our hospital has thresholds for RBC transfusion, as described in question 3 above.

Question 7

Our hospital has thresholds for platelet transfusion, as described in question 3 above.

Question 8

Our hospital has thresholds for plasma transfusion, as described in question 3 above.

Subject 3 Product manipulations for paediatric and neonatal patients

Question 1

Our transfusion service provides irradiated blood components which are recommended in the following conditions:

(a) Low birthweight newborn (<1200 g)
(b) Premature newborn (<28 weeks of gestation)
(c) Neonate and paediatric patients with severe congenital immunodeficiencies
(d) Transfusion of blood components from relatives and HLA compatible donors
(e) Intrauterine transfusion
(f) Massive transfusion. RBCs must be transfused up to 24 h postirradiation

Question 2

Our transfusion service provides leucodepleted blood components which are recommended in the following conditions:

(a) HLA alloimmunization prevention
(b) Febrile nonhaemolytic transfusion reaction prevention
(c) Chronic transfusion regimen (i.e. haemoglobinopathies and myelodysplastic syndrome)
(d) Prestorage leucodepleted blood components are accepted as surrogate for CMV-negative products in our country. Therefore, transfusion of CMV-negative or prestorage leucodepleted blood components is recommended in the following conditions:
  (i) Low birthweight newborn (<1200 g)
  (ii) Neonate whose mother is CMV negative or unknown CMV status
  (iii) Intrauterine transfusion
  (iv) Bone marrow transplant recipient with CMV-negative donor
  (v) Solid organ transplant recipient with CMV-negative donor

Question 3

Our transfusion service provides washed RBCs which are recommended for patients who have had severe allergic or anaphylactic reactions in previous transfusion.

Question 4
Our transfusion service does not maintain a stock of thawed plasma for immediate use.

Question 5
Our transfusion service does not provide pathogen-inactivated blood products.

Question 6
Our transfusion service provides prophylactically matched RBC units for Rh, Kell, Duffy, Kidd and MNS antigen systems for chronically transfused patients with hereditary haemoglobinopathies and myelodysplastic syndrome.

Question 7
We do not provide other specific tests for paediatric patients.

Question 8
Our transfusion service does have a procedure to minimize the number of donors the patients are exposed to. Once a RBC unit is selected to a neonate or paediatric patient, we try to transfuse aliquots of the same unit whenever feasible.

Question 9
Our transfusion service uses small-volume test-tubes (i.e. 1·2 ml) to draw blood samples from neonates and paediatric patients.

Question 10
RBC units for massive transfusion, RBC exchange in neonates or intrauterine transfusion must be transfused up to 5 days after collection.

Subject 4. Blood product dosing

Question 1
We usually prepare 10–15 ml/kg body weight (b.w) of RBC for paediatric/neonatal patients.

Question 2
We usually prepare 10–15 ml/kg b.w. of platelets for paediatric/neonatal patients.

Question 3
We usually prepare 10–15 ml/kg b.w. of plasma for paediatric/neonatal patients.

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4 Yuan S, Tsukahara E, De La Cruz K, *et al.*: How we provide transfusion support for neonatal and pediatric patients on extracorporeal membrane oxygenation. *Transfusion* 2013; **53**:1157–1165

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Spain

Subject 1. Hospital and transfusión service demographics

Question 1
Spain

Question 2
Yes, it is a university hospital.

Question 3
We receive the blood components from the Regional Blood Center (Centro de Transfusion Comunidad de Madrid, CTCM). They provide the blood components, and we prepare them for transfusion.

Question 4a
Neonate: less than 30 days old.

Question 4b
Paediatric: less than 18 years old.

Question 5
Yes, it is a monographic paediatric hospital constituted by 180 inpatient beds.

Question 6
No, it is only for paediatric patients.

Question 7a
There are Allergy and Rheumatology services, but not Immunology.

Question 7b
Yes

Question 7c
Yes

Question 7d
Yes

Question 7e
Yes

Question 7f
No

Question 7g
Yes

Question 7h
Yes

Question 7i
No

Question 7j
Yes

Question 7k
Yes

Question 7l
Yes

Question 7m
General surgery, neurosurgery, traumatology, plastic surgery, urology.

Question 7n
Yes

Question 7o
Yes

Question 7p
Yes

Question 8a
1800–2000 RBCs.

Question 8b
All of them have been older than 4 months. There is not a neonatal department, so neonatal patients are not admitted.

Question 9a
150–250 plasma units.

Question 9b
All of them have been older than 4 months (no neonatal department).

Question 10a
1300–1500 platelet units.

Question 10b
All of them have been older than 4 months (no neonatal department).

Subject 2. Transfusion indications for paediatric and neonatal patients

Question 1b
Yes. Guide for the transfusion of blood components and plasma derivatives, 5th edition, SETS (Spanish Society of Blood Transfusion and Cellular Therapy).

(a) Criteria vary according to age: preterm infants, under 4 months, older than 4 months.

Question 2b
Yes; elaborated by transfusion Committee based on the guide for the transfusion of blood components and plasma derivatives of the Spanish Society of Blood

Transfusion and Cellular Therapy: Blood Derivatives Transfusion Guide (Code: CTR-DC-002).
(a) They differ according to the weight and age.

Question 3b
Yes. Elaborated by transfusión Committee based on the guide for the transfusion of blood components and plasma derivatives of the Spanish Society of Blood Transfusion and Cellular Therapy: Blood Derivatives Transfusion Guide (Code: CTR-DC-002). See the indications on question 6, 7 and 8.

Question 4b
Yes, they must provide the indication for the transfusion.
(a) The indication is entered electronically.

Question 5
Yes, they must provide the patient's diagnosis at the time of ordering blood products.

Question 6b
Yes. Elaborated by transfusion Committee based on the guide for the transfusion of blood components and plasma derivatives of the Spanish Society of Blood Transfusion and Cellular Therapy: Blood Derivatives Transfusion Guide (Code: CTR-DC-002) [1].
(a) Thresholds for paediatrics:
Paediatrics <4 months:
- Hb <7 g/dl with low reticulocytes and anaemia symptoms.
- Hb <9 g/dl if:
  - Oxygen requirements with CPAP or mechanic ventilation with FiO_2 30–35% or high flow rate with more than 1 l/kg and FiO_2 30–35% or oxygen glasses with >2 l/min and saturation ≤92%.
  - Signs of apnoea, bradycardia, tachycardia or tachypnoea and low weight gain (≤10 g/day for 4 days receiving ≥100 kcal/kg/day).
- Hb <9 g/dl if:
  - Oxygen requirements with CPAP or mechanic ventilation with FiO_2 ≥35% or high flow rate with more than 1 l/kg and FiO_2 ≥35% and saturation ≤92%.
  - Preoperative anaemia
- Hb <15 g/dl with: congenital cyanotic cardiopathy or oxygenation with extracorporeal membrane.

Paediatrics >4 months:
- Hb <7 g/dl with chronic anaemia and/or not responding to specific and symptomatic treatment.
- Hb 7–10 g/dl according to the clinical situation:
  - Acute loss of ≥25% of blood volume.
  - Preoperative Hb <8 g/dl or losses above 15% of the blood volume.
  - Hb <8 g/dl and treatment with chemotherapy and/or radiotherapy.
- Hb <13 g/dl and severe pulmonary disease, cyanotic cardiopathy or oxygenation with extracorporeal membrane with descent of O_2 saturation.

Question 7
Yes. Elaborated by transfusión Committee based on the guide for the transfusion of blood components and plasma derivatives of the Spanish Society of Blood Transfusion and Cellular Therapy: Blood Derivatives Transfusion Guide (Code: CTR-DC-002) [1].
(a) Thresholds for paediatrics and neonates:
They should be transfused below the following figures:
- Platelets $<20 \times 10^9$/l and asymptomatic
- Platelets between 30 and 50×10^9/l in unstable patient:
  - Premature in their first week of life and/or <1 kg.
  - Premature with bleeding Grade III or IV
  - Newborns with signs of bleeding
  - Need for invasive procedures or administration of drugs that alter platelets
  - Platelets $<50 \times 10^9$/l and
- Need to perform an invasive procedure or exchange transfusion
- Platelets $<100 \times 10^9$/l before a major surgery

Question 8
Yes. Elaborated by transfusión Committee based on the guide for the transfusion of blood components and plasma derivatives of the Spanish Society of Blood Transfusion and Cellular Therapy: Blood Derivatives Transfusion Guide (Code: CTR-DC-002) [1].
(a) Thresholds for paediatrics and neonates:
(i) Prior to invasive procedures or surgery if INR (international normalized ratio) >1·5 or 2 times above normal value.
(ii) Replacement treatment for disseminated intravascular coagulation or massive transfusion.
(iii) Deficit of coagulation factors, with haemorrhage prior to invasive procedures or surgery, if the specific coagulation factor is not available for administration.
(iv) Thrombotic thrombocytopenic purpura.
(v) In the case of fulminant purpura of the newborn due to protein C and S deficiency, if specific concentrates of these factors are not available for administration.

(vi) For reconstitution of the erythrocytes concentrate, when total blood is not available for the realization of exchange transfusion.
(vii) If is necessary to revert the effect of the vitamin K-dependent anticoagulants, we recommend to use vitamin K in the first place. In situations with vital risk of bleeding or urgent invasive procedure, Complex Prothrombin concentrate will be administered, if is not available, fresh frozen plasma will be used.

Subject 3. Product manipulation for paediatric and neonatal patients

Question 1b
Yes. Elaborated by transfusión Committee based on the guide for the transfusion of blood components and plasma derivatives of the Spanish Society of Blood Transfusion and Cellular Therapy: Blood Derivatives Transfusion Guide (Code: CTR-DC-002) [2].

Indications for irradiation

- Severe immunodeficiency syndromes.
- Receptors of Allogeneic Hematopoietic Stem Cell Transplantation (HSCT) from the beginning of the conditioning until the patient is receiving prophylaxis for graft-versus-host disease.
- Patients with Hodgkin lymphoma.
- Patients treated with purine analogs (fludarabine, cladribine and deoxycoformycin).
- Exchange transfusion in intrauterine transfusion receptors.
- Receivers of intrauterine transfusions (UTI) up to 6 months after the probable date of birth (40 weeks of gestation) or if the donation comes from a first or second family degree.
- Patients undergoing bone marrow or peripheral blood progenitor extraction for autologous reinfusion from 7 days before and during the collection.
- Patients undergoing transplantation of autologous haematopoietic progenitors (HSCT) since the beginning of the conditioning up to 3 months after transplantation (6 months if total body irradiation was used in conditioning).
- Patients treated with alemtuzumab (anti-CD52).
- Patients with aplastic anaemia treated with antithymocyte gamma globulin.

Question 2b
Yes. All of them are leucodepleted according to national requirements

Question 3b
Yes, provided by the regional blood centre.

(a) Ig A deficit.

Question 3a
No, we do not maintain a stock of thawed plasma units.

Question 4b
Yes; all plasma units are inactivated according to the CTCM standard procedure. The inactivation protocol varies annually according to a public assignment procedure, being more frequent inactivation with blue methylene in the last years. Also, a small proportion of platelet units are inactivated with Amotosalen.

Question 5b
In girls, we match the following antigens Rh and Kell, as referred in SOP SET-PT-035.

Question 6
Yes, we matched blood components for CMV in haematopoietic stem cell transplantation receptors.

We carry out studies such as direct Coombs test, detection of irregular antibodies by indirect Coombs test, identification of them by panels or extended phenotype studies; the rest of the extended or complementary studies are provided by Regional Blood Center.

Question 7
Yes, we aliquot the units and prioritize the use of apheresis platelets instead of pools.

Question 8
No.

Question 9a
No.

Subject 4. Blood product dosing

Question 1
Units or half unit according to the weight.

Question 2
Five unit pools or apheresis products for patients over 30 kg, and half apheresis for those less than 30 kg.

Question 3
10–20 ml/kg adjusted to plasma units volume (250 cc).

References

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Japan

Subject 1. Hospital and transfusion service demographics

Question 1
Japan.

Question 2
Yes.

Question 3
All the allogenic blood products are from the Japanese Red Cross Blood Center, and autologous blood products are prepared in our hospital.

Question 4a
Less than 30 days old.

Question 4b
Between 30 days old and 15 years.

Question 5
No.

Question 6
Yes. About 20 beds.

Question 7a
No.

Question 7b
Five physicians.

Question 7c
One physician.

Question 7d
Two physicians.

Question 7e
No.

Question 7f
No.

Question 7g
Yes.

Question 7h
Seven physicians.

Question 7i
No.

Question 7j
Four physicians.

Question 7k
Three physicians.

Question 7l
One physician.

Question 7m
Five physicians.

Question 7n
Four physicians.

Question 7o
Yes (at the Dept. of Otolaryngology).

Question 7p
Yes (at the Dept. of Palliative Care).

Question 8a
1260·24 units (in Japan, 1 unit is defined as that obtained from 200 ml of whole blood).

Question 8b
(a) 240·74 units.
(b) 79·5 units.
(c) 940 units.

Question 9a
406 units (in Japan, 1 unit is defined as 120 ml of plasma).

Question 9b
(a) 134 units.
(b) 40 units.
(c) 232 units.

Question 10a
8067 units (in Japan, 1 unit is defined as 2×10^{10} counts/bag)

Question 10b
(a) 647 units.
(b) 90 units.
(c) 7330 units.

Subject 2. Transfusion indications for paediatric and neonatal patients

Question 1
Yes.
(a) We have just revised the guideline for neonatal and paediatric (up to 4 months) transfusions. The threshold for the administration of each labile blood for neonates is somehow different from that for adults. The indications for neonatal and paediatric transfusion are as follows:
  (i) RBC transfusion will be considered; (1) if the patients' Hb is equal to or lower than 7 g/dl when the patients are in a stable condition; (2) if the patients' Hb is equal to or lower than 11 g/dl when the patients are chronically dependent on oxygen administration; and (3) if the patients' Hb is equal to or lower than 12 g/dl when the patients are the neonates within 24 h after birth or neonates under intensive care treatment. RBC storage less than 2 weeks from donation is preferable, and 10–20 ml/kg of RBC will be given at a speed of 1–2 ml/kg/h if there are no signs of congestive heart failure in the patients. If there are signs of congestive heart failure, RBC transfusion will be discussed separately. Because transfusion of RBC using the needle thinner than 24 gauge with pressure pump may cause haemolysis, careful attentions need to be paid to this kind of haemolysis. RBC transfusion should be finished within 6 h after opening the bag. If the duration of transfusion exceeds 6 h, RBC should be aseptically divided into small bags and stored at 2–6°C until use.
  (ii) (1) Platelet concentrate transfusion should be considered if the platelet count is lower than 2–3×10^3/μl when the patients are stable and have no signs of bleeding. Higher platelet counts are recommended for the premature infants within a few days after birth. (2) Platelet concentrate administration will be considered when the platelet count is lower than 3×10^3/μl if the patients are diagnosed as NAIT (neonatal alloimmune thrombocytopenia). (3) Platelet count should be maintained at more than 5×10^3/μl when the patients are infants with very low birthweight, with any signs of bleeding or undergoing invasive treatments. (4) Platelet count should be maintained at 5–10×10^3/μl when the patients are developing DIC or undergoing major surgeries.
  (iii) FFP should be administered; (1) when there is elongation of PT or APTT despite an administration of vitamin K, and there is bleeding or is undergoing invasive treatments; (2) when RBC transfusion exceeds half of the amount of circulating blood; and (3) when the patients are diagnosed with Upshaw–Schulman syndrome (congenital thrombotic thrombocytopenic purpura). FFP should be administered at 10–20 ml/kg every 12–24 h (1) and (2). In the case of (3), FFP should be administered at 10 ml/kg every 2–3 weeks. FFP can be substituted by saline solution in the case of the partial exchange transfusion for neonatal polycythemia.

Question 2
No.

Question 3
No.

Question 4
Yes.
(a) Yes.

Question 5
No. However, columns are available to enter the diagnoses of the patients, and physicians can input them on voluntary bases.

Question 6
Yes.
(a) For adult patients only.

Question 7
Yes.
(a) For adult patients only.

Question 8
Yes.
(a) For adult patients only.

Subject 3. Product manipulations for paediatric and neonatal patients

Question 1
Yes.
(a) All RBC and platelets are irradiated.

Question 2
Yes.
(a) All the labile blood products are leucodepleted and supplied by the Japanese Red Cross.

Question 3
Yes.
(a) Washed RBCs can be purchased from Japanese Red Cross, and we usually do not prepare washed RBC in our hospital. We have experience of preparing washed RBC only once for a patient with paroxysmal nocturnal haematuria.

Question 4
No.

Question 5
No.

Question 6
No.

Question 7
No.

Question 8
Yes.
(a) One unit RBC is provided split into up to 3 bags.

Question 9
No.

Question 10
No.

Subject 4. Blood product dosing

Question 1
0·5–2 units (in Japan, 1 unit is defined as that obtained from 200 ml of whole blood).

Question 2
5–20 units (in Japan, 1 unit is defined as 120 ml of plasma)

Question 3
1–3 units (in Japan, 1 unit is defined as 2×10^{10} counts/bag)

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Paola Maria Manzini, Giuseppina Facco & Clara Pecoraro

Italy

Subject 1. Hospital and transfusion service demographics

Question 1
Our hospital is located in North West Italy in the city of Torino.

Question 2
It is a teaching academic hospital.

Question 3
The Blood Establishment, from which we receive blood components, is part of our facility.

Question 4
At our hospital, an age thresholds of less than 30 days old is used to define neonate while a thresholds of less than 18 years old define paediatric patients.

Question 5
No.

Question 6
Our hospital treats both adult and paediatric patients and has nearly 300 inpatient beds for paediatric and neonatal patients.

Question 7a
Yes.

Question 7b
Yes.

Question 7c
Yes.

Question 7d
Yes.

Question 7e
Yes.

Question 7f
Yes.

Question 7g
Yes.

Question 7h
Yes.

Question 7i
Yes.

Question 7j
Yes.

Question 7k
Yes.

Question 7l
Yes.

Question 7m
Yes.

Question 7n
Yes.

Question 7o
Yes.

Question 7p
Yes.

Additionally, our hospital provides solid organ transplants for paediatric and neonatal patients.

Question 8a
Around 3000 RBCs are transfused to paediatric and neonatal patients every year.

Question 8b
(a) Nearly 300 RBCs to neonates younger than 1 month old.
(b) 180 RBCs to paediatric patients between 1 and 4 months old.
(c) 2500 RBCs to paediatric patients between 4 months and 18 years old.

Question 9a
Around 1300 plasma units are transfused to paediatric and neonatal patients each year.

Question 9b
(a) 240 plasma units to neonates younger than 1 month old.
(b) 90 plasma units to paediatric patients between 1 and 4 months old.
(c) 1000 plasma units to paediatric patients between 4 months old and 18 years old.

Question 10a
Around 2000 platelet concentrates are transfused to paediatric and neonatal patients each year.

Question 10b
(a) 50 platelet concentrates to neonates younger than 1 month old.
(b) 15 platelet concentrates to paediatric patients between 1 and 4 months old.
(c) 1900 platelet concentrates to paediatric patients between 4 months old and 18 years old.

Subject 2. Transfusion indications for paediatric and neonatal patients

Question 1

In Italy, there is a national recommendation for Neonatal transfusion [1] (last revision in 2014), made by Italian Society of Transfusion Medicine (SIMTI), through a working group of medical experts, including transfusion medicine, foetal medicine, neonatology, paediatric intensive care and haematologist. The recommendation is shared by the Italian society of neonatology (SI). The main differences from adult guidelines concern:

- Blood component selection: from regular donors only, irradiated, then 'fresh' (before the end of Day 5 following donation) and with a 24-h shelf-life postirradiation for intrauterine transfusions (IUT) and exchange blood transfusion (EBT). In order to reduce donor exposure, small-volume splits of single donor (pedi-packs) are used for neonatal transfusions; blood components have to be prepared following the standards of The Guide to the Preparation, use and quality assurance of blood components, 19th Edition, European Directorate for the Quality of Medicines & HealthCare of the Council of Europe [2]
- Small-volume transfusions (15 ml/kg in nonbleeding neonates);
- Suggestions of restrictive RBCs transfusion thresholds in stable and nonbleeding patient. However, the final decision for transfusion is made by clinicians based on their clinical judgement.

Question 2

Our hospital has local policy that is available for clinicians on local network. In addition to the indications suggested at national level, our policy recommends the following:

- Blood component selection: from regular donors who have given at least two donations per year within the previous 2 years;
- Small-volume splits of single donor (pedi-packs, mean volume 70–80 ml) are stored for the same patient at least until T&S expiry date (72 h);
- Suggestions of restrictive RBCs transfusion thresholds in stable and nonbleeding patient, avoiding for very low birthweight (VLBW) and extremely low birthweight (EVLBW) haemoglobin levels below the lower limits tested in the Cochrane review (Table 3) [3].

Question 3

Our hospital has a list of indications for ordering RBC plasma and platelets; for paediatric transfusion, indication refers to BSH Guideline [4]. These indications include IUT, EBT, haemolytic disease of newborn (HDN), preterm anaemia and neonatal cardiac surgery.

Question 4

In our hospital it is mandatory, for the person ordering the transfusion, to provide the indication for the transfusion at the time that the blood products are ordered, at the moment the indication is chosen from a list present in the emocomponent order paper. By the end of 2019, an electronic order will be available.

Question 5

It is also mandatory for the person ordering the transfusion to provide the patient's diagnosis when blood products are ordered.

Question 6b

Our hospital has guidelines with threshold for RBC, plasma and platelets transfusion for adult patients as well as for paediatric and neonatal pts.

(a) See Table 1 for RBCs thresholds in stable nonbleeding neonatal patients. Indications do not exclude clinical evaluation by clinicians who eventually decide for transfusion.

Table 1. Haemoglobin threshold levels (g/l) (Haematocrit %) triggering RBC transfusion (modified by Whyte *et al.* [3])

Age in days	Blood sampling	Respiratory support	No respiratory support
1–7	Capillary	≤115 (35%)	≤100 (30%)
8–14	Capillary	≤100 (30%)	≤85 (25%)
≥15	Capillary	≤85 (25%)	≤75 (23%)

Question 7b

Thresholds for platelet transfusion in neonates are also suggested and are shown in Table 2. Indications do not exclude clinical evaluation by clinicians who eventually decide for transfusion.

Table 2. Platelets threshold levels (10^9/l) triggering platelet transfusion [1, 4]

Platelets count	Indication for transfusion
<30	Always indication for transfusion
30–49	Neonates with bleeding, current coagulopathy, before surgery, previous intracranial haemorrhage
50–99	Major bleeding or requiring major surgery
>100	Usually no indication for transfusion

Question 8
Our hospital does not have thresholds for plasma transfusion in paediatric and neonatal patients but suggests plasma use in neonates with clinically significant bleeding (including massive blood loss), prior to invasive procedures with a risk of significant bleeding, who have an abnormal coagulation profile, defined as a PT or APTT significantly above the normal gestational and postnatal age-related reference range and neonates who have congenital bleeding disorders, with no specific factor concentrate available. Our policy discourages the routine use of plasma to correct abnormalities of the coagulation screen alone in nonbleeding neonates and for prevention of intraventricular haemorrhage.

Subject 3. Product manipulations for paediatric and neonatal patients

Question 1
Our transfusion department offers irradiated products. Indications for irradiation are as follows: prevention of graft-versus-host disease and particularly in IUT, EBT and for all neonatal VLBW and ELBW patients; in paediatric patients with haematological malignancies and in liver transplantation patients younger than 4 years old.

Question 2
Since 2017, Italy has introduced universal leucodepletion so RBCs and platelets are all leucodepleted. Even before our department has always issued leucodepleted RBCs and platelets for IUT, EBT, neonatal transfusions and paediatric oncologic and haematologic patients.

Question 3
We also have the chance to offer washed RBCs. Indications are as follows: EBT and all patients with repeated serious allergic or anaphylactic or anaphylactoid reaction or patients considered to be at higher risk of an anaphylactic or anaphylactoid reaction due to selective severe IgA deficiency with or without anti-IgA antibodies. Washed RBCs are also delivered in operating room during liver transplant for patients younger than 8 months old.

Question 4
We do not maintain a stock of thawed plasma units for immediate issue.

Question 5
In our transfusion centre, we can offer pathogen-inactivated plasma, cryoprecipitate and cryoprecipitate-depleted plasma. Methods for inactivation are as follows: solvent/detergent and riboflavin/UV.

Question 6
Our transfusion department prophylactically matches, for all neonates and paediatric patients, RBCs C, c, E, e and Kell antigens other than ABO and RhD.

Question 7
Usually, we do not provide other specific tests for neonatal/paediatric patients, unless some peculiar condition as CMV-negative stem cell transplantation candidate where CMV-negative blood units are issued.

Question 8
In order to minimize number of donors, the patients are exposed to, for neonatal transfusion, we use small-volume splits of single donor (pedi-packs, mean volume 70–80 ml) and store them for the same patient at least until T&S expiry date (72 h to 3 days). During liver transplant, RBC units divided into two paediatric units are delivered coupled to be transfused one after the other in case of needing before transfusion of any other RBC.

Question 9
To minimize the volume of the samples drawn for laboratory testing, only small-volume test-tubes for collecting samples are used. A policy to reduce when possible frequency of sampling is applied in all departments.

Question 10
Irradiated RBCs with no more 5 days shelf-life postirradiation are used for all neonatal patients and paediatric patients younger than 6 months old. Five-day storage age RBCs are issued during liver transplant, for IUT, EBT and neonatal cardiac surgery. RBCs with a 24-h shelf-life postirradiation are used for IUT, EBT, neonatal cardiac surgery and liver transplant younger than 4 years old.

Subject 4. Blood product dosing

Question 1
For stable paediatric and/or neonatal patients, 5–10 ml/kg of RBCs is usually prescribed.

Question 2
For stable paediatric and/or neonatal patients, 10 ml/kg of platelet concentrate is usually prescribed.

Question 3
For stable paediatric and/or neonatal patients, 15–20 ml/kg of plasma [1, 4] is usually prescribed.

References

1 Antoncecchi S, Casadei AM, Del Vecchio A, *et al.*: Raccomandazioni per la terapia trasfusionale in Neonatologia. http://www.simti.it/Index.aspx?ok=1.
2 *The Guide to the Preparation, Use and Quality Assurance of Blood Components*, 19th edn. www.edqm.eu: European Directorate for the Quality of Medicines & HealthCare of the Council of Europe (EDQM).
3 Whyte R, Kirpalani H: Low versus high haemoglobin concentration threshold for blood transfusion for preventing morbidity and mortality in very low birth weight infants. *Cochrane Database Syst Rev* 2011; (11):CD000512
4 British Committee for Standards in Haematology. *British Committee for Standards in Haematology Clinical Guideline: Transfusion for Fetuses, Neonates and Older Children*. London: BCSH, 2016.

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Lakhvinder Singh, Rekha Hans, Ratti Ram Sharma & Praveen Kumar

India

Subject 1. Hospital and transfusion service demographics

Question 1
Our hospital is located in India.

Question 2
Ours is a major academic teaching hospital offering the widest possible selection of services. It is a large public tertiary healthcare institute and a referral centre for five provinces of north India. It conducts postgraduate and doctoral courses in all the major medical and surgical specialties and superspecialities. It also conducts graduate and postgraduate courses in nursing and medical laboratory technology. About 1·2–1·3 million patients visit the outpatient services (OPD) of our institute every year. It has inpatient bed strength of 2200 with an annual inpatient admission numbers ranging from 80 000 to 90 000.

Question 3
The institute has a Department of Transfusion Medicine, a hospital-based academic blood centre with postgraduate and doctoral programmes in the speciality. The Department collects around 60 000 units of blood, majority (>90%) from voluntary source, prepares blood components and performs mandatory screening for infectious markers (HIV-1&2, HBV, HCV, syphilis and malaria) and compatibility testing. The requisite blood components are issued to both adult and paediatric patients in emergency as well as for routine transfusions. The Dept. also has an active apheresis unit performing plateletpheresis, therapeutic plasma exchange and stem cell harvesting and cryopreservation.

Question 4a
A less than 30-day-old child is defined as a neonate in our Institute.

Question 4b
A less than 13 years old is defined as a paediatric patient in our Institute.

Question 5
Our Institute provides treatment for both paediatric and adult patients.

Question 6
Our Institute provides treatment for both paediatric and adult patients. In our institute, we have an Advanced Pediatric Care Centre with bed strength of 283 exclusively for paediatric patients in the same campus.

Question 7a
Yes.

Question 7b
Yes.

Question 7c
Yes.

Question 7d
Yes.

Question 7e
Yes.

Question 7f
Yes.

Question 7g
Yes.

Question 7h
Yes.

Question 7i
Yes.

Question 7j
Yes.

Question 7k
Yes.

Question 7l
Yes.

Question 7m
Yes.

Question 7n
Yes.

Question 7o
Yes.

Question 7p
Yes

Question 8a
On an average, 10 000–12 000 packed red blood cells (PRBC) units are transfused annually to paediatric and neonatal patients in our institute and in the year 2017–2018 (1 July 2017 to 30 June 2018), 12 144 units of PRBC were transfused.

Question 8b
(a) A total of 2754 PRBC units were transfused to the patients younger than 1 month, in the year 2017–2018 (1 July 2017 to 30 June 2018).
(b) A total of 1140 PRBC units were transfused to patients of 1–4 months, in the year 2017–2018 (1 July 2017 to 30 June 2018).
(c) A total of 8250 PRBC units were transfused to patients older than 4 months, in the year 2017–2018 (1 July 2017 to 30 June 2018).

Question 9a
On an average, 3000–3500 fresh-frozen plasma (FFP) units and 100–150 cryoprecipitate units are transfused annually to paediatric and neonatal patients in our institute and in the year 2017–2018 (1 July 2017 to 30 June 2018), and 3322 units of FFP and 91 units of cryoprecipitate were transfused.

Question 9b
(a) A total of 715 FFP units and 2 cryoprecipitate units were transfused to patients of younger than 1 month, in the year 2017–2018 (1 July 2017 to 30 June 2018).
(b) A total of 212 FFP units and 2 cryoprecipitate units were transfused to patients of 1–4 months, in the year 2017–2018 (1 July 2017 to 30 June 2018).
(c) A total of 2395 FFP units and 87 cryoprecipitate units were transfused to patients older than 4 months, in the year 2017–2018 (1 July 2017 to 30 June 2018).

Question 10a
On an average, 8000–8500 whole blood-derived random donor platelets (RDP) and 200–250 single-donor apheresis platelet (SDAP) units (split into aliquots) are transfused annually to paediatric and neonatal patients in our institute and in the year 2017–2018 (1 July 2017 to 30 June 2018), and 8055 RDPs and 227 SDAP were transfused.

Question 10b
(a) A total of 2386 RDPs and 16 SDAPs (split into aliquots) were transfused to patients of younger than 1 month, in the year 2017–2018 (1 July 2017 to 30 June 2018).
(b) A total of 320 RDPs and 8 SDAPs (split into aliquots units) were transfused to patients of 1–4 months, in the year 2017–2018 (1 July 2017 to 30 June 2018).
(c) A total of 5349 RDPs and 203 SDAPs (split into aliquots) units were transfused to patients older than 4 months, in the year 2017–2018 (1 July 2017 to 30 June 2018).

Subject 2. Transfusion indications for paediatric and neonatal patients

Question 1
There are evidence-based clinical practice guidelines developed by the National Neonatology Forum of India, October 2010, and are available to guide neonatal transfusion practice [1]. For paediatric transfusions, standard textbook and current international published guidelines are followed.

However, there are no national published guidelines for adult transfusion for comparison.

Question 2

Our institute has local protocols for paediatric and neonatal transfusions based on the current national and international guidelines. However, there are no published local guidelines for adult transfusion for comparison.

Question 3b

The neonatologists follow the National Neonatology Forum of India, October 2010, guidelines for ordering blood components for transfusion. For the paediatric age group; standard national and international guidelines are followed. On review of the blood requisitions for the last one year (1 July 2017 to 30 June 2018), the indications for blood component ordering are listed below:

Indications for RBC transfusion – (percentage of total RBC transfusions)

Neonates Medical (60%)	Exchange transfusion for neonatal sepsis (50%) and haemolytic disease of newborn (20%)
	Anaemia developing due to various other neonatal problems such as anaemia of prematurity and haemorrhagic disease of newborn (30%)
Neonates Surgical (40%)	Congenital malformations such as anorectal malformations, posterior urethral valves and cardiac anomalies such as Tetralogy of Fallot
Paediatrics Medical (69%):	Haematological malignancies (36%).
	Genetic disorders (26%) – thalassaemia.
	Anaemia due to
	(a) Acute infections (20%): pneumonia, meningitis, pyrexia of unknown origin with anaemia, acute respiratory distress syndrome
	(b) Chronic infections (8%): tubercular meningitis.
	(c) Other indications (10%): haemolytic-uraemic syndrome, chronic kidney disease and autoimmune haemolytic anaemias
Paediatrics Surgical (31%)	Abdominal mass, subacute intestinal obstruction, acute appendicitis.
	Congenital malformations – patent ductus arteriosus, ventricular septal defects, hydrocephalus, pelvic-ureteric junction obstruction.
	Childhood malignancies and tumours such as Ewing's sarcoma, teratoma, germ cell tumours.
	Orthopaedic indications such as limb and spine fractures

Indications for plasma: (percentage of total plasma transfusions)

Neonate – Surgical (74%)	Congenital malformations – tracheo-oesophageal fistula (83·7%), intestinal atresias (16·3%)
Neonate – Medical (26%)	Double volume exchange transfusions (7·6%) Sepsis (92·4%)
Paediatric – Surgical (37%)	Congenital malformations (83·7%) – intestinal atresias, malrotation, pelvic-ureteric junction obstruction, subacute intestinal obstruction
	Trauma (16·3%) – blunt trauma abdomen, fractures, limb injury
Paediatric – Medical (63%)	Bleeding disorders (6·3%) – haemophilia, protein C and S deficiency, factor deficiency.
	Acute infections (41·2%) – liver abscess, brain abscess, septic shock, postoperative sepsis, disseminated intravascular coagulopathy
	Chronic infections (6·3%) – tubercular meningitis, meningoencephalitis
	Haematological disorders (4·7%) – haemolytic-uraemic syndrome
	Haematological malignancies (41·5%) – acute lymphoblastic leukaemia, acute myeloid leukaemia, lymphoma

Indications for platelets: (percentage of total platelet transfusions)

Neonate – Surgical (81%)	Congenital malformations – such as tracheo-oesophageal fistula
Medical (19%)	Acute infections – early onset of neonatal sepsis, necrotizing enterocolitis
Paediatric – Medical (73%)	Haematological malignancies (75·8%) – such as acute lymphoblastic leukaemia, acute myeloid leukaemia and aplastic anaemia.
	Acute infections (24·2%) – pneumonia, meningitis, parvo virus infection
Surgical (27%)	Congenital malformations (98%) – such as tracheo-oesophageal fistula, Tetralogy of Fallot, intestinal atresia.
	Trauma (2%) – limb injury, blunt trauma abdomen

Question 4

It is not mandatory for the person ordering transfusion to provide the indication for the transfusion at the time the blood products are ordered. However, there is a provision for conveying the specific indication for blood component transfusion in the blood requisition form, which is subsequently entered electronically in the Hospital Information System.

Question 5

It is not mandatory for the person ordering transfusion to provide the diagnosis at the time the blood products are ordered. However, there is a provision for conveying the specific indication/diagnosis for blood component transfusion in the blood requisition form, which is subsequently entered electronically in the Hospital Information System. In addition, the importance of mentioning an indication/diagnosis on the blood order is also discussed in the hospital transfusion committee to provide necessary instructions to the user departments for compliance at regular intervals.

Question 6b

(a) The thresholds for RBC transfusion in neonates in our institute are given as below:
  (i) PCV <36% and requiring
    • >35% supplemental oxygen
    • MAP ≥6–8 cm H2O by CPAP or IMV
  (ii) PCV <31% and requiring
    • <35% supplemental oxygen or MAP <6 cm H_2O by CPAP or IMV
    • >9 episodes of apnoea and bradycardia in 12 h or 2 episodes in 24 h requiring bag and mask ventilation while on adequate methylxanthine therapy
  (iii) PCV <40% and
    • HR >180/min or RR >80/min persisting for 24 h
    • Wt gain <10 g/day for 4 days while on 100 Cal/kd/day
    • Undergoing surgery
  (iv) PCV <21% and
    • Asymptomatic with reticulocytes <100 000/μl (2%)

The thresholds for RBC transfusion for paediatric patients in our institute are given as below:

- Hb <10 g/dl in haemodynamically unstable patients.
- Hb <7 g/dl in haemodynamically stable patients.

Question 7b

Yes

(a) The thresholds for platelet transfusion in neonates in our institute are given as below:
  (i) Platelet count <50 000/μl in – any preterm infant (<33 weeks) in 1st week of life – clinically unstable term infants in 1st week of life – any neonate undergoing invasive procedure (e.g. ventricular tap) – preterm neonate who has to be started ibuprofen or indomethacin or who has recent-onset grade III/IV IVH
  (ii) Platelet count <20 000/μl in all stable infants beyond 1st wk of life without active bleeding.
  (iii) Platelet count <100 000/μl in the presence of alloimmune thrombocytopaenia
  (iv) Platelet count <100 000/μl in the presence of active major bleeding
(b) The thresholds for platelet transfusion for paediatric patients in our institute are given as below:
  (i) Platelet count <50 000/μl in case of active bleeding other than ecchymoses or petechiae.
  (ii) Platelet count <100 000/μl in intracranial bleeding or there is a condition that impairs platelet adhesion.
  (iii) Platelet count <10 000/μl when there is no evidence of active bleeding other than ecchymotic, petechial haemorrhages, and there is thrombocytopaenia from bone marrow suppression or severe sepsis.

Question 8b

(a) The thresholds for plasma transfusion for neonates in our institute are given as below:
  i Abnormal prothrombin time and activated partial thromboplastin time (PT ≥17 s is abnormal in both term and preterm. APTT of >45 s in term and >55 s in preterm).
(b) The thresholds for plasma transfusion for paediatric patients in our institute are given as below:
  i FFP transfusion is indicated in critically ill patients with coagulopathy associated with active bleed. International normalized ratio (INR) >1·5.

Subject 3. Product manipulations for paediatric and neonatal patients

Question 1b

Yes, the department of transfusion medicine has the facility for irradiation of blood components.

(a) Following are the main indications for irradiation:
  (i) Acute leukaemias (acute myeloid leukaemia, acute lymphocytic leukaemia)
  (ii) Intrauterine transfusions
  (iii) Patients undergoing stem cell transplantation.

Question 2b

Yes, the department of transfusion medicine provides buffy coat-depleted (1 log leucoreduced) RBCs to thalassaemia and haemato-oncology patients, and these units are further leucoreduced at bedside of the patient by using third-generation leucofilters.

Question 3b

Yes, the department of transfusion medicine offers washed RBCs for thalassaemia/multiply transfused patients who report recurrent severe allergic reactions to RBC transfusion.

Question 4a

No, the department of transfusion medicine does not stock thawed plasma units, but offer thawed plasma only on patient-specific demand.

Question 5a

No, the department of transfusion medicine does not has facility for pathogen inactivation.

Question 6b

Yes, the department of transfusion medicine prophylactically matches extended Rh blood group antigens (E, e, C,

c) and Kell antigen other than ABO and RhD for thalassaemia patients.

Question 7
Department of transfusion medicine does not screen the donor units, other than the infectious markers mentioned above in reply to question 3 (subject: 1), or CMV, due to its high prevalence in general population and it is difficult get a CMV-negative units.

Question 8
Department of transfusion medicine prepares Pedi bags from adult red cell units and split the single-donor apheresis platelet products for paediatric patients to minimize the donor exposure and optimize the product usage.

Question 9
Smaller blood volume samples are taken from neonates and younger paediatric patients for laboratory testing and they are run the dedicated equipments for their analysis.

Question 10
Department of transfusion medicine has a policy to reserve RBCs for maximum of 72 h for a particular patient after which it can be released for other patients for optimum usage of the product.

Subject 4. Blood product dosing

Question 1
- The usually prescribed red cell dose for neonates is 10 ml/kg over 4 h.
- The usually prescribed red cell dose for paediatrics-10–15 ml/kg.

Question 2
- The usually prescribed platelet dose for neonates is 10 ml/kg of PC over 1 h.
- The usually prescribed platelet dose for paediatrics is 10 ml/kg.

Question 3
- The usually prescribed plasma dose for neonates is 10 ml/kg over 2–3 h
- The usually prescribed platelet dose for paediatrics is 10–20 ml/kg

Reference
1 https://www.scribd.com/document/357493116/Nnf-Guidelines-2011 [Last accessed 10 July 2018].

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Agneta Wikman & Emöke Deschmann

Sweden

Subject 1. Hospital and transfusion service demographics

Question 1
Sweden.

Question 2
Karolinska University Hospital is a teaching/academic hospital in Stockholm.

Question 3
Blood is collected in our own collection centres and components are prepared in our own facility, a hospital blood bank.

Question 4a
Neonate is defined as less than 1 month old, corrected for gestational age.

Question 4b
Paediatric patients are less than 18 years old.

Question 5
No.

Question 6
At the hospital, both adult and paediatric patients are treated.
(a) The hospital has in total 212 paediatric inpatient beds. The paediatric departments are organized in themes, with 72 beds in neonatology, 28 beds in high specialty medicine (infections, allergy and respiratory disorders, obesitas, investigations NUD) 84 beds in surgery, paediatric intensive care unit, haematology, oncology, 28 beds in orthopaedics, neurology and habilitation.

Question 7
The hospital has all specialties listed, with reservation for heart transplantations that are not done at Karolinska. In addition, the hospital has an ECMO unit, where both neonatal and paediatric patients are treated.

Question 8a
3683 RBC transfusions were given to paediatric patients during 2017.

Question 8b
867 RBC transfusions were given in the Neonatology Department.

Information on the age of the recipients is not available.

Question 9a
1339 plasma transfusions were given to paediatric patients during 2017.

Question 9b
375 plasma transfusions were given in the Neonatology Department.

Information on the age of the recipients is not available.

Question 10a
1876 platelet transfusions were given to paediatric patients during 2017.

Question 10b
217 platelet transfusions were given in the Neonatology Department.

Information on the age of the recipients is not available.

Subject 2. Transfusion indications for paediatric and neonatal patients

Question 1
There are no Swedish national guidelines for neonatal and/or paediatric transfusions. Ongoing work for neonatal transfusions is not implemented yet.

Question 2
There are local guidelines at the hospital, specific for neonatal transfusions and more general for paediatric transfusions. The guidelines differ from adult guidelines, regarding the thresholds, indications and considerations.

Question 3
The hospital has no list of indications for ordering RBC/plasma/platelet transfusions to paediatric patients.

Question 4
It is not routine to provide the indication for the transfusion when ordering blood.

Question 5
No.

Question 6
The local guidelines have haemoglobin thresholds for neonatal RBC transfusions [1], but the general paediatric guidelines have not.

Neonates. Different thresholds, from Hb $\leq$120 to $\leq$85 g/l, EVF $\leq$0·35 to $\leq$0·25 depending of the age (day 1–15) and respiratory support or not.

Paediatrics. There are no strict general transfusion thresholds. Indication is based on status, circulation, cause of anaemia.

Question 7
The local guidelines have platelet count thresholds for neonatal platelet transfusions [1], but the general paediatric guidelines have not.

Neonates. Stable, platelet count $<30 \times 10^9$/l

BW <1500 g and <7 days old, coagulation disorder $<30–49 \times 10^9$/l

Bleeding, FNAIT with ICH, neurosurgery $<50–100 \times 10^9$/l

Paediatrics. No strict general platelet count thresholds. Indication based on bleeding tendency. Platelet

transfusion is not indicated in stable patients with platelet count >20 $\times$ 10^9/l.

Question 8
The local guidelines give no strict thresholds for plasma transfusion. Indications are coagulation disorder, DIC in septicaemia.

Subject 3. Product manipulations for paediatric and neonatal patients

Question 1
The transfusion department offers irradiated products, when requested. All neonates receive routinely irradiated products. In addition, stem cell transplanted patients and the majority of paediatric patients with malignant disorders receive irradiated products. Patients with nonmalignant haematological disorders such as sickle cell disease and thalassaemia do not receive irradiated products.

Question 2
The transfusion department provides universal leucodepleted blood products, since almost 20 years.

Question 3
Washed RBCs are offered to those with a previous severe allergic reaction.

Question 4
The transfusion department maintains a stock of thawed plasma units for immediate issue.

4 units of blood group AB plasma are always available at the blood bank, and also, thawed plasma of other blood groups is normally available. In addition, the trauma unit has 4 units of thawed AB plasma in an external fridge.

Question 5
All platelet units are pathogen-inactivated with Intercept® (Cerus) technology. Solvent–detergent plasma (Octaplas®, Octapharma AG, Austria) is available on special indications (e.g. regular plasma transfusions due to a coagulation factor deficiency, severe allergic reactions and plasmapheresis).

Question 6
RBCs are prophylactically matched for Rh, K, Kidd, Duffy for patients with chronic transfusion requirements (thalassaemia, sickle cell, etc) [2, 3]. In malignant disorders, RBCs are not routinely antigen-matched.

Question 7
Other than mandatory testing is done only on specific indications. For example, CMV is tested if granulocyte transfusions are given. In other blood components leucodepletion is considered sufficient not to transmit CMV, also in intrauterine blood transfusions.

Question 8
Procedures to minimize the number of donors the patients are exposed to are not routinely used, fresh blood components are normally prioritized.

Question 9
The neonatal ward has a policy to minimize the volume and frequency of the samples drawn for laboratory testing; small-volume test-tubes and priority of analyses have been implemented.

Question 10
The transfusion department has policies for the maximum storage age of RBCs that can be issued to specific patients. RBC paediatric units, 70 ml, is stored maximum 14 days after the day of collection and 24 h after irradiation, RBC units for paediatric patients and to all who requires chronic transfusions is less than 14 days. RBC units used for the preparation of blood exchange and prime blood are less than 5 days and maximum 24 h after irradiation [4].

Subject 4. Blood product dosing

Question 1
The dose of RBCs prescribed for stable patients is to neonates 15–20 ml/kgBW and to paediatric patients 10 ml/kgBW.

Question 2
The dose of platelets prescribed for stable patients is to neonates 10–15 ml/kgBW and to paediatric patients 10 ml/kgBW.

Question 3
The dose of plasma prescribed for stable neonates is 10 ml/kgBW. In the local paediatric guidelines, the plasma dosage is not mentioned.

References

1 Neonatal hematology and transfusion medicine. *Clin Perinatol* 2015; **42**:469–684
2 Matteocci A, Perelli L: Red blood cell alloimmunization in sickle-cell disease and in thalassemia: current status, future perspectives and potential role of molecular typing. *Vox Sang* 2014; **106**:197–208
3 La Salle-Williams M, Nuss R, Le T, *et al.*: Extended red blood cell matching for transfusion in sickle-cell disease: a review of 14 years experience from a single center. *Transfusion* 2011; **51**:1732–1739

4 Whole Blood Leukocyte-Depleted For Exchange Transfusion, p 418, EDQM, 19th edn, 2017.

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Hartirathpal Kaur, Joyce Ching Mei Lam, Selina Kah Ying Ho & Pei Lin Koh

Singapore

Subject 1. Hospital and transfusion service demographics

Question 1
Singapore.

Question 2
We are not a hospital, but we serve as Singapore's national blood service (Blood Services Group (BSG), Health Sciences Authority (HSA).

There are three main public hospitals in Singapore with neonate and paediatric services, and these are all teaching/academic hospitals. These hospitals are as follows:

1 KK Women's and Children's Hospital (KKH)
2 National University Hospital (NUH)
3 Singapore General Hospital (SGH – primarily neonates)

Blood Services Group (BSG), Health Sciences Authority (HSA), which serves as the national blood service of Singapore, supplies blood to the above hospitals. In addition, BSG also supplies blood and provide pretransfusion test services to a few private hospitals which may contribute to a small pool of the neonate/paediatric population who receives transfusion.

Question 3
See reply to Question 2.

Question 4a
<1 month.

Question 4b
<16 years old in KKH, <18 years old in NUH.

Question 5a
KKH is a paediatric and women specialty hospital with 365 beds for the paediatric specialty. The other hospitals are not paediatric specialty hospitals.

Question 6
All the hospitals stated in question 2 treat both adult and paediatric patients.

Question 6a
For SGH: neonatal intensive care unit 10, high dependency 18, nursery 20 (neonates only).

For NUH: 100 paediatric beds.

Question 7a
Yes at KKH and NUH.

Question 7b
Yes at KKH and NUH.

Question 7c
Yes at KKH and NUH.

Question 7d
Yes at KKH and NUH.

Question 7e
Yes at KKH and NUH.

Question 7f
Yes at KKH and NUH.

Question 7g
Yes at KKH and NUH.

Question 7h
Yes at KKH and NUH.

Question 7i
Yes at KKH and NUH.

Question 7j
Yes at KKH and NUH.

Question 7k
Yes at KKH and NUH.

Question 7l
Yes at KKH and NUH.

Question 7m
Yes at KKH and NUH.

Question 7n
Yes at KKH and NUH.

Question 7o
Yes at KKH and NUH.

Question 7p
Yes at KKH and NUH.

Question 8
The figures stated in Questions 8–10 refer to the number of blood product units supplied to neonates and paediatric patients from BSG, HSA across the various hospitals in Singapore over the last 1 year.

Question 8a
4394.

Question 8b
(a) 794.
(b) 530.
(c) 3070.

Question 9a
1063.

Question 9b
(a) 320.
(b) 106.
(c) 637.

Question 10a
2241.

Question 10b
(a) 310.
(b) 274.
(c) 1656.

Subject 2. Transfusion indications for paediatric and neonatal patients

Question 1
No.

Question 2
There are hospital-specific guidelines.

Question 2b
(a) Transfusion triggers.
(b) Provision of manipulated blood products for special groups: intrauterine transfusion, neonatl exchange transfusion, paediatric extracorporeal membrane oxygenation (ECMO), cardiac surgery.

Question 3b
Yes.
(a) Please see replies to questions 6–8 below for the indications.

Question 4b
Yes.
(a) KKH : yes.
(b) NUH: yes.
(c) SGH: yes.

Question 5
(a) KKH: no.
(b) NUH: no.
(c) SGH: no.

Question 6b
Below are the RBC transfusion thresholds for the three major paediatric hospitals.

Question 6b

KKH thresholds.

RBC transfusion thresholds for neonates

	Suggested transfusion threshold		
Postnatal age	**Ventilated**	**On oxygen or noninvasive positive pressure ventilation**	**Off oxygen**
First 24 h	<12	<12	<10
<Week 1 (day 1–7)	<12	<10	<10
Week 2 (day 8–14)>Week 3 (day 15 onwards)	<10	<9·5 <8·5	<7·5[a]

(Continued)

RBC transfusion thresholds for neonates

	Suggested transfusion threshold		
Postnatal age	**Ventilated**	**On oxygen or noninvasive positive pressure ventilation**	**Off oxygen**
Cumulative blood loss in 1st week of life in extremely low birthweight (Body weight <1 kg) infants requiring intensive care	10% blood volume		
Acute blood loss	10% blood volume or estimated (5 ml/kg RBC increases Hb by 1 g/dl)		

[a]It is accepted that clinicians may use up to 8·5 g/dl depending on clinical situation

RBC transfusion threshold for paediatrics

Clinical situation	**Hb transfusion trigger**
Patients undergoing chemotherapy	
Stable	8 g/dl
Unstable/febrile	9 g/dl
Patients with chronic anaemia on regular transfusion therapy	9 g/dl
Symptomatic patients or patients with ongoing blood loss	7 g/dl

NUH paediatric RBC transfusion thresholds.

1 Actively bleeding patient with haemodynamic compromise.
2 Symptomatic anaemia.
3 Regular transfusion for thalassaemia patients.
4 Hb <7 g/dl even if asymptomatic.
5 Hb <10 g/dl in hypoxic patients or patients with sepsis.

SGH neonate RBC transfusion thresholds.

1 Transfuse infants at haematocrit <25% (or Hb <8 g/dl) if the neonate is asymptomatic with reticulocytes <100 000/μl, at the discretion of the attending physician.
2 Transfuse infants at haematocrit less than 30% if:
   - There are significant apnoea and bradycardia (defined as >9 episodes in 12 h or 2 episodes in 24 h requiring bag-mask ventilation while receiving therapeutic doses of methylxanthines).
   - The patient requires nasal CPAP of 6 cm water or less (FiO_2 <35% by hood or nasal cannula).
   - The patient has persistent tachycardia (heart rate >180/min) or tachypnoea (respiratory rate of >80 breaths/min), persisting without other explanation for 24 h.
   - Weight gain of patient is deemed unacceptable (defined as weight gain of <10 g/day observed over 4 days) in the light of adequate caloric intake (at least 100 kcal/kg/day) without other explanation, such as known increases in metabolic demands or known losses in metabolic demands (malabsorption).
   - If the patient is scheduled for surgery, transfuse in consultation with the surgical team.
3 Transfuse for haematocrit levels of less than 35% in the following situations:
   - Infant with severe pulmonary disease [defined as requiring; FiO_2 >35% supplemental hood oxygen or continuous positive airway pressure (CPAP) or NIPPV or mechanical ventilation with a mean airway pressure of >6 cm water].
   - Infant with hypotension requiring pressor support or is critically ill.
   - Infant in whom anaemia may be contributing to heart failure.
4 Transfuse if there is a history of massive blood loss (blood volume of 80 ml/kg), at the discretion of the attending physician.
5 Transfuse if haematocrit levels less than 45% for babies on ECMO/cyanotic congenital heart disease.

Question 7b

Below are the platelet transfusion thresholds for the three major public hospitals with paediatric and/or neonatal service.

KKH.

Platelet transfusion thresholds for neonates

Indications for platelets transfusion	**Platelet count ($\times 10^9$/l)**
Neonates with no bleeding including neonates with NAIT if no bleeding and no family history of ICH	<25
Neonates with bleeding with current coagulopathy, before surgery, or infants with NAIT if previously affected sibling with ICH	<50
Neonates with major bleeding or requiring major surgery	<100

ICH, intracranial haemorrhage; NAIT, neonatal alloimmune thrombocytopaenia.

Platelet transfusion thresholds for paediatrics

Indications for platelet transfusion	**Platelet counts ($\times 10^9$/l)**
Bone marrow failure (eg aplastic anaemia)	10–20

(Continued)

Platelet transfusion thresholds for paediatrics	
Indications for platelet transfusion	**Platelet counts ($\times 10^9$/l)**
Patients undergoing chemotherapy	
Stable	20
Unstable/febrile	30
Prior to lumbar puncture	50
Prior to surgical procedures	50–80
Prior to neurosurgical procedures	100

NUH Paediatric platelet transfusion thresholds.

1 Bleeding patient with thrombocytopaenia to maintain platelet count more than 50×10^9/l or 100×10^9/l (critical site bleeding).
2 Severe thrombocytopaenia – platelet $<10 \times 10^9$/l (even if patient is not bleeding; exceptions: immune/idiopathic thrombocytopaenic purpura in which platelet transfusion alone will not bring up the platelet count) or platelet $<20 \times 10^9$/l (depending on assessment of bleeding risk, e.g. sepsis).
3 Before invasive procedure which may cause bleeding if platelet count $<50 \times 10^9$/l.
4 Before surgery if platelet counts less $<100 \times 10^9$/l to reduce risk of bleeding.

SGH neonate platelet transfusion thresholds	
Indications for platelet transfusion	**Platelet counts ($\times 10^9$/l)**
Well and stable babies	50
Active bleeding, definite threat of bleeding from an invasive procedure or surgery, major haemorrhage (Grade 3–4 IVH, evolving IVH, pulmonary haemorrhage),	100
Fulminant NEC, critically ill baby, NSAID therapy, sepsis and preterm babies <1500 g (in the first 2 weeks)	

IVH, intraventricular haemorrhage; NEC, necrotizing enterocolitis.

Question 8b

Below are the plasma transfusion thresholds for the three major paediatric hospitals.

KKH neonate and paediatric plasma transfusion thresholds.

1 Haemorrhagic disease of the newborn.
2 Significant coagulopathy, for example PTT >63 s or PT >25 s (1·5× longer than upper limit of normal range) with risk of significant bleeding or prior to invasive procedure.
3 Reversal of warfarin overdose, in combination with prothrombin complex concentrate (PCC) and vitamin K.
4 Clotting factor deficiencies for which no alternative clotting factor concentrates are available, for example factor XI deficiency.
5 Massive transfusion.

NUH paediatric plasma transfusion thresholds.

1 Bleeding patient with coagulopathy (defined as PT/aPTT >1·5 times upper limit of normal).
2 Prophylactic in patients with coagulopathy going for invasive procedure or surgery.
3 Plasma exchange.

SGH neonate plasma transfusion thresholds. Coagulopathy (PT >16 s PTT >60 s) with bleeding or risk of significant bleeding.

Subject 3. Product manipulations for paediatric and neonatal patients

Question 1b

Yes.

(a) Following are the indications which BSG follows in the supply of irradiated and leucoreduced blood products for patients of all ages:
  (i) Haematopoietic stem cell transplant recipients (autologous or allogenic), from the time of conditioning chemotherapy onwards;
  (ii) Intrauterine transfusions;
  (iii) Neonatal exchange transfusion subsequent to intrauterine transfusions;
  (iv) Patients currently or previously treated with the following medications:
    - Purine analogue drugs such as fludarabine, cladribine, deoxycoformycin and clofarabine.
    - Bendamustine
    - Campath (alemtuzumab)
    - Antithymocyte globulin (ATG);
  (v) Patients with suspected or confirmed congenital T-cell immune deficiency disorders;
  (vi) Recipients of donor units known to be from a 1st- or 2nd-degree blood relative;
  (vii) Human leucocyte antigen (HLA) compatible blood components and
  (viii) All granulocyte products.

Question 2b

Yes.

(a) Following are the indications which BSG follows in the supply of leucoreduced blood products for patients of all ages:

(i) Patients who have developed febrile nonhaemolytic transfusion reactions on two or more occasions.
(ii) CMV-seronegative recipients at risk of CMV transmission via transfusion, including:
- Patients undergoing bone marrow transplants (leucoreduced and irradiated)
- Neonates (1st 28 days of life)
- Premature infants and/or infants weighing less than 1200 g at birth
- Intrauterine transfusions or in neonates who previously received IUT (leucoreduced and irradiated).

(iii) Nonhepatic solid organ transplant organ candidates to reduce the rate of human leucocyte (HLA) alloimmunization.
(iv) Haematology patients likely to require regular transfusions of blood and blood components to reduce the rate of human leucocyte (HLA) alloimmunization.
(v) All neonates undergoing cardiac surgery.
(vi) All paediatric ECMO patients.

(b) Following are the indications which BSG follows in the supply of leucoreduced blood products for patients of all ages:
(i) Patients who have developed febrile nonhaemolytic transfusion reactions on two or more occasions.
(ii) CMV-seronegative recipients at risk of CMV transmission via transfusion, including:
- Patients undergoing bone marrow transplants (leucoreduced and irradiated)
- Neonates (1st 28 days of life)
- Premature infants and/or infants weighing less than 1200 g at birth
- Intrauterine transfusions or in neonates who previously received IUT (leucoreduced and irradiated).

(iii) Nonhepatic solid organ transplant organ candidates to reduce the rate of human leucocyte (HLA) alloimmunization.
(iv) Haematology patients likely to require regular transfusions of blood and blood components to reduce the rate of human leucocyte (HLA) alloimmunization.
(v) All neonates undergoing cardiac surgery.
(vi) All paediatric ECMO patients.

Question 3b
Yes.
(a) Following are the indications which BSG follows in the supply of washed RBCs for patients of all ages:
(i) IgA deficiency.
(ii) Severe allergic/anaphylactic transfusion reactions.

Question 4a
No.

Question 5a
No.

Question 6a
No.

Question 7
No. Leucoreduced blood products are provided as a measure for minimizing transfusion-transmitted CMV infection.

Question 8
No.

Question 9
Yes, please refer below:

KKH. Neonates aged below 4 months do not require routine cross-matching if the following criteria are met: BW <1·5 kg, pretransfusion ABO/Rh available, DCT negative, maternal ABO/Rh available, negative maternal antibody screen.

NUH. Paediatric blood tubes are used for group and cross-match and other blood investigations.

SGH (neonates).
- using microtubes and taking the bare minimum needed to run the sample.
- trending electrolytes using the microelectrolyte assay from the Arterial Blood Gas analyser in the neonatal intensive care unit.
- using transcutaneous CO_2 & O_2 monitors to minimize arterial blood gas sampling.
- Plan to also start transcutaneous serum bilirubin measurements to minimize blood taking.

Question 10a
No for NUH paediatrics.

Question 10b
Yes for KKH and SGH. Refer below.

Question 10c

SGH (neonates). Yes – Preference for as fresh as possible RBCs (within 3 days of collection), but have used up to 5-day-old RBCs when there are supply issues.

BSG recommends the following.
- For intrauterine transfusion and exchange transfusion: red cells less than 5 days from date of collection.

- Paediatric ECMO: red cells less than 7 days from date of collection.
- Neonates of infants <5 kg undergoing cardiac surgery: red cells less than 7 days from date of collection.

Subject 4. Blood product dosing

Question 1
10–20 ml/kg.

Question 2
10 ml/kg (10–20 ml/kg).

Question 3
10–15 ml/kg (10–20 ml/kg).

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Rachel Moss and Helen V. New

United Kingdom

Subject 1. Hospital and transfusion service demographics

Question 1
United Kingdom.

Question 2
Yes.

Question 3
Blood Centre.

Question 4a
First 28 days following birth.

Question 4b
Less than 18 years old.

Question 5
Yes, we are a paediatric specialty hospital with 350 inpatient beds.

Question 6
N/A.

Question 7a
Yes.

Question 7b
Yes.

Question 7c
No.

Question 7d
Yes.

Question 7e
Yes.

Question 7f
Yes.

Question 7g
No.

Question 7h
Yes.

Question 7i
Yes.

Question 7j
Yes.

Question 7k
Yes.

Question 7l
Yes.

Question 7m
Yes.

Question 7n
No.

Question 7o
Yes.

Question 7p
Yes.

Question 8a
5250 RBCs are transfused to paediatric and neonatal patients per year.

Question 8b
Information not available.

Question 9a
1700 plasma units are transfused to paediatric and neonatal patients per year.

Question 9b
Information not available.

Question 10a
4457 platelet units are transfused to paediatric and neonatal patients per year.

Question 10b
Information not available.

Subject 2. Transfusion indications for paediatric and neonatal patients

Question 1
Yes (New HV *et al*., on behalf of the British Society for Haematology. Guidelines on transfusion for fetuses, neonates and older children. *Br J Haematol* 2016; 175:784–828).

The aim of the guidelines is to provide healthcare professionals with clear guidance on the management of all aspects of paediatric transfusion, available all in one place. Unlike the UK adult transfusion guidelines, which mostly focus on specific areas of transfusion, the guidelines have a wide scope, including areas such as cardiac surgery and major haemorrhage. They review the paediatric-specific literature and make recommendations vs consensus-based 'key practice points' depending on the quality of evidence available. They include both clinical and laboratory sections, covering neonatal/paediatric transfusion indications, administration, pretransfusion testing and component selection, and details of specialized blood components for fetuses/neonates/infants.

Question 2
Yes, we have local guidelines specific for neonatal and paediatric transfusions. We have no adult guidelines.

Question 3
Yes, we have a list of indications for ordering RBC/plasma/platelets, but within the current 40-page blood transfusion policy and not succinct.

Question 4
It is currently not mandatory, but we will be introducing a new electronic patient record system in 2019 that will make it mandatory.

Question 5
No, it is not mandatory but is considered best practice to do so.

Question 6
For RBC transfusions, our thresholds are based on British Society for Haematology (BSH) guidelines (New *et al*., 2016).

Question 7
Our platelet transfusions are based on BSH guidelines (New *et al*., 2016).

Question 8
Our plasma transfusions are based on BSH guidelines (New *et al*., 2016).

Subject 3. Product manipulations for paediatric and neonatal patients

Question 1
Yes, we offer irradiated products. Please see attached document 'Blood Transfusion Special Requirements'.

Question 2
Yes, we offer leucodepleted RBCs. They are standard issue in the UK (universal prestorage leucodepletion).

Question 3
Yes, we offer washed RBCs, based on consultant decision postrecurrent transfusion reactions.

Question 4
Yes, we maintain a stock of thawed plasma. We keep 1 unit of AB solvent–detergent FFP (SDFFP).

Question 5
Yes, we offer SDFFP and methylene-blue-treated cryoprecipitate.

Question 6
Yes, we match for the following:

- Transfusion-dependent patient with Rh-phenotyped units.
- Patient with clinically significant antibodies with units Rh-phenotyped and negative for their clinically significant antibody based on current clinical guidelines.

Question 7
Yes, CMV testing is done at NHSBT.

Question 8
Yes, we minimize exposure by the use of paedipacks (split packs for neonatal red cells and neonatal platelets as provided by NHSBT).

Question 9
Yes.

Question 10
Yes, our policy follows:

- Patients under 1 year requiring large volume neonatal pack transfusions (LVT) <5 days.
- Cardiac surgical patients over 1-year units <14 days.
- Sickle cell disease patients units <14 days.
- Irradiated units <14 days (all patients except neonatal/infant large volume transfusion and all cardiac surgery where irradiated blood is used within 24 h postirradiation).

Subject 4. Blood product dosing

Question 1
This is the recommendation for a target Hb:

$$\text{Volume to be transfused} = \frac{\text{Desired Hb (g/l)} - \text{actual Hb (g/l)} \times \text{weight (kg)} \times 4^{*}}{10}$$

**It is reasonable to use a Factor of 4 (practice varies between 3 and 5), but this should be assessed on an individual patient basis.*

With a local volume recommendation of:

- Neonates – 15 ml/kg
- Paediatrics – 3–4 ml/kg to raise Hb by 10 g/l

Question 2
We prescribe 10–15 ml/kg.

Question 3
We prescribe 10–15 ml/kg.

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BLOOD TRANSFUSION SPECIAL REQUIREMENT REQUESTS

FILE FORM AT FRONT OF PATIENT NOTES
*A COPY OF THIS FORM **MUST** BE FAXED TO BLOOD TRANSFUSION*
ITEMS WITH * ARE MANDATORY

First form/updated form* (delete where applicable)

***Patient surname**		***Patient forename**	
***Hospital number**		***Date of Birth**	
***Diagnosis** Please include any atypical antibodies			

The chart overleaf gives indications for the diagnosis which have the following special requirements. Tick all that apply. Please complete the reason for the request as well as the review date.

*Requirement	Tick all that apply (leave blank if no longer required)	*Reason for requirement/removal See overleaf	*Review period
CMV negative	☐		
Irradiated components	☐		
HLA matched components	☐		

ABO Mismatched Transplant **Heart / Bone Marrow / Renal** ***(Indicate type)***

Donor Group	Recipient group	Red cells	Platelets	Plasma
……. RhD ……	……. RhD ……	……. RhD ……	……. RhD ……	……. RhD ……

Haemoglobinopathies

Condition	Referring hospital	Last Transfusion Date	Any known antibodies

Authorised by			
***Name**		***Bleep number**	
***Position**		***Date**	
***Form FAXED to 8288**	☐	**Signed:**	

Laboratory Use Only:

Received in laboratory (Print name):	**Signature:**	**Date / Time:**
Entered on OmniLab (Print name)	**Signature:**	**Date / Time:**
#SBMS Check:(Print name):	**Signature:**	**Date / Time:**

#Senior/Chief BMS to check for accuracy and appropriateness. Refer to Haem SpR if required.

Guidance on Special Requirements

CMV (Cytomegalovirus) negative requirements		
CMV Negative Components	□ Neonates <6 months □ Intrauterine transfusion □ Exchange transfusion □ **CMV negative recipients of allogeneic SCT** □ SCID □ Pregnancy for patients requiring transfusion (except in emergency).	**Granulocytes –** CMV negative if recipient negative Granulocytes must always be irradiated
Irradiation requirements		
Stem Cell Transplantation (BMT or PBSC)	**Allogeneic recipients** – require irradiated components from start of conditioning until Consultant states otherwise. **All donors** require irradiated components from 7 days prior to and during the harvest. **Autologous recipients** – require irradiated components 7 days prior to and during harvest. Then from start of conditioning until 3 months post transplant.	
Neonates	**Intrauterine Transfusion (IUT)** – all components are required to be CMV Neg and irradiated (use within 24 hours post irradiation). Neonates post IUT: all components including ET are required to be CMV Neg and irradiated up to 6 months post EDD. **Exchange Transfusion (ET)** – Blood must be CMV Neg and irradiated (use within 24 hours post irradiation).	
Miscellaneous/ Specific Drugs	**Purine Analogues** – such as fludarabine, cladribine (2-cda), deoxycoformycin, clofarabine, nelarabine and bendamustine **Alemtuzumab (Anti-CD52) (Campath, MabCampath)** **Human Leucocyte Antigen** (HLA) Matched Components and components from first or second degree relatives. **Known or suspected Congenital Immunodeficiency** – such as **CID**, **SCID, Wiskott Aldrich** or **Di George Syndrome** (CMV negative blood components **are not** required **except** for SCID) **Asplenia**, together with any other immunodeficiency. (Asplenia alone does not qualify) **Aplastic Anaemia** (on **Anti-Thymocyte Globulin (ATG)** treatment) **Hodgkin's Lymphoma** **Granulocytes –need to consider if the patient requires CMV negative**	
Other Requirements		
Haemoglobinopathies	**These patients are regularly transfused either at GOSH or other Trust under shared care** **Phenotyped Blood –** to help prevent the formation of allo-antibodies, all patients are given Rh and K negative red cells. If antibodies develop, they are also given antigen negative red cells. These may not be standard stock therefore order in advance (24 hours preferably) **Transfusion History –** please inform the laboratory when and where the last transfusion occurred.	

NB. Remember to complete special requirement boxes on the pink blood prescription chart, if the requirement is new or has been amended please start a new chart.

Anne Kinmonth, Mary Comande, Helen Savoia & Gemma Crighton

Australia

Subject 1. Hospital and transfusion service demographics

Question 1
Australia.

Question 2
Yes, it is major specialist paediatric hospital, providing tertiary care for Victoria, Tasmania, southern New South Wales (as well as specialist treatment for patients from other states and overseas) and is a major teaching hospital.

Question 3
Our hospital receives blood components from the Australian Red Cross Blood Service; requests for specialized blood products such as phenotype-matched or CMV-seronegative components are directed to the Blood Service. However, we have an onsite irradiator and irradiate our own components.

Question 4a
In our hospital, the definition of a neonate, specified by the neonatal department, is an infant that is less than 28 days of age.

Question 4b
In our hospital, a paediatric patient is considered someone less than 18 years of age.

Question 5
357 inpatient beds.

Question 6
No, it only treats paediatric patients. On occasion, we will treat a young adult while they are awaiting transition to adult services.

Question 7a
Yes.

Question 7b
Yes.

Question 7c
Yes.

Question 7d
Yes.

Question 7e
Yes.

Question 7f
Yes.

Question 7g
Yes.

Question 7h
Yes.

Question 7i
Yes.

Question 7j
Yes.

Question 7k
Yes.

Question 7l
Yes.

Question 7m
Yes.

Question 7n
Yes.

Question 7o
Yes.

Question 7p
Yes.

Question 8
Approximately 4700 RBC per year.

Question 9
Approximately 2350 per year.

Question 10
Approximately 3100 per year.

Subject 2. Transfusion indications for paediatric and neonatal patients

Question 1
Yes, the National Blood Authority, Australia, has developed a series of six patient blood management (PBM) modules and Module 6 specifically focuses on evidence-

based neonatal and paediatric PBM. The Modules include recommendations based on systematic review, practice points which are based on consensus where systematic review found insufficient high-quality data to produce evidence-based recommendations. Finally, it includes expert opinion points based on consensus where relevant guidance is required. Module 6 includes general information about blood product modifications, foetal transfusion, blood conservation strategies and iron deficiency anaemia. The Appendices include information on transfusion volume calculations, a preoperative haemoglobin (Hb) assessment and optimization template, a critical bleeding template and dosing information for intravenous iron and tranexamic acid.

The Australian and New Zealand Society of Blood Transfusion have developed local guidelines, which provide guidance for paediatric, neonatal and foetal transfusions, and they include specific information on blood product administration, transfusion volume calculations and rates of infusion, in addition to blood product modifications.

The Transfusion Orientation Pack produced by the Australian Red Cross Blood Service provides specific paediatric guidance for red cell and platelet transfusion triggers and dosing.

Our hospital's blood product prescription guideline has been adapted for use in our state in Australia.

Question 2

Yes, our hospital has developed its own neonatal and paediatric blood transfusion and blood management resources and guidelines for our clinicians. We do not have any specific adult transfusion guidelines on our website. Clinicians access our guidelines both internally from within our hospital, locally across the state and nationally across Australia.

Our guidelines differ from adult guidelines because they provide specific guidance for the different clinical scenarios that affect neonates and children and take into account some of the specific differences between these patient groups.

Our guidelines provide guidance for specific, transfusion indications, consent for transfusion, refusal of transfusion consent, blood group and antibody testing, calculating transfusion volumes, blood product modifications such as indications for CMV-seronegative blood products, fresh products and irradiated blood products.

Transfusion consent for example in an adult involves a discussion between the consenting adult and the clinician, whereas in children, it involves a discussion with the parents or guardians and may involve discussion with the child. Refusal of transfusion consent by a parent/guardian is a unique situation, and in this instance, parents' wishes may be over-ridden if a transfusion is considered life-saving.

Most neonates are eligible for extended expiry for their blood group and antibody screening, because the development of antibodies to red cell antigens is very uncommon in the first 4 months of life and this reduces the requirement for repeated sampling.

There are a number of different considerations in neonates and children that determine whether a transfusion is indicated and these differ compared with adults. Neonates in particular have higher normal Hb values ranges compared with adults and children. Red cell transfusion thresholds in neonates depend on the gestational age, the postnatal age, the Hb concentration and the degree of respiratory support the neonate is receiving. There are a number of unique transfusion indications affecting only fetuses and neonates, such as foeto-maternal alloimmune thrombocytopaenia, intrauterine transfusion for haemolytic disease of the newborn and exchange transfusions and these have their own specific considerations such as human platelet antigen (HPA) or red cell alloantibody matching.

Transfusion volumes for neonates, infants and small children must be carefully calculated based on ml/kg and prescribed in ml (not units) with a specific appropriate transfusion rate.

There are some specific blood product modifications such as phenotype matched, irradiated. CMV-seronegative and washed blood products where indications differ between children and adults or the requests occur more frequently in children.

Question 3

Yes.

Paediatrics Haemoglobin threshold	**Indication/clinical information**
Hb <70 g/l	Often indicated, however, lower thresholds may be acceptable in patients without symptoms (symptoms may include – tachycardia, flow murmur, lethargy, dizziness, shortness of breath and cardiac failure) and where specific therapy (e.g. iron) is available
Hb 70–90 g/l	RBC may be indicated, depending on the clinical setting, for example the presence of bleeding or haemolysis and clinical signs and symptoms of anaemia
	Patients with disease or therapy-related bone marrow failure
Hb >90 g/l	RBC transfusion is often unnecessary and may be inappropriate
	Sickle cell disease

(Continued)

Paediatrics	
Haemoglobin threshold	**Indication/clinical information**
Threshold not specified	Blood prime for circuit
	Red cell exchange transfusion
	Haemolysis
	Clinically significant acute blood loss
Transfusion may be indicated at higher thresholds for specific situations	
Preterm neonates	
Children with cyanotic heart disease or on ECLS	
Children with haemoglobinopathies (thalassaemia or SCD) or congenital anaemia on a chronic transfusion programme	

Neonates	
Haemoglobin threshold	**Indication/clinical information**
Hb <100–120 g/l	Preterm or term neonate with no respiratory support, week 1 of life
Hb <85–100 g/l	Preterm or term neonate with no respiratory support, week 2 of life
Hb <70–100 g/l	Preterm or term neonate with no respiratory support, week 3 of life
Hb <110–130 g/l	Preterm neonate with respiratory support, week 1 of life
Hb <100–125 g/l	Preterm neonate with respiratory support, week 2 of life
Hb <85–110 g/l	Preterm neonate with respiratory support, week 3 of life
	Clinically significant acute blood loss

ECLS, extracorporeal life support; RBC, red blood cell; SCD, sickle cell disease.

Question 4

Yes, it is mandatory.

Yes, the indication is entered electronically.

Question 5

No, there is a space where the patient's clinical information or diagnosis can be entered, but it is not mandatory. As we have an electronic medical record, it is possible, to review in real time the patient's clinical diagnosis, medical notes and laboratory investigations to determine transfusion indication.

Question 6

Yes, thresholds are included with some of the indications, please see table above.

Question 7

Yes.

Paediatrics	
Platelet count	**Indication/clinical information**
$<10 \times 10^9$/l	Clinically stable paediatric patients receiving chemotherapy for leukaemia or post-HSCT
	Clinically stable patients with solid tumours (prophylactic)[a]
	[a]Transfusions at higher levels may be required for bladder, brain or necrotic tumours
	Critically ill patients with no bleeding
$<20 \times 10^9$/l	Chemotherapy, HSCT and risk factors (e.g. fever, sepsis, minor bleeding, mucositis and DIC without bleeding)
	Critically ill patients with no bleeding and risk factors (e.g. sepsis, renal failure and medications)
	Nasogastric tube insertion
	Intramuscular injections, for example Erwinia asparaginase
	Insertion of a nontunnelled central venous line
$<30 \times 10^9$/l	LP and ongoing chemotherapy-induced thrombocytopaenia
	CNS tumour and:
	A VP shunt or Ommaya reservoir
	Has a gross total resection and is receiving chemotherapy and/or radiation
	Has residual tumour and is receiving chemotherapy and/or radiation
$<50 \times 10^9$/l	LP and new disease induced thrombocytopaenia
	Patient undergoing invasive procedure (including tunnelled central venous line insertion)
	Moderate active bleeding (including bleeding associated with DIC)
	CNS tumour and:
	A past history of intracranial haemorrhage
	Is receiving an anti-angiogenesis agent
$<75 \times 10^9$/l	Major haemorrhage due to trauma or significant postoperative bleeding (e.g. postcardiac surgery)
$<100 \times 10^9$/l	Patient undergoing high-risk invasive procedure (e.g. neurosurgery/ophthalmology)
	ECLS (lower platelets may be acceptable in stable patients)
Platelet transfusion not indicated	
Stable patients with chronic, stable, severe thrombocytopenia due to: Alloimmunization, ITP, TTP, aplastic anaemia or MDS	
These patients should receive platelet transfusions with clinically significant bleeding only	
BMA and trephine biopsy	
Intravenous cannula insertion	

Neonates	
Platelet threshold	**Indication/clinical information**
$<30 \times 10^9$/l	Stable term or preterm neonate with asymptomatic thrombocytopaenia and no bleeding
$30–50 \times 10^9$/l	

(Continued)

Paediatrics	
Platelet count	**Indication/clinical information**
	Preterm neonate with thrombocytopaenia being treated for sepsis or requiring respiratory support
$<50 \times 10^9$/l	Term or preterm neonate with bleeding symptoms (mucocutaneous, gastrointestinal, petechiae/purpura), coagulopathy or prior to surgery
$<100 \times 10^9$/l	Term or preterm neonate with major bleeding (drop in Hb requiring RBC transfusion) or those that require major surgery (e.g. neurosurgery)

BMA, bone marrow aspirate; CNS, central nervous system; DIC, disseminated intravascular coagulopathy; ECLS, extracorporeal life support; Hb, haemoglobin; HSCT, haematopoietic stem cell transplantation; ITP, immune thrombocytopaenia; LP, lumbar puncture; MDS, myelodysplastic syndrome; RBC, red blood cell; TTP, thrombotic thrombocytopaenic purpure; VP, ventriculo-peritoneal.

Question 8

Yes

Paediatrics and neonates – fresh-frozen plasma	
Laboratory parameter	**Indication/clinical information**
Significant coagulopathy	Acute bleeding Liver disease, with clinically significant bleeding or in the context of coagulopathy post liver transplantation Acute DIC with bleeding
Prolonged INR	Warfarin reversal, in the presence of significant or life-threatening bleeding or prior to emergency surgical procedures • Given in addition to vitamin K NOTE: vitamin K-dependent clotting factor concentrates (e.g. Prothrombinex) may be given instead of FFP for bleeding secondary to warfarin or emergency warfarin reversal
Not specified	During massive transfusion or cardiac bypass for the treatment of bleeding
Not specified	Plasma exchange for the treatment of TTP
Not specified	Specific factor deficiencies where a factor concentrate is not available
FFP is not indicated for	
The correction of minor coagulation abnormalities (minor prolongation of the INR/APTT) in the nonbleeding child	
Liver disease when there are minor coagulation abnormalities and no bleeding	
For reversal of a INR <2·0 in patients undergoing minor procedures	

APTT, activated partial thromboplastin time; DIC, disseminated intravascular coagulopathy; FFP, fresh-frozen plasma; INR, international normalized ratio; TTP, thrombotic thrombocytopaenic purpura.

Paediatrics – cryoprecipitate	
Laboratory parameter	**Indication/clinical information**
Fibrinogen <1·5 g/l	Active bleeding During massive transfusion or cardiopulmonary bypass
Fibrinogen <1·0 g/l	Acquired fibrinogen deficiency of acute DIC for the treatment of bleeding
Fibrinogen <1·0 g/l	Prior to an invasive procedure and there is a risk of significant bleeding associated with the surgery or it is at a critical site (e.g. neurosurgery or eye surgery)
Hyperfibrinolysis	During massive transfusion or cardiopulmonary bypass
Cryoprecipitate is not indicated for	
Nonbleeding children with mildly reduced fibrinogen levels	
Liver disease when there are minor coagulation abnormalities and no bleeding	

Additional neonate indication – cryoprecipitate	
Laboratory parameters	**Indication/clinical information**
Fibrinogen <0·5 g/l	Active bleeding in the neonate

DIC, disseminated intravascular coagulopathy.

Subject 3. Product manipulations for paediatric and neonatal patients

Question 1

Yes, our hospital has an onsite irradiator and is able to provide irradiated red cells. Our hospital has a universal blood product irradiation for patients in the following units: paediatric intensive care unit (PICU), neonatal unit (NNU) and oncology patients, in addition infants under 3 months of age and patients treated with extracorporeal life support (ECLS) or left-ventricular assist devices receive irradiated components. Although not all patients in these units are at risk of transfusion-associated graft-versus-host disease, this policy ensures patients who require irradiated products are not missed. In addition, blood is irradiated for intrauterine and exchange transfusions, directed donations and immune-compromised patients, this includes immunology patients with conditions such as severe combined immune deficiency (SCID) and common variable immune deficiency (CVID), as well as patients with malignancy, transplantation recipients (bone marrow, cord blood and solid organ).

Question 2

All red cells and platelets components (both apheresis and pooled) manufactured by the Blood Service are prestorage leucodepleted. The leucodepletion system used by the Blood Service enables leucodepletion of some but not all clinical plasma. As a result, there is a mixed inventory of leucodepleted and nonleucodepleted clinical plasma components.

Question 3

Washed blood components are produced by the Blood Service on special requests. Requests for these components are usually discussed with the laboratory haematology team. Indications include patients with IgA deficiency and patients with severe allergic reactions to previous red cell or platelet transfusions.

Question 4

Yes, two units of AB plasma are available for emergency use and for life-threatening bleeding.

Question 5

No, at present, the Blood Service does not offer pathogen-inactivated blood components.

Question 6

At present, all patients at our institution receive Kell-negative blood, due to the risk of Kell alloimmunization, by not matching for Kell in young girls with child-bearing potential. Patients with haemoglobinopathies such as sickle cell disease and patients with congenital anaemia will have red cell genotyping assessment at diagnosis. Their transfusions will be matched for Rh (C, D and E) and Kell. Patients receiving exchange transfusions for SCD or RBC transfusion for warm autoimmune haemolytic anaemia will have RBC most suitably matched to negative antigens of Rh/Kell, Jka, Fy and Ss systems.

If a patient forms a red cell alloantibody, they will have extended red cell matching and antigen-negative blood will be provided for any alloantibodies they may have or at risk of making and consideration given for matching for Fya, Jk, M, N and Ss.

Fetuses receiving an intrauterine transfusion and neonates receiving a exchange transfusion for haemolytic disease of the foetus and newborn will be provided with red cells that are RhD-negative (or RhD identical with neonate if mother not Rh immunized), Kell-negative and antigen-negative for any maternal alloantibodies. If there is time, an extended maternal phenotype will be performed and consideration given for provided red cells matched for Fya, Jk, M, N and Ss.

Question 7

CMV testing is performed on an ad hoc basis by the treating clinician and is not performed by the transfusion laboratory. We have a policy, which outlines in which patients' CMV-seronegative blood products are indicated. CMV-seronegative blood products are indicated for intrauterine transfusion, neonatal exchange transfusions, preterm and term infants up to 28 days postestimated due date, patients with SCID, who are CMV-negative (including those undergoing haematopoietic stem cell transplantation), pregnant women and granulocyte infusions. All other indications – haematology/oncology patients, allogeneic and autologous stem cell transplantation, solid organ transplant patients and other immunodeficiency patients, leucocyte deplete blood products – are considered equivalent to CMV-seronegative products.

Question 8

We attempt to reduce donor exposure in the multiple-transfused haemato-oncology patient and allocate apheresis platelets when possible. If we are aware a neonate is going to need multiple transfusion, we will attempt to minimize donor exposure by allocating pedipaks. Since implementation of an electronic medical record, blood components are now generally only issued at the time a request is made for a transfusion. This means they are not allocated prior to transfusion, and therefore, a neonate does not have blood components allocated prior to transfusion unless we are aware they are going to require multiple transfusions.

Question 9

We have no formal policy in place to minimize the volume and frequency of blood samples drawn; however, we do have a number of strategies in place, which aim at blood conservation in these patients. We have paediatric collection tubes, which are standard of care for our neonates and small paediatric patients. Patients in the NNU and PICU have discard volumes returned after sampling. We use of point of care testing for INRs for patients on warfarin, arterial and venous blood gas sampling and glucose analysis for diabetics. We have a policy for neonates for extended blood group and antibody testing in the first 4 months of life if the DAT is negative and there are no maternal alloantibodies.

Question 10

Yes, in Australia, red cell units can be stored up until 42 days. The following table gives information regarding the age of red cells on the day of issue for particular patient groups.

Patient group	Age of red cells on day of issue	Consideration
Neonatal exchange transfusion	<5 days	Kell, negative, CMV negative, Rh and phenotype matched
Intrauterine transfusion	<5 days	Kell, negative, CMV negative, Rh and phenotype matched

(Continued)

Patient group	Age of red cells on day of issue	Consideration
Paediatric large volume transfusion[a]	<7 days	In an emergency, the blood bank scientist will issue the most appropriate unit available at the time
Cardiac surgery requiring cardiopulmonary bypass		
ECLS		
Craniofacial surgery		
Massive transfusion	Aim <10 days	
Paediatric-routine transfusion	Standard issue	
Postoperative surgical patient		
Oncology patient		
Solid organ transplantation		
Chronically transfused patients	Aim <14 days	Patients with
Congenital anaemia who are transfusion dependent		
Haemoglobinopathies (SCD, thalassaemia)		
Aplastic anaemia		
haemoglobinopathies are matched with Rh and Kell		
Extended phenotype matching for patients with alloantibodies		
Extended phenotype matching may take precedence over age of red cells		
Small-volume (top up) neonatal transfusions	Standard issue	
Children and adolescents not included in any groups listed above	Standard issue	

CMV, cytomegalovirus; ECLS, extracorporeal life support; SCD, sickle cell disease.

[a]Equivalent to a single circulating blood volume (~80 ml/kg).

Subject 4. Blood product dosing

Question 1

The transfusion volume for a red cell transfusion is calculated for children <20 kg from the equation

$$\text{ml} = \text{weight (kg)} \times \text{Hb (g/l) rise}(\text{desired Hb} - \text{actual Hb}) \times 0{\cdot}5$$

For children >20 kg – 1 unit of red cells is prescribed.

Question 2

	<10 kg	10–19 kg	20–29 kg	30–39 kg	>40 kg
Pooled platelets (adult unit)	10 ml/kg	10 ml/kg	10 ml/kg up to 1 unit	1 unit	1 unit
Apheresis platelets (adult unit)	5–10 ml/kg	5–10 ml/kg	5–10 ml/kg up to 1 unit	1 unit	1 unit
Paediatric apheresis platelets (pedipak)	5–10 ml/kg or 1 pedipak	5–10 ml/kg or 2 pedipak	3–4 pedipaks	4 pedipaks	4 pedipaks

Question 3

A dose of 10–20 ml/kg of fresh-frozen plasma is prescribed for stable paediatric or neonatal patients with consideration given to the average fresh-frozen plasma unit size of about 284 ml. A dose of 5–10 ml/kg of cryoprecipitate is prescribed for stable paediatric or neonatal patients, with consideration given to the typical unit size of approximately 37 ml.

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Joanne Yacobovich & Vered Yahalom

Israel

Subject 1. Hospital and transfusion service demographics

Question 1
Israel.

Question 2
Yes.

Question 3
Prepared in a neighbouring facility.

Question 4a
Less than 30 days old.

Question 4b
Less than 18 years old.

Question 5a
300 inpatient beds, 100 are intensive care/emergency.

Question 6
No.

Question 7a
Yes.

Question 7b
Yes.

Question 7c
Yes.

Question 7d
Yes.

Question 7e
Yes.

Question 7f
Yes.

Question 7g
Yes.

Question 7h
Yes.

Question 7i
Yes.

Question 7j
Yes, both.

Question 7k
Yes, including dialysis.

Question 7l
Yes.

Question 7m
Yes.

Question 7n
Yes.

Question 7o
Yes.

Question 7p
Yes.

Question 8a
>5000 in 2017.

Question 9
>700 in 2017 (variable volume).

Question 10
>2150 in 2017 (variable volume).

Subject 2. Transfusion Indications for paediatric and neonatal patients

Question 1b
Yes – Only for platelets, approved by Israeli paediatric haematology–oncology society.
(a) Higher platelet thresholds for preterm babies, sick newborns and babies on ECMO.
Platelet dosing per kg weight up to 1 SDP.

Question 2b
Yes – Lower threshold for RBC Tx (see 3b).

Question 3b
Yes.

RBC.
- HB <8·0 g/dl for anaesthesia, patients on oxygen, fever,

- HB <6·0 g/dl in general,
- HB 6–8 g/dl – can consider RBC

PLT.
- If <10 000/μl
- or <20 000 for febrile patients,
- <80 000 postneurosurgery

Question 4b
Yes – requested not mandatory.
(a) No.

Question 5
Yes.

Question 6b
Yes – see Q.3.

Question 7b
Yes – see Q.3.

Question 8a
No.

Subject 3. Product manipulations for paediatric and neonatal patients

Question 1b
Yes – Haematooncology and oncology patients.

Question 2b
Yes – Haematooncology and oncology patients.

Question 3b
Yes – Severe transfusion reactions.

Question 4b
Yes – 2 units of every ABO blood group.

Question 5a
No.

Question 6b
Yes – Haemoglobinopathies, AIHA patients.

Question 7
CMV-negative components for selected patients – SCID CMV negative.

Question 8
Only if required by the treating physician.

Question 9
Yes, microtainers for CBC, smaller tubes for coagulation tests, finger prick monitoring for INR monitoring in inpatients.

Question 10b
Yes – 7 days exchange Tx, preterm. Ten days thalassaemia/SCD patients (up to 14 if multiple antibodies).

Subject 4. Blood product dosing

Question 1
10–15 ml/kg.

Question 2
15 ml/kg up to 1 SDP unit.

Question 3
10–15 ml/kg.

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Canada

Subject 1. Hospital and transfusion service demographics

Question 1
Canada.

Question 2
Yes.

Question 3
Blood center.

Question 4a
Neonate less than 4 months.

Question 4b
Paediatric less than 18 years.

Question 5
Yes, 350 beds.

Question 7a
Yes.

Question 7b
Yes.

Question 7c
Yes.

Question 7d
Yes.

Question 7e
Yes.

Question 7f
Yes.

Question 7g
Yes.

Question 7h
Yes.

Question 7i
Yes.

Question 7j
Yes.

Question 7k
Yes.

Question 7l
Yes.

Question 7m
Yes.

Question 7n
Yes.

Question 7o
Yes.

Question 7p
Yes.

Question 8a
Just over 8000 units per year (range from 8000 to 8700 units in recent years).

Question 8b
It is not possible at this time to subgroup by age, maybe in the future (with help with EPIC/HCLL).

Question 9a
About 1500 units per year (range 1400–1600 in recent years).

Question 9b
It is not possible at this time to subgroup by age, maybe in the future (with help with EPIC/HCLL).

Question 10a
Just over 3500 units (total of pools and apheresis platelets) per year (range 3500–3800 in recent years).

Question 10b
It is not possible at this time to subgroup by age, maybe in the future (with help with EPIC/HCLL).

Subject 2. Transfusion Indications for paediatric and neonatal patients

Question 1b
Yes, some recommendations (neonatal, platelet).
(a) Recommendations for neonatal red cell transfusions differ from adults.
(b) C17 recommendations for platelets – threshold higher for bleeding, fever.

Question 2b
Yes.
(a) Red cells similar to adults.
(b) Platelets more similar to C17 guidelines.

Question 3b
Yes.
(a) This is what we have in EPIC right now.

Red cells
Acute or surgical blood loss
To maintain Hb. Level >70 g/l
To maintain Hb. Level >100 g/l
To maintain Hb. Level > _____specify
Chronic transfusion programme
Exchange transfusion
ECMO
Dialysis prime

(Continued)

Apheresis prime
Plasma
Bleeding with INR >1·5 or APTT >1·5× top of age-related reference range
Preinvasive procedure with INR >1·5 or APTT >1·5× top of age-related reference range
Replacement therapy when specific factor concentrate not available
Therapeutic plasma exchange
Massive haemorrhage/transfusion
Urgent reversal of warfarin if prothrombin complex not available
Platelets
PLT.ct <10 000/μl
PLT.ct <20 000/μl stable infant
PLT.ct <20 000/μl (sepsis, bleeding, other considerations)
PLT.ct <50 000/μl unstable infant
PLT.ct <50 000/μl actively bleeding
PLT.ct <50 000/μl pre invasive procedure
PLT.ct <50 000/μl pre major surgery
PLT. Ct <100 000/μl CNS bleeding
PLT. Ct <100 000/μl CNS surgery

Question 4b

Yes, have to select in EPIC.

Question 5

No.

Question 6b

Yes.

(a) Over 4 months, similar to adults (as per AABB paediatric transfusion handbook).
(b) Neonates as per AABB paediatric transfusion handbook, except we use Hb 140 instead of 150 for congenital cyanotic heart disease.

Question 7b

Yes.

Guidelines for platelet transfusion in neonates:

1 Stable infant, platelet count $<20 \times 10^9$/l.
2 Unstable infant, platelet count $30–50 \times 10^9$/l.
3 Infant with active bleeding, or invasive procedure, platelet count $<50 \times 10^9$/l.

Prophylactic platelet transfusion (for hem/onc patients over 4 months of age):

Platelet count 10×10^9/l:

- All patients.

Platelet count 20×10^9/l:

- Patients with fever, sepsis, DIC, bleeding, coagulopathy, splenomegaly, AML M3, brain tumour.
- Bone marrow aspirate and biopsy.
- Insertion of PICC line (peripherally inserted central line).

Platelet count 50×10^9/l:

- Lumbar puncture.
- Major surgery.
- Hurler's syndrome post-BMT.
- For placement of central venous catheters other than PICC lines, consult IGT (image-guided therapy) in advance.

Platelet count 100×10^9/l:

- CNS bleeding, CNS surgery, invasive procedure in patients with D.I.C.

Question 8b

Yes.

See the indications in Epic in 3.

Subject 3. Product manipulations for paediatric and neonatal patients

Question 1b

Yes.

Irradiated cellular blood products (red cells and platelets):

The following patient populations receive irradiated cellular blood components at Sick Kids:

- Infants up to 6 months of age
- Primary immune deficiencies (SCID, Wiscott–Aldrich syndrome, Di George's syndrome, 22q deletion etc).
- Cardiac patients with a diagnosis of truncus arteriosus or interrupted aortic arch, until test result for 22q deletion is known.
- Patients receiving or have received: purine analog (e.g. fludarabine, cladribine, pentostatin/deoxycoformicin), alemtuzumab (anti-CD 52), antithymocyte globulin (ATG).
- Leukaemia, lymphoma. severe aplastic anaemia.
- Solid tumours if receiving intense chemotherapy such as those listed above.
- Bone marrow transplant recipients (and donors during bone marrow harvest).
- Heart transplant and lung transplant recipients (ATG for conditioning).
- Components from blood relatives (directed donations).
- HLA-matched single-donor apheresis platelets.

Question 2b

Yes.

(a) All RBCs are prestorage leucoreduced by blood centre.

Question 3b
Yes, but rarely do.
(a) Patients with anti-IgA and those still reacting to plasma-reduced red cells.

Question 4a
No.

Question 5a
No.

Question 6b
Yes.
(b) K neg for all female patients.
(c) Rh and K for sickle cell and WAIHA.
(d) Fya, Jka, Jkb, S for SCD who have already made clinically significant antibodies.

Question 7
No.

Question 8a
Yes.

Dedicated units for neonates under 1000 g birthweight.

Split units for patients >4 months who only gets part of unit at a time (e.g. to prevent alloimmunization prekidney transplant) (give half a unit now, half a unit at a subsequent date).

Our routine platelet product is pooled buffy coat (4 donors) for children. We try to give part of an apheresis platelet to neonates and to small infants who only need 100 ml or less of platelets.

Question 9
Yes, microtubes.

Question 10b
Yes.
(a) Fresher units for cardiac surgery
(b) <7 days for infants <3 months
(c) <7 days if possible for infants 3–6 months old, otherwise <14 days
(d) <14 days for 6 months to 4 years
(e) <28 days for patients over 4 years
(f) Neonatal top-up transfusions – any age
(g) Neonatal exchange transfusion – <7 days
(h) Haemoglobinopathy patients on chronic transfusion programme – phenotyped units <21 days ordered for scheduled patients, but will use up to 35 days
(i) Sickle cell red cell exchange – <21 days

Subject 4. Blood product dosing

Question 1
Peds: 10–15 ml/kg.
Neonates: 15–20 ml/kg.

Question 2
Peds: 5–10 ml/kg.
Neonates: 10–15 ml/kg.

Question 3
10–15 ml/kg.

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