NHS Blood and Transplant

Paediatric and Neonatal transfusion – your questions answered

Introduction and Risks

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Transfusion decisions

- Risks vs benefits
- Clinical situation
- Transfusion thresholds
- Doses
- Special components
- Alternatives to transfusion?

- What is the evidence?
- ‘Patient blood management’ (PBM)
- Paediatric guidelines

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Paediatric Transfusion Guidelines

- Canadian
- The Netherlands
- US: AABB
- Italian
- UK ‘NICE’ 2015 – not < 1 yr
- Australian National Blood Authority PBM 2016

***PLUS* Local guidelines**

BSH Guidelines 2016

bjh guidelines

Guidelines on transfusion for fetuses, neonates and older children

Helen V. New,[1,2] Jennifer Berryman,[3] Paula H. B. Bolton-Maggs,[4] Carol Cantwell,[2] Elizabeth A. Chalmers,[5] Tony Davies,[6] Ruth Gottstein,[7] Andrea Kelleher,[8] Sailesh Kumar,[9] Sarah L. Morley[10] and Simon J. Stanworth,[11] on behalf of the British Committee for Standards in Haematology

- Aim: to bring together most aspects of paediatric transfusion
- Writing group: clinical and laboratory specialists, including neonatology, paediatrics, anaesthetics, haematology, fetal medicine
- Two sections:
  - 'Clinical transfusion'
  - 'Blood components and pre-transfusion testing'
- Pragmatic, practical, educational, evidence based where possible
- 'key practice points' vs 'recommendations

British Journal of Haematology, 2016, 175, 784–828
http://www.b-s-h.org.uk/guidelines/guidelines/transfusion-for-fetuses-neonates-and-older-children

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Background to BSH 2016

- literature evidence
- current practice
  - National Comparative Audits
    - FFP, paediatric red cell
  - user feedback
- updated specialist components
- Serious Hazards of Transfusion (SHOT)

Neonatal exchange units

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- Usually group O
  - compatible with maternal antibodies
- Hct 0.5-0.55 (NHSBT)
- CMV negative
- Anticoagulant: citrate, phosphate, dextrose
- < 5 days old - reduce risk of hyperkalaemia
- Irradiated, especially if previous IUT
  - shelf life 24 hours

Approx 8000 units manufactured per annum.

Kept in ‘stock holding units’ between manufacturing centres and hospitals. Irradiated and issued to hospitals on request.

If not issued, remanufactured into standard red cell units (SAGM)

> 7000 units pa

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Guideline key updated areas

- red cell thresholds: neonatal, paediatric
- cardiac surgery
- laboratory guidance
- alternatives
- practice points relating to PBM
  - eg '*Transfusion volumes for non-bleeding infants and children, excluding those on chronic transfusion programmes, should generally be calculated to take the post-transfusion Hb to no more than 20 g/L above the transfusion threshold, usually a maximum of one unit.'*
- selection of components in emergency
- major haemorrhage

Algorithm for compatibility testing for a neonate BSH 2016

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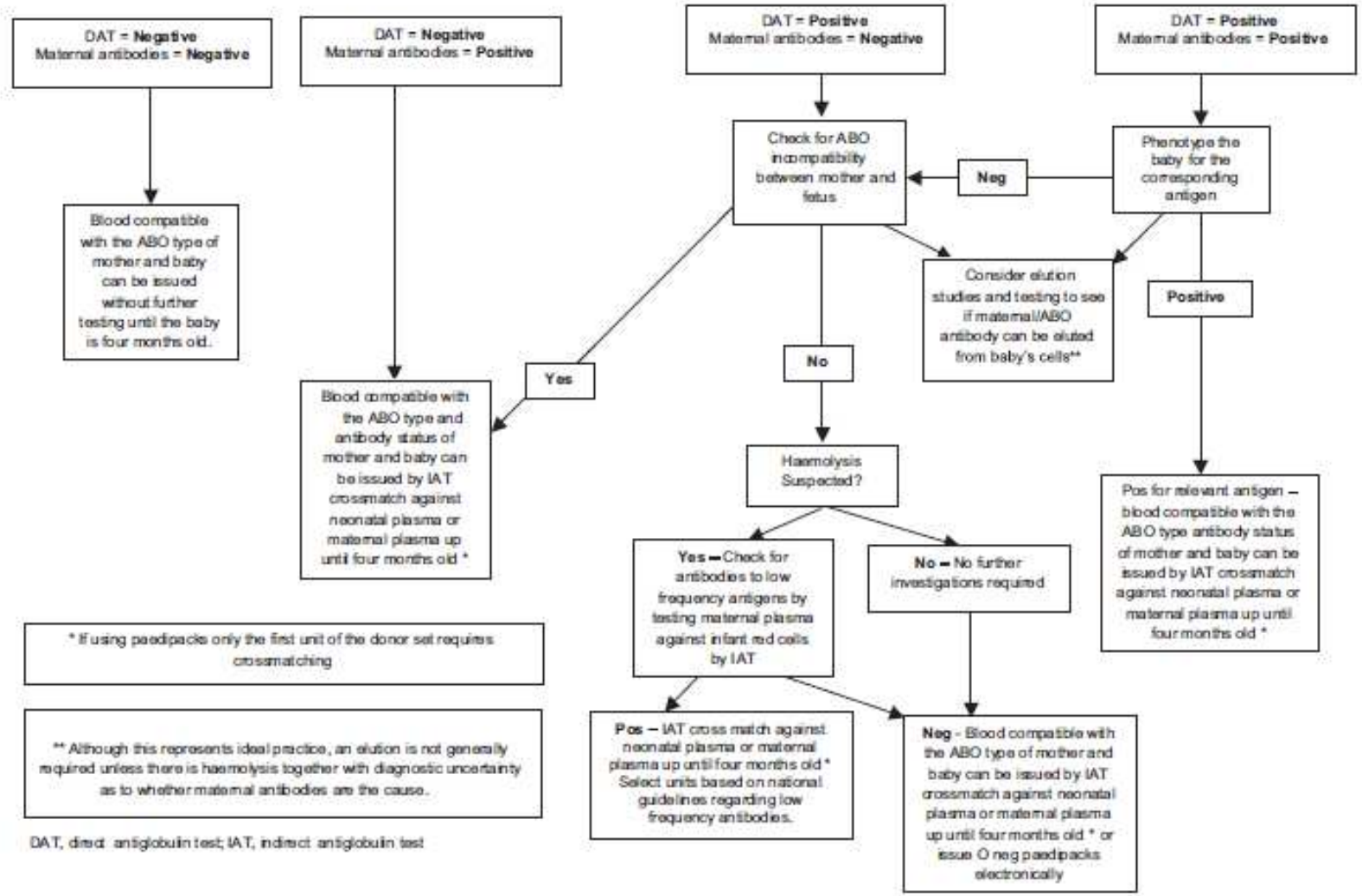
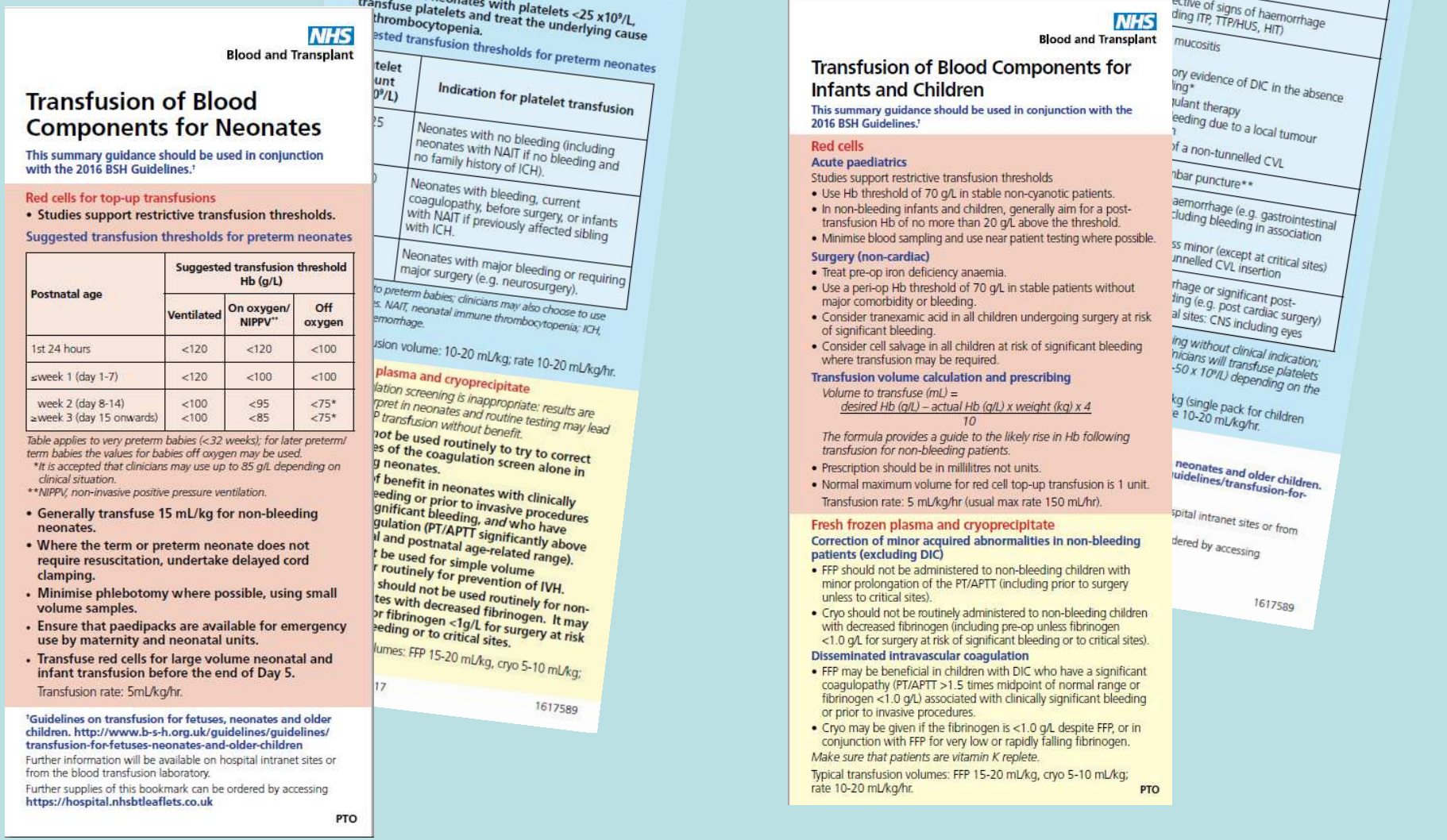


Guideline Bookmarks



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Transfusion of Blood Components for Neonates

This summary guidance should be used in conjunction with the 2016 BSH Guidelines.[1]

Red cells for top-up transfusions

- **Studies support restrictive transfusion thresholds.**

Suggested transfusion thresholds for preterm neonates

Postnatal age	Suggested transfusion threshold Hb (g/L)		
	Ventilated	On oxygen/ NIPPV**	Off oxygen
1st 24 hours	<120	<120	<100
≤week 1 (day 1-7)	<120	<100	<100
week 2 (day 8-14)	<100	<95	<75*
≥week 3 (day 15 onwards)	<100	<85	<75*

Table applies to very preterm babies (<32 weeks); for later preterm/ term babies the values for babies off oxygen may be used.
**It is accepted that clinicians may use up to 85 g/L depending on clinical situation.*
***NIPPV, non-invasive positive pressure ventilation.*

- **Generally transfuse 15 mL/kg for non-bleeding neonates.**
- **Where the term or preterm neonate does not require resuscitation, undertake delayed cord clamping.**
- **Minimise phlebotomy where possible, using small volume samples.**
- **Ensure that paedipacks are available for emergency use by maternity and neonatal units.**
- **Transfuse red cells for large volume neonatal and infant transfusion before the end of Day 5.**

Transfusion rate: 5mL/kg/hr.

[1]Guidelines on transfusion for fetuses, neonates and older children. http://www.b-s-h.org.uk/guidelines/guidelines/transfusion-for-fetuses-neonates-and-older-children

Further information will be available on hospital intranet sites or from the blood transfusion laboratory.

Further supplies of this bookmark can be ordered by accessing **https://hospital.nhsbtleaflets.co.uk**

PTO

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Platelets

- **For preterm neonates with platelets <25 x10⁹/L, transfuse platelets and treat the underlying cause thrombocytopenia.**

ested transfusion thresholds for preterm neonates

telet unt (0⁹/L)	Indication for platelet transfusion
25	Neonates with no bleeding (including neonates with NAIT if no bleeding and no family history of ICH).
	Neonates with bleeding, current coagulopathy, before surgery, or infants with NAIT if previously affected sibling with ICH.
	Neonates with major bleeding or requiring major surgery (e.g. neurosurgery).

to preterm babies; clinicians may also choose to use s. NAIT, neonatal immune thrombocytopenia; ICH, emorrhage.

usion volume: 10-20 mL/kg; rate 10-20 mL/kg/hr.

plasma and cryoprecipitate

lation screening is inappropriate: results are pret in neonates and routine testing may lead P transfusion without benefit.

ot be used routinely to try to correct es of the coagulation screen alone in g neonates.

f benefit in neonates with clinically eeding or prior to invasive procedures gnificant bleeding, and who have gulation (PT/APTT significantly above l and postnatal age-related range).

t be used for simple volume r routinely for prevention of IVH.

should not be used routinely for non- tes with decreased fibrinogen. It may r fibrinogen <1g/L for surgery at risk eeding or to critical sites.

lumes: FFP 15-20 mL/kg, cryo 5-10 mL/kg;

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Platelets

- For most stable children, transfuse prophylactic platelets when platelet count <10 x 10⁹/L (excluding ITP, TTP/HUS and HIT where platelets are only transfused for life-threatening bleeding).

Suggested transfusion thresholds for platelets

Platelet count (x 10⁹/L)	Clinical situation to trigger platelet transfusion
<10	ective of signs of haemorrhage ding ITP, TTP/HUS, HIT)
	mucositis
	ory evidence of DIC in the absence ling*
	ulant therapy eeding due to a local tumour
	f a non-tunnelled CVL
	nbar puncture**
	aemorrhage (e.g. gastrointestinal cluding bleeding in association
	ss minor (except at critical sites) unnelled CVL insertion
	rhage or significant post- ding (e.g. post cardiac surgery) al sites: CNS including eyes
	ing without clinical indication; nicians will transfuse platelets -50 x 10⁹/L) depending on the
	kg (single pack for children e 10-20 mL/kg/hr.

neonates and older children. uidelines/transfusion-for-

spital intranet sites or from

dered by accessing

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Transfusion of Blood Components for Infants and Children

This summary guidance should be used in conjunction with the 2016 BSH Guidelines.[1]

Red cells

Acute paediatrics

Studies support restrictive transfusion thresholds

- Use Hb threshold of 70 g/L in stable non-cyanotic patients.
- In non-bleeding infants and children, generally aim for a post-transfusion Hb of no more than 20 g/L above the threshold.
- Minimise blood sampling and use near patient testing where possible.

Surgery (non-cardiac)

- Treat pre-op iron deficiency anaemia.
- Use a peri-op Hb threshold of 70 g/L in stable patients without major comorbidity or bleeding.
- Consider tranexamic acid in all children undergoing surgery at risk of significant bleeding.
- Consider cell salvage in all children at risk of significant bleeding where transfusion may be required.

Transfusion volume calculation and prescribing

Volume to transfuse (mL) =

$$\frac{\text{desired Hb (g/L)} - \text{actual Hb (g/L)} \times \text{weight (kg)} \times 4}{10}$$

The formula provides a guide to the likely rise in Hb following transfusion for non-bleeding patients.

- Prescription should be in millilitres not units.
- Normal maximum volume for red cell top-up transfusion is 1 unit.

Transfusion rate: 5 mL/kg/hr (usual max rate 150 mL/hr).

Fresh frozen plasma and cryoprecipitate

Correction of minor acquired abnormalities in non-bleeding patients (excluding DIC)

- FFP should not be administered to non-bleeding children with minor prolongation of the PT/APTT (including prior to surgery unless to critical sites).
- Cryo should not be routinely administered to non-bleeding children with decreased fibrinogen (including pre-op unless fibrinogen <1.0 g/L for surgery at risk of significant bleeding or to critical sites).

Disseminated intravascular coagulation

- FFP may be beneficial in children with DIC who have a significant coagulopathy (PT/APTT >1.5 times midpoint of normal range or fibrinogen <1.0 g/L) associated with clinically significant bleeding or prior to invasive procedures.
- Cryo may be given if the fibrinogen is <1.0 g/L despite FFP, or in conjunction with FFP for very low or rapidly falling fibrinogen.

Make sure that patients are vitamin K replete.

Typical transfusion volumes: FFP 15-20 mL/kg, cryo 5-10 mL/kg; rate 10-20 mL/kg/hr.

PTO

Risks?

SHOT – adverse outcome reports

- errors, immunological reactions
- pulmonary complications (TACO, TRALI)

Infection – viral, bacterial, vCJD

Component related: additives, K+

Luban, et al, 1991; Lee et al *Transfusion* 2014

Procedure related

eg neonatal exchange transfusion

‘Restrictive’ vs ‘Liberal’ transfusions

- long term outcomes

Age of blood?

SHOT Paediatric reports 2008-15

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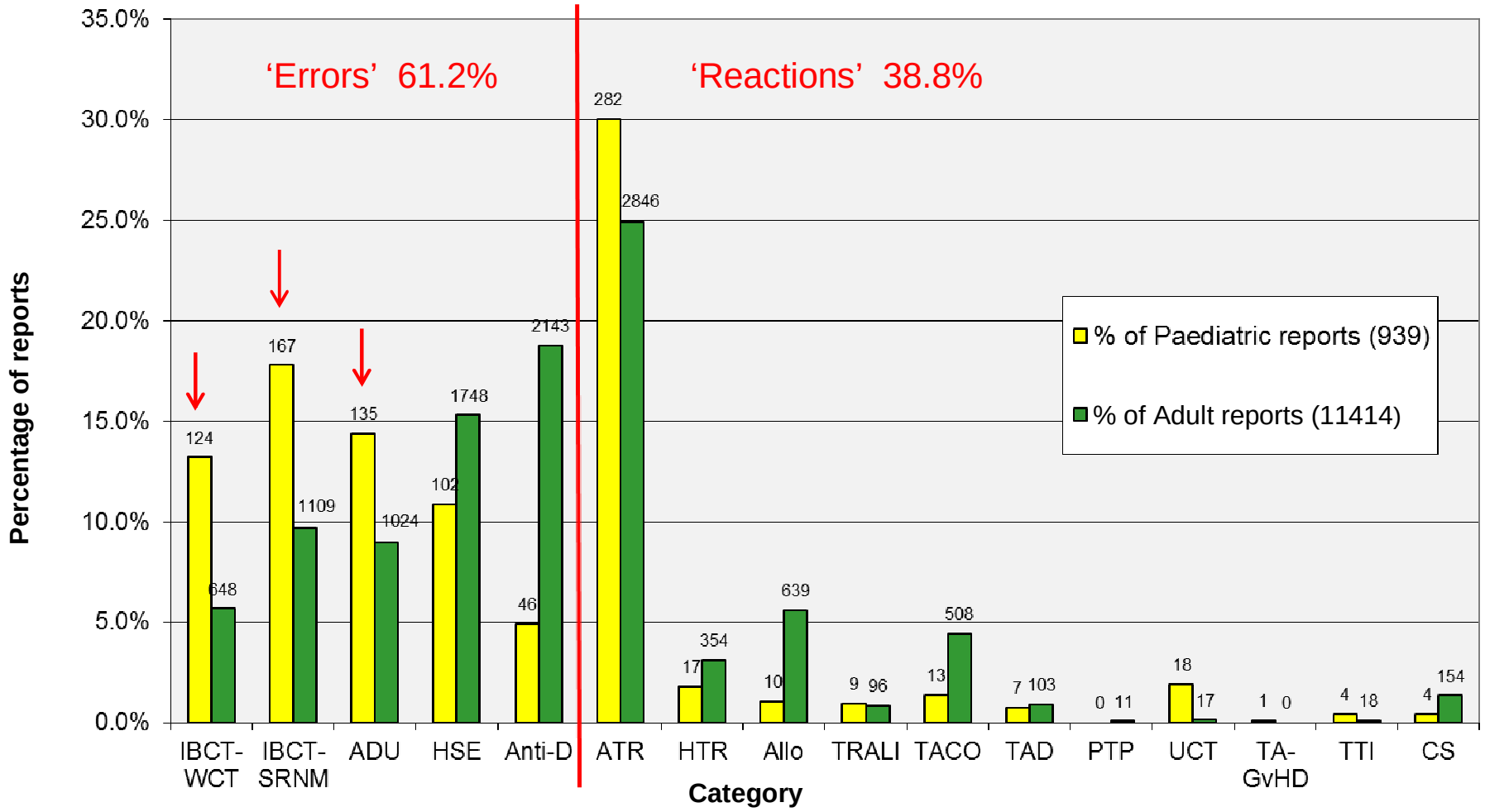
939/12,353 total (7.6%)



SERIOUS HAZARDS OF TRANSFUSION SHOT

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Themes of recurrent errors

- lab failure to test maternal sample for neonatal pretransfusion testing
- selection of wrong type of component for neonatal transfusion
  - obstetric ‘emergency O neg’ blood for neonatal resuscitation
  - neonatal exchange transfusion
- special requirements not met
  - understanding, communication (shared care)
  - lab IT systems inadequate/overriden

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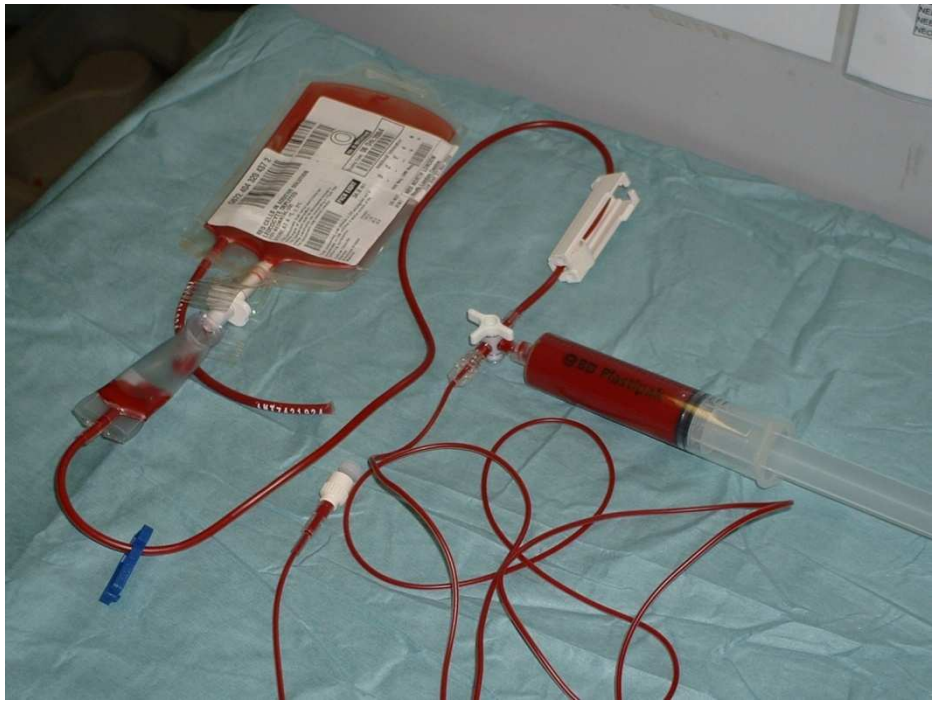
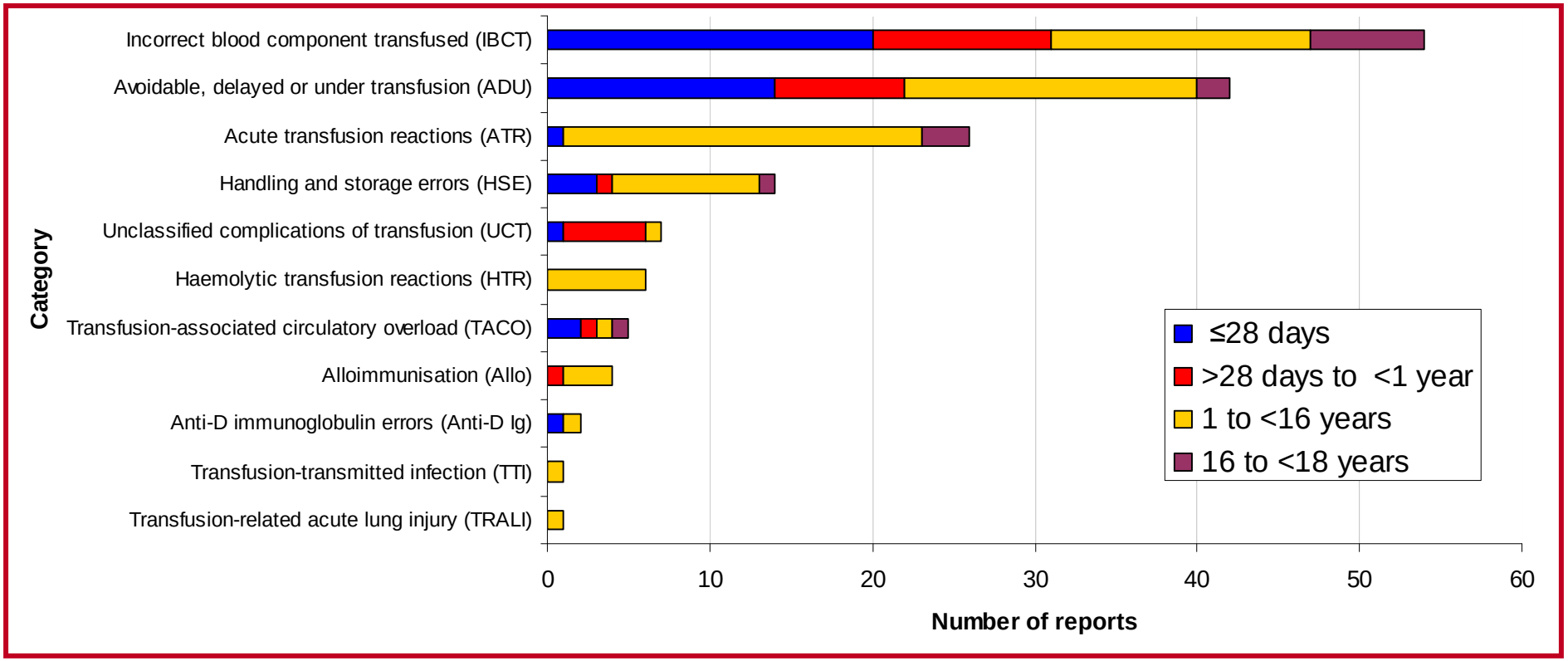
Administration errors

- prescription volumes (‘units’ not ‘mL’)
- administration errors
  - eg three way-tap on neonatal transfusion infusion sets



SHOT 2015
Categories subdivided by age group

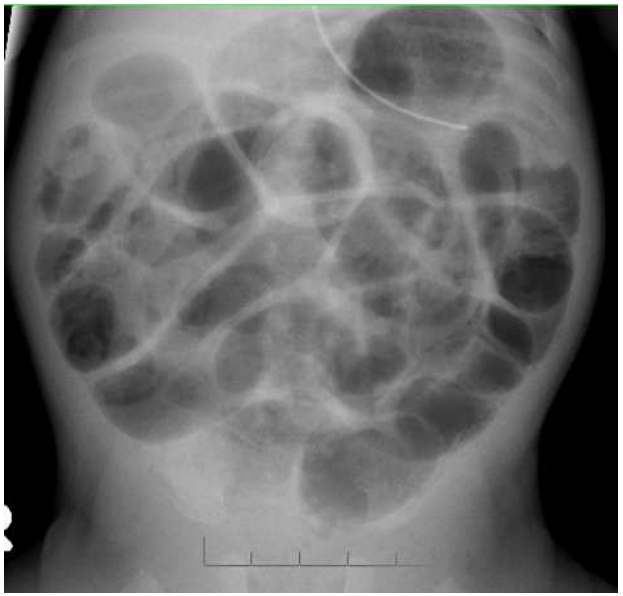


Reactions: are we getting a representative picture for neonates?

- under reporting
- missed neonatal reactions?
- immunological immaturity?

- necrotising enterocolitis (NEC)?
- intraventricular haemorrhage?
- TACO, TRALI rates?
- new definitions?

What are the true risks?



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Summary

- Paediatric transfusion balance of risk vs benefits
- BSH transfusion guidelines 2016
- evidence and consensus based
- basis for local guidelines, focus of education
- support development of paediatric PBM

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Acknowledgements

- BSH Guideline writing group
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- SHOT
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