SPECIFICATION SPN214/3
The Clinical Significance of Blood Group Alloantibodies and the Supply of Blood for Transfusion

This Specification replaces SPN214/2

Copy Number

Effective **12/01/15**

Summary of Significant Changes

Change author from Dr Nay Win to Dr Geoff Daniels. Other minor corrections include: change "HDN" to "HDFN" throughout document. Page 2: name of Regional Co-ordinator for SE changed to Alan Gray. Table 1a and Table 1b contents updated. Reference 8: change from 2nd edition to 3rd edition.

Purpose

This document outlines current knowledge on the clinical significance of blood group alloantibodies. Its prime purpose is to enable clinical decisions to be made regarding the management and blood transfusion support of patients with blood group antibodies that are not commonly encountered and for which antigen-negative blood is not available in the routine stock. The overall aim is to ensure that a uniform RCI Clinical Policy for the supply of blood for transfusion is implemented throughout the NHSBT.

Definitions

BCSH British Committee for Standards in Haematology
CHAD Cold Haemagglutinin Disease
DHTR Delayed Haemolytic Transfusion Reaction
HDFN Haemolytic Disease of the Fetus Newborn
HTR Haemolytic Transfusion Reaction
IAT Indirect Antiglobulin Test
IBGRL International Blood Group Reference Laboratory
IDP International rare Donor Panel
NHSBT NHS Blood and Transplant
NFBB National Frozen Blood Bank
RCI Red Cell Immunohaematology

Applicable Documents

- Guidelines for pre-transfusion compatibility procedures in blood transfusion laboratories. BCSH guidelines (Transfusion Medicine, 2013, 23, 3-35)

- INF437: Guidelines for the management of urgent red cell transfusion and situations when serological compatibility cannot be assured

- The clinical significance of blood group antibodies. (Transfusion Medicine, 2002, 12, 287-295)

General Requirements

Many of the antibodies described in this document are directed to high frequency antigens and may create difficulties in obtaining compatible blood. Red cells negative for high frequency antigens are not readily available and availability should be discussed with the National Frozen Blood Bank. Finding compatible blood should create no difficulty for patients with antibodies to antigens of lower frequency, but these antibodies may have to be considered when multiple specificities are present. Antibodies to lower frequency antigens may have the potential to cause haemolytic disease of the fetus and newborn (HDFN). Therefore, the clinical significance of many of these antibodies is also described in this document.

It is not possible to provide a strict policy on whether or not antigen-negative blood is required for transfusion, based purely on the specificity of the antibody. Other factors that need to be considered are:

- how urgently blood is required;
- the clinical diagnosis and the patient's bone marrow function;
- whether the patient is immunologically compromised and unlikely to respond;
- strength and thermal amplitude of the antibody;
- class and subclass of the immunoglobulin;
- results of *in vitro* functional assays (e.g. a monocyte chemiluminescence assay, which may provide some indication of the potential clinical significance of the antibody);
- *in vivo* red cell survival. (Studies are difficult to correlate with clinical outcome as the behaviour of a small volume of labelled red cells may not accurately reflect the response to the transfusion of a large volume of red cells. Red cell survival studies are undertaken by very few service laboratories.)

Where BCSH guidelines are provided for an antibody specificity these should be followed[1,2].

When an antibody is identified and considered to be of no clinical significance, particular care must be taken to ensure that it is not masking the presence of another, clinically significant, antibody.

Requests for rare units

When rare units are required, all new cases should be authorised by the RCI/on-call consultant who should establish the clinical need, urgency and number of units required and inform the centre RCI BMS. The RCI BMS should, in normal hours contact their Regional co-ordinator (out of hours approach the NFBB direct), to identify suitable units.

The Regional Co-ordinator should search the NHSBT PULSE database to see if wet units are available before deciding to use frozen red cells. Where suitable units are not available in the NFBB, IBGRL should be contacted for advice regarding availability of donors on the International Panel.

The Regional Co-ordinators:	M&SW	(Sue Search)	-	(2)7576
	SE	(Alan Gray)	-	(6)8418
	North	(Heather Webster)	-	(5)8703

National Frozen Blood Bank - (5) 7165 [Out of hours – (5)7170]
Nicole Thornton, IBGRL - (2) 7586

When compatible blood is not readily available

The following strategies should be considered:

1. Correction of anaemia wherever possible.
2. Autologous pre-deposit (for surgery).
3. Cell salvage (for surgery).
4. Calling up donors of known phenotype.
5. Consultation of the National and International Frozen Blood Banks.
6. Mass screening of donations.
7. Transfusing serologically incompatible (or 'least incompatible') blood, with or without immunosuppression.
8. Testing members of the patient's family, especially siblings.
9. Consultation of the International Rare Donor Panel.

When antigen-positive blood is to be transfused

It is important to note that antibodies that show strong reactivity by IAT may be more active in vivo than if the same antibody showed weaker reactions. Where possible 'serologically least incompatible' units should be selected. Some of the antibodies listed are extremely rare and little or nothing is known about their clinical significance[2]. Absence of evidence of clinical significance does not mean that a transfusion of 'incompatible' blood will be uneventful. ABO compatible, RhD matched, serologically least incompatible blood, should be transfused with extra caution. Where appropriate, strategies for ameliorating the immunological response, such as the use of intravenous immunoglobulin and high dose steroids, should be considered[3,4]. Advice on this may only be given to hospitals by an NHSBT consultant, who should discuss the case with an RCI consultant whenever time permits. Based on the few reported cases, the recommendation is that 0.4g/kg intravenous immunoglobulin (IVIG) together with IV steroids are infused 6–8 hours prior to a planned 'incompatible' transfusion[4,5]. The transfusion should be given at the slowest rate consistent with the clinical condition and the patient observed closely throughout. Consider additional dose of IVIG and steroids, if hemolytic transfusion reactions develop [5,6,7]. It has also been reported that treatment with IVIG and steroids may correct severe anemia in severe delayed haemolytic transfusion reaction[6].

Occasionally, clinical urgency requires that blood must be transfused before the antibody has been identified or before a tentative identification has been confirmed. Under these circumstances, ABO compatible, RhD matched, serologically least incompatible blood should be transfused with extra caution. The decision to issue ABO, compatible RhD matched, least incompatible blood should be made on the balance of risk of severe haemorrhage (anaemia, urgent requirement), versus a haemolytic transfusion reaction with potential complications including renal failure. As discussed above, strategies for ameliorating the immunological response, such as the use of intravenous immunoglobulin and high dose steroids, should be considered. Transfusion should be given for resuscitation with IV methylprednisolone 1g cover (it is readily available and easy to be administered but alternative IV steroids should be used such as hydrocortisone 200mg, which is stocked on most wards, while awaiting Methylprednisolone). The patient should be monitored closely and reviewed.

If haemolytic transfusion reactions develop IVIG may be required[5,6,7].

For some antibody specificities the recommendation is that serologically least incompatible red cells may be given, but that antigen-negative red cells should be provided for strong examples of the antibody (Table 1)[8]. Generally, a strong example of the antibody would be one giving a reaction strength grade 3 or greater (on a scale of 0-5) by IAT.

Antibodies to low frequency antigens

Either blood negative for the corresponding antigen or blood compatible by IAT at 37^{o}C, as appropriate, may be supplied.

HDFN

Virtually all antibodies reactive by IAT have been implicated in HDFN (see BCSH Guidelines for testing protocols, Transfusion Medicine 1996; 6:273-283). Whenever an IAT-reactive antibody is detected during pregnancy, a cord sample should be tested by a DAT and, if positive, the haemoglobin and bilirubin levels monitored to diagnose HDFN. Haemolysis caused by antibodies to red cell antigens of lower frequency is generally not sufficiently severe to require intra-uterine transfusion (IUT), but blood may be required for neonatal transfusion. It should be noted that frozen and thawed red cells are both safe and effective for intrauterine and exchange transfusions (coagulation tests should be undertaken during and after neonatal exchange transfusions; in rare cases where there is a risk of bleeding, fresh frozen plasma (FFP) transfusions may be required).

Table 1a. Recommendations for red cells to be selected for transfusion

Antibody	Recommendation
ABO	
Anti-A, -B, -A,B	Antigen-negative red cells
Anti-A_1	Red cells compatible by IAT at 37°C
MNS	
Anti-M (active at 37°C), -S, -s, -U	Antigen-negative red cells
Anti-N (active at 37°C), -En^a, antibodies to low frequency MNS antigens (anti-'Mi^a')	Red cells compatible by IAT at 37°C
P1PK	
Anti-P1 (active at 37°C)	Red cells compatible by IAT at 37°C
Rh	
All Rh antibodies (except anti-C^w)	Antigen-negative red cells
• **Anti-C^w** • Previously detected but not detectable in current sample	1) Red cells compatible by IAT at 37°C 2) Select as above
Lutheran	
• Anti-Lu^a • Previously detected but not detectable in current sample	1) Red cells compatible by IAT at 37°C 2) Select as above
Anti-Lu^b, -Lu3	Antigen-negative red cells
Antibodies to other high frequency Lutheran antigens	Serologically least incompatible red cells, but antigen-negative red cells for strong examples of the antibody
Kell	
All Kell antibodies (except anti-Kp^a, -Ul^a and -K17)	Antigen-negative red cells
• Anti-Kp^a, Ul^a, -K17 • Previously detected but not detectable in current sample	1) Red cells compatible by IAT at 37°C 2) Select as above
Lewis	
Anti-Le^a, -Le^b, -Le^{a+b}	Red cells compatible by IAT at 37°C
Duffy	
All Duffy antibodies	Antigen-negative red cells
Kidd	
All Kidd antibodies	Antigen-negative red cells

Antibody	Recommendation
Diego	
Anti-Di^{b}, -Wr^{b}	Antigen-negative red cells
Anti-Di^{a}	Red cells compatible by IAT at 37°C
• **Anti-Wr^{a}** • Previously detected but not detectable in current sample	1) Red cells compatible by IAT at 37^{o}C 2) Select as above
Yt	
Anti-Yt^{a}	Serologically least incompatible red cells, but antigen-negative red cells for strong examples of the antibody
Anti-Yt^{b}	Red cells compatible by IAT at 37^{o}C
Xg	
Anti-Xg^{a}	Red cells compatible by IAT at 37^{o}C
Scianna	
Anti-Sc1	Antigen-negative red cells
Anti-Sc2, -SC4 (Rd)	Red cells compatible by IAT at 37^{o}C
Anti-Sc3, -SC5, -SC6, -SC7	Ideally antigen-negative red cells, but, due to their extreme rarity, serologically least incompatible red cells should be used with extra caution
Dombrock	
Anti-Do^{a}, -Do^{b}	Red cells compatible by IAT at 37^{o}C
Anti-Gy^{a}, -Hy, -Jo^{a} and other Dombrock antibodies	Serologically least incompatible red cells, but antigen-negative red cells for strong examples of the antibody
Colton	
Anti-Co^{a}	Antigen-negative red cells
Anti-Co^{b}	Red cells compatible by IAT at 37^{o}C
Anti-Co3	Ideally antigen-negative red cells, but, due to their extreme rarity, serologically least incompatible red cells should be used with extra caution
Landsteiner-Wiener	
Anti-LW^{a}, -LW^{ab}	Serologically least incompatible D– red cells
Anti-LW^{b}	Red cells compatible by IAT at 37^{o}C
Chido/Rodgers	
Chido/Rodgers antibodies	Serologically least incompatible red cells
H	
Anti-H (in O_h individuals)	Antigen-negative red cells
Anti-H/HI (in para-Bombay secretors)	Red cells compatible by IAT at 37^{o}C (use ABO-identical)

Antibody	Recommendation
Anti-HI (in patients with common ABO phenotypes)	Red cells compatible by IAT at 37^{o}C
Kx	
Anti-Kx	Antigen-negative red cells
Gerbich	
Gerbich antibodies	Serologically least incompatible red cells
Cromer	
Cromer antibodies	Serologically least incompatible red cells, but antigen-negative red cells for strong examples of the antibody
Knops	
Knops antibodies	Serologically least incompatible red cells
Indian	
Anti-In^{a}	Red cells compatible by IAT at 37^{o}C
Anti-In^{b}	Serologically least incompatible red cells, but antigen-negative red cells for strong examples of the antibody
Ok	
Anti-Ok^{a}	Ideally antigen-negative red cells, but, due to their extreme rarity, serologically least incompatible red cells should be used with extra caution
Raph	
Anti-MER2	Serologically least incompatible red cells
John Milton Hagen	
Anti-JMH	Serologically least incompatible red cells
I	
Alloanti-I (active at 37^{o}C)	Antigen-negative red cells
Autoanti-I	Red cells compatible by IAT at 37^{o}C

Globoside	
Anti-P, -PP1P^{k}	Antigen-negative red cells
GIL	
Anti-Gil	Ideally antigen-negative red cells, but, due to their extreme rarity, serologically least incompatible red cells should be used with extra caution
RHAG	
Anti-Duclos, -DSLK	Antigen-negative or Rh_{null} red cells
JR	
Anti-Jr^{a}	Serologically least incompatible red cells, but antigen-negative red cells for strong examples of the antibody
Lan	
Anti-Lan	Serologically least incompatible red cells, but antigen-negative red cells for strong examples of the antibody
Vel	
Anti-Vel	Antigen-negative red cells
CD59	
Anti-CD59	Ideally antigen-negative red cells, but, due to their extreme rarity, serologically least incompatible red cells should be used with extra caution
COST	
Anti-Cs^{a}	Serologically least incompatible red cells
Er	
Anti-Er^{a}	Serologically least incompatible red cells
Collection 209	
Anti-LKE	Serologically least incompatible red cells
High frequency (901)	
Anti-AnWj	Antigen-negative red cells
Anti-At^{a}	Serologically least incompatible red cells, but antigen-negative red cells for strong examples of the antibody
Anti-Emm, -PEL, -ABTI	Serologically least incompatible red cells
Anti-MAM	Ideally antigen-negative red cells, but, due to their extreme rarity, serologically least incompatible red cells should be used with extra caution
Antibody	**Recommendation**
Anti-Sd^{a}	Serologically least incompatible red cells (avoid Sd(a+++) donors)

Table 1b. Recommendations for red cells to be selected for transfusion

Give antigen-negative red cells

Anti-A, -B, -A,B
Anti-M (active at 37°C), -S, -s, -U
All Rh antibodies (except anti-C^w)
Anti-Lu^b, -Lu3
Kell antibodies (including anti-K, -k, -Kp^b, -Js^a, -Js^b, -Ku (but not anti-Kp^a , -Ul^a and -K17)
All Duffy antibodies (anti-Fy^a, -Fy^b, -Fy3, -Fy5)
All Kidd antibodies (anti-Jk^a, -Jk^b, -Jk3)
Anti-Di^b, -Wr^b
Anti-Sc1
Anti-Co^a
Anti-H (in O_h individuals)
Anti-Kx
Alloanti-I (active at 37°C)
Anti-P, -$PP1P^k$
Anti-Duclos, -DSLK (Rh_{null} cells suitable)
Anti-Vel
Anti-AnWj

Give red cells compatible by IAT at 37°C

Anti-A_1
Anti-N (active at 37°C), -En^a, antibodies to low frequency MNS antigens (anti-'Mi^{a}')
Anti-P1 (active at 37°C)
Anti-Lu^a
Anti-C^w
Anti-Le^a, -Le^b, -Le^{a+b}
Anti-Kp^a, Ul^a, -K17
Anti-Wr^a
Anti-Yt^b
Anti-Xg^a
Anti-Do^a, -Do^b
Anti-Di^a
Anti-Co^b
Anti-H/HI in para-Bombay, use ABO identical
Anti-HI (in patients with common ABO phenotypes)
Anti-In^a
Autoanti-I

Give serologically least incompatible red cells, but antigen-negative red cells for strong examples of the antibody
Antibodies to other (not anti-Lu^{b} or -Lu3) high frequency Lutheran antigens Anti-Yt^{a} Anti-Gy^{a}, -Hy, -Jo^{a} and other Dombrock antibodies Cromer antibodies Anti-In^{b} Anti-Jr^{a} Anti-Lan Anti-At^{a}
Give ABO/D compatible, least incompatible red cells
Anti-LW^{a}, -LW^{ab} (use D–) Chido/Rodgers antibodies Gerbich antibodies Knops antibodies Anti-JMH Anti-MER2 Anti-Cs^{a} Anti-Er^{a} Anti-LKE Anti-Emm, -PEL, -ABTI Anti-Sd^{a} (avoid Sd(a+++) donors)
Ideally antigen-negative red cells should be given, but, due to their extreme rarity, ABO/D compatible, least incompatible red cells should be used with extra caution
Anti-Sc3, -SC5, -SC6, -SC7 Anti-Co3 Anti-Ok^{a} Anti-Gil Anti-CD59 Anti-MAM

Blood group antibodies

Antibodies are presented below in the order of the ISBT blood group classification. A table summarising the recommendations for selection of suitable blood is provided above. An alphabetical index is provided at the end of the document.

ABO system

Anti-A, -B, and –A,B cause severe intravascular haemolytic transfusion reactions. **Antigen-negative blood must be selected for transfusion.**

Anti-A_1 is rarely active at 37^{o}C and not considered clinically significant. **IAT-compatible blood should be selected (BCSH guidelines).**

Plasma products with high titre ABO antibodies should only be given to group O recipients.

MNS system

Anti-M and -N can usually be ignored and are not detected by IAT at 37^{o}C. Rarely anti-M or -N are active at 37^{o}C and then are capable of causing transfusion reactions.

If anti-M is active by IAT at 37^{o}C, M– blood must be selected (BCSH guidelines).

If anti-N is active by IAT at 37^{o}C, IAT-compatible blood unselected for N may be used.

About 22% of donors are M–
About 28% of donors are N–

Rarely, anti-M may cause HDFN.

Anti-S and -s can cause HTRs. **Antigen-negative blood must be selected (BCSH guidelines).**

About 45% of donors are S–
About 11% of donors are s–

Anti-S and -s may cause HDFN.

Anti-U detects a high frequency antigen and has caused immediate and delayed HTRs. **U– blood, which is also S– s–, must be selected**.

Occasionally anti-N present in a U– patient reacts, by IAT at 37^{o}C, with all red cells except those of the N– U– phenotype. **When this occurs, N– U– blood should be selected.**

U– blood is usually only found in people of African origin. Contact NFBB for information regarding availability of 'wet' and frozen U– units.

Anti-U may cause HDFN.

Other antibodies to high frequency MNS antigens. These are the En^a family of antibodies and are exceedingly rare. There are single reports of **anti-En^a** causing a severe HTR and severe HDN. **If possible IAT-compatible blood should be selected.** Consult IBGRL for availability of En(a-) donors on the IDP.

Antibodies to low frequency MNS antigens. Antibodies generally referred to as anti-Mi^a (including anti-Mur and -Vw) and the antigens they define are rare in England but relatively common in people from East Asia. They can cause immediate and delayed HTRs and severe HDFN. **IAT-compatible blood (most donors) must be selected.**

P1PK system

P1 antibodies are not usually reactive above 25^{o}C and do not cause HTRs. Very rare examples of anti-P1 are reactive at 37^{o}C and can cause severe immediate or delayed HTRs. **If P1 typed units are readily available select P1 neg units, or if not, units compatible with IAT (using polyspecific antihuman globulin reagent at 37^{o}C by LISS technique) should be used for transfusion when anti-P1 active at 37^{o}C is present.** About 20% of donors are P1 neg. Anti-P1 has not been implicated in HDFN.

Rh system

All Rh antibodies should be considered to be potentially clinically significant, capable of causing both HTRs and HDN. **BCSH guidelines recommend that when an Rh antibody reactive in IAT (the majority of Rh antibodies) is present, antigen-negative blood must be selected. However, as anti-C^w has never been reported to have caused an HTR, IAT-compatible blood may be used when anti-C^w is detected.**

All Rh antibodies have the potential to cause HDFN.

Antibodies to high frequency Rh antigens are rare. They include anti-Rh29, the antibody characteristically made by immunised Rh_{null} individuals, and anti-Hr_o (-Rh17) and related antibodies that detect epitopes on the RhCcEe protein.

Anti-Rh29 Only Rh_{null} blood, which is extremely rare, is suitable.

Anti-Hr_0 (-Rh17). Only Rh_{null} or D-- (or related phenotype) blood is suitable.

Other antibodies to high frequency antigens. These include antibodies such as **anti-Hr**, **-Hr^B, -Rh46, and -MAR.** Rh_{null} or D-- blood would be suitable, but it might be easier to obtain blood lacking the specific antigen.

e-like antibodies. Anti-hr^S and -hr^B resemble anti-e and may be found in patients of African origin. They have not been reported to be clinically significant, but a particularly potent example might cause problems. R_2R_2 cells should be compatible, but the patient may then be stimulated to produce an antibody to a high frequency antigen (anti-Hr or -Hr^B) or anti-E. Consult NFBB for availability of hr^S- and hr^B-negative donors.

Anti-C^w is a relatively common antibody. There is no report of anti-C^w causing a transfusion reaction and IAT-compatible blood may be selected. Anti-C^w has been implicated in HDN: one case of hydrops fetalis, attributed to anti-C^w, has been reported[9].

About 97% of donors are C^w–.

Antibodies to low frequency antigens. The Rh system contains many low frequency antigens. Antibodies to these antigens should all be considered to have the potential to cause HDFN. Anti-E^w, -Go^a, -Rh32, -Be^a, -Evans, and -Tar have all been implicated in HDFN.

Lutheran system

Anti-Lu^a has caused mild DHTRs. **IAT-compatible blood should be selected**.

About 92% of donors are Lu(a–).

Anti-Lu^b has caused mild DHTRs. **Antigen-negative blood should be selected.**

Anti-Lu3 is a very rare antibody produced by immunised individuals with the recessive type of Lu_{null} [Lu(a–b–)]. **Lu_{null} blood should be selected.** The dominant, In(Lu) type of Lu_{null} is most readily available.

Other antibodies to Lutheran system high frequency antigens have not been proven to be clinically significant. However, **as a precaution Lu_{null} blood should be selected for patients with strong examples of the antibody**.

Lutheran antibodies have not been implicated in severe HDFN.

Lewis system

Lewis antibodies are not clinically significant, and can be ignored when selecting blood for transfusion.

For anti-Le^a, -Le^b, and -Le^{a+b}, blood compatible by IAT at 37°C should be selected (BCSH guidelines).

Most anti-Le^b have Le^{bH} specificity and might react strongly with group O red cells, but be non-reactive with group A_1 or B cells.

About 80% of donors are Le(a–).
About 30% of donors are Le(b–).

Lewis antibodies have not been implicated in severe HDFN.

Kell system

Most Kell system antibodies are clinically significant and antigen-negative blood must be selected, except in the case of anti-Kp^a, in which only one case of severe DHTR is reported.

Kell antibodies have the potential to cause HDFN.

Anti-k has caused severe immediate HTRs. **k– blood must be selected**. K+k– blood has a frequency of about 0.2%. If blood is not available locally, contact NFBB.

Anti-Kp^b has caused delayed HTRs. **Kp(b–) blood must be selected**. Kp(a+b–) blood has a frequency of about 0.01%

Anti-Js^{b} has caused delayed HTRs. **Js(b–) blood must be selected**. Js(a+b–) blood is very rare in a mainly white population.

Anti-Ku, the antibody produced by immunised K_o individuals, can cause severe HTR. **If possible, K_o blood (very rare) should be selected**.

Other antibodies to high frequency Kell antigens. These are very rare antibodies. None is reported to have caused an HTR, but **antigen-negative blood is recommended if possible**. In most cases, the only antigen-negative blood available will be K_o blood (see above).

Antibodies to low frequency Kell antigens.

Anti-Js^{a}: antigen-negative blood (most donors) must be selected.
Anti-Kp^{a}, -Ul^{a}, -K17: IAT-compatible blood is suitable.

About 98% of donors are Kp(a–).
About 99.7% of donors are K:–17.

Duffy system

Anti-Fy^{a} and -Fy^{b} have caused immediate and delayed HTRs

The BCSH guidelines recommend that when Duffy antibodies are present, antigen-negative blood must be selected.

Both have the potential to cause HDFN.

About 32% of donors are Fy(a–).
About 20% of donors are Fy(b–).

Anti-Fy3 is a rare antibody detecting antigens on all red cells except those of the Fy(a–b–) phenotype. Anti-Fy3 has caused immediate and delayed HTRs. **Fy(a–b–) blood must be selected.**

Anti-Fy5 is a rare antibody, similar to anti-Fy3, but it does not react with Fy(a–b–) or Rh_{null} cells. Anti-Fy5 has caused delayed HTRs; **Fy(a–b–) blood must be selected**.

Fy(a–b–) phenotype is rare in Caucasians, but very common in people of African origin.

Anti-Fy3 and -Fy5 have not been implicated in severe HDFN.

Kidd system

Anti-Jk^{a} and -Jk^{b} are dangerous antibodies as they are often difficult to detect, yet they are a common cause of delayed HTRs. Anti-Jk^{a} have also caused immediate HTRs.

The BCSH guidelines recommend that when Kidd antibodies are present, antigen-negative blood must be selected.

About 24% of donors are Jk(a–).
About 27% of donors are Jk(b–).

Kidd antibodies do not usually cause HDFN, though there are reports of severe HDFN caused by anti-Jk^{a} and anti-Jk^{b}.

Anti-Jk3 is a very rare antibody that reacts with all red cells except those of the Jk(a–b–) phenotype. It can cause immediate and delayed HTRs. **Jk(a–b–) blood must be selected**. Anti-Jk3 has not been implicated in HDFN.

Diego system

Anti-Di^{a} detects an antigen that is very rare in Caucasians, but polymorphic in people of Eastern Asia and Native Americans. There is no firm evidence that anti-Di^{a} has caused an HTR, but anti-Di^{a} has haemolytic potential. **IAT compatible blood (most donors) must be selected**.

Anti-Di^{a} has been implicated in severe HDFN.

Anti-Di^{b} is a rare antibody that detects an antigen of very high frequency. Anti-Di^{b} has been implicated in HTRs and HDFN. **Antigen-negative blood should be selected**.

Anti-Wr^{a} is a relatively common antibody to a very low frequency antigen. It has caused HTRs. **If anti-Wr^{a} is detected, IAT-compatible blood must be selected**.

Anti-Wr^{a} has caused severe HDFN

Anti-Wr^{b} is a rare alloantibody to a very high frequency antigen. There is no report of anti-Wr^{b} causing an HTR or HDN. **If possible, for strong antibodies, antigen-negative blood should selected**. Wr(b–) blood is extremely rare.

Other antibodies of the Diego system all detect antigens of very low frequency. None has caused an HTR, but anti-ELO (-DI8) has caused severe HDFN**. IAT-compatible blood (most donors) should be selected**.

Yt system

Anti-Yt^{a} detects an antigen with a frequency of about 99.7%. Anti-Yt^{a} has rarely been responsible for a HTR. **Yt(a–) blood is not usually required for transfusion, but is recommended for strong examples of the antibody**.

There is no report of anti-Yt^{a} causing HDFN.

Anti-Yt^{b} detects an antigen with a frequency of about 8%. There is no report of anti-Yt^{b} causing a HTR or HDFN. **IAT compatible blood should be selected.**

Xg system

Anti-Xg^a detects an antigen with a frequency of 66% in males and 89% in females. There is no report of a HTR due anti-Xg^a. Xg^a typed donor blood is not available, but **IAT-compatible blood should be selected.**

Anti-Xg^a has not been implicated in HDFN.

Scianna system

Anti-Sc1, -Sc3, -SC5, -SC6 and -SC7 detect antigens of very high frequency. Apart from a DHTR caused by anti-SC7, there is no report of these antibodies causing a HTR or HDFN. The antibodies are IgG and usually potent, but evidence of clinical significance is limited because of the rarity of the antibodies. **Antigen-negative blood should be selected, if possible**. Sc:–1, 2, 3 blood may be available, but is extremely rare. Sc:–1,–2,–3 donors are not available. **When anti-Sc3, -SC5, -SC6 or -SC7 are present, serologically least incompatible blood may be given with extra caution.**

Anti-Sc2 and –SC4 (Rd) detect antigens of low frequency. Neither antibody has not been reported to have caused an HTR, but anti-SC4 has been implicated in HDFN. **IAT-compatible blood (most donors) should be selected.**

Dombrock system

Anti-Do^a and -Do^b are generally found in sera containing multiple red cell antibodies. They have caused immediate and delayed HTRs. Finding compatible blood may be complicated by the presence of the other antibodies. In most instances typed donors are not available. **IAT-compatible blood should be selected.**

About 34% of donors are Do(a–).
About 18% of donors are Do(b–).

Anti-Gy^a, -Hy, -Jo^a and other Dombrock antibodies are rare antibodies that detect antigens of very high frequency. There is one report of anti-Hy causing an HTR, but, because of the rarity of the antibodies, evidence of clinical significance is limited. **Antigen-negative blood is not usually required for transfusion, but is recommended for strong examples of the antibody.**

No Dombrock antibody has caused HDFN.

Colton system

Anti-Co^a detects an antigen of high frequency and has caused delayed HTRs and severe HDFN. **Co(a–) blood should be selected**.

About 0.2% of donors are Co(a–).

Anti-Co^b is a rare antibody that detects an antigen with a frequency of about 8.5%. An acute HTR and a mild DHTR due to anti-Co^b are reported. **IAT-compatible blood (90% of donors) should be selected**.

Anti-Co^b has not been implicated in serious HDFN.

Anti-Co3 is a very rare antibody detecting an antigen of very high frequency. Anti-Co3 has caused a mild HTR and serious HDFN. **Ideally, Co(a–b–) blood should be selected for compatibility testing**, **but is extremely rare. Serologically least incompatible blood may be given with extra caution.**

LW system

Anti-LW^{a} and -LW^{ab} detect antigens of very high frequency. There is no report of either antibody causing a HTR. **Antigen-negative blood may not be required for transfusion, but D– blood should be selected (unless anti-c is present in an R_1R_1 LW(a–) patient).**

Anti-LW^{b}, which detects an antigen of low frequency, has not been reported to have caused a HTR. **IAT-compatible blood (most donors) should be selected.**

No LW antibody has been implicated in HDFN.

Chido/Rodgers system

Chido/Rodgers antibodies detect C4 antigens that become attached to the red cell surface *in vivo*. No Chido/Rodgers antibody has caused an HTR and **antigen-negative blood is not required for transfusion.** (Use serum neutralised with AB serum for compatibility testing).

H system

Anti-H is always present in the serum of individuals with the O_h (Bombay) phenotype (red cell H-deficient, non-secretor). Like anti-A and -B, -H is likely to cause a severe immediate HTR. **Blood of the O_h (Bombay) phenotype must be selected**.

Some non-secretors of *A* or *B* genotype have very low levels of red cell H and have the 'para-Bombay' A_h or B_h phenotype. These individuals usually have anti-H in their serum, though this is rarely of high titre. Little information exists on the clinical significance of anti-H in A_h or B_h individuals. **Ideally O_h (Bombay) phenotype should be selected, but if not available red cells of the appropriate ABO group (A for A_h, B for B_h) may be used.**

Anti-H may rarely cause severe HDFN.

Anti-HI is present in the serum of individuals with some para-Bombay phenotypes (red cell H-deficient, secretor). Anti-HI is unlikely to be active at 37^{o}C. **ABO-identical blood, compatible at 37^{o}C, can be used for transfusion**.

Anti-HI may be found in group A_1, A_1B, and B individuals and may be active at 37^{o}C. **Blood that is compatible at 37^{o}C can be used for transfusion**. **If the antibody is active at 37^{o}C, blood of the ABO group of the patient should be used. Group O and A_2 blood should not be used.**

Kx system

Anti-Kx is a rare antibody found in the serum of immunised individuals with McLeod syndrome, usually together with anti-Km. Anti-Kx + -Km has caused severe HTRs. **If possible, antigen-negative (McLeod phenotype) blood should be selected.**

Gerbich system

Anti-Ge2, -Ge3, -Ge4, -GEPL, -GEAT and –GETI detect antigens of very high frequency. There is no firm evidence that any of these antibodies has caused a HTR. **Antigen-negative blood is not usually required for transfusion,**

Anti-Ge3 has caused severe HDFN[10].

Antibodies to low frequency antigens. None of these antibodies has caused an HTR or HDFN.

Cromer system

Anti-Cr^a, -Tc^a, -Dr^a, -IFC, and other antibodies to high frequency Cromer antigens. There is no firm evidence that any of these rare antibodies has caused a HTR and the evidence from functional cellular assays is equivocal. **Antigen-negative blood is not usually required for transfusion, but should be considered for strong examples of the antibody.** Typed donors are not available in the UK.

Antibodies to low frequency antigens. None of these antibodies has caused an HTR.

No Cromer antibody has been implicated in HDFN.

Knops system and the COST antibodies

Anti-Kn^a, -McC^a, -Sl1, -Sl3, -Yk^a, -KCAM and -Cs^a detect antigens of relatively high frequency.

Anti-Kn^b, -McC^b, -Sl2, and -Cs^b detect antigens of relatively low frequency.

All of these antibodies can be considered to be of no clinical significance and can be ignored when selecting blood for transfusion. Use of least-incompatible blood will reduce the hazard of masking other, clinically-significant, antibodies.

No Knops antibody has caused HDFN.

Indian (In) system

Anti-In^b is a rare antibody that recognises an antigen of very high frequency. There is one reported case of anti-In^b causing a HTR. **In(b–) blood is not usually required for transfusion, but should be considered for strong examples of the antibody.**

Anti-In^a is a rare antibody that detects an antigen that is rare in populations of European origin, but with a frequency of about 3% in Indians and 10% in Arabs. Anti-In^a is not reported to be clinically significant. **IAT-compatible red cells should be selected for transfusion.**

Anti-In^a and -In^b have not been implicated in HDFN.

Ok system

Anti-Ok^a, -OKGV, -OKVM. There is almost no information on the clinical significance of Ok antibodies, but *in vivo* survival tests and cellular functional assays suggest that anti-Ok^a is clinically significant. **Ok(a–) blood is extremely rare. When Ok(a–) blood is not available, serologically least incompatible blood may be given with extra caution.**

Ok antibodies have not been implicated in HDFN.

Raph system

Anti-MER2, the only antibody of the Raph system, detects an antigen of very high frequency, although the red cells of about 8% of Caucasians are serologically MER2–. There is one report of an HTR caused by anti-MER2. **Serologically least incompatible blood may be used for transfusion.**

Anti-MER2 has not been implicated in HDFN.

JMH system

Anti-JMH detects an antigen of high frequency and JMH– is usually an acquired phenotype. Anti-JMH is not considered clinically significant. **Serologically least incompatible blood may be used for transfusion.**

Anti-JMH has not been implicated in HDFN.

I system

Anti-I is always present as an alloantibody in the serum of individuals with the rare adult i phenotype (I– i+), although it is more commonly found as an autoantibody in CHAD patients. I+ blood transfused to patients with allo anti-I has caused increased destruction of cells and therefore **I– blood should be considered if the anti-I is active at 37^{o}C**. I– blood is not required when auto anti-I is present.

Anti-I has not been implicated in HDFN.

Globoside system

Anti-P and anti-P,P1,P^k are antibodies always present in individuals with the rare P^k and p phenotypes, respectively. Both antibodies can react at 37^{o}C, be strongly haemolytic, and can cause HTR. **Antigen-negative red cells must be selected**. Both antibodies are compatible with p cells, anti-P is also compatible with P^k cells.

Neither anti-P nor -P,P1,P^k has been reported to cause HDFN, but there is a high rate of early spontaneous abortion.

Gill system

Anti-Gil is a rare antibody to an antigen of very high frequency. Anti-GIL may have been responsible for a HTR. **Serologically least incompatible blood should be used with extra caution.**

Anti-Gil has not been implicated in HDFN.

RHAG system

Anti-Duclus and –DSLK are very rare antibodies to antigens of very high frequency. There is no information on clinical significance. **Antigen negative or Rh_{null} red cells should be selected**.

Anti-Ol^a and -RHAG4 detect very rare antigens and **IAT-compatible blood (most donors) should be selected.**

JR system

Anti-Jr^a. There is little evidence that anti-Jr^a has caused a HTR (there is only one case report of DHTR[12]) and one report of fatal HDFN (with anti-Jr^a , 1:1024)[13]. **Jr(a–) blood is not usually required for transfusion, but should be considered for strong examples of the antibody.** Jr(a–) blood is not available in the UK.

Lan system

Anti-Lan. One example of anti-Lan is reported to have caused an immediate HTR. **Lan– blood is not usually required for transfusion, but should be considered for strong examples of the antibody.**

There is no report of anti-Lan causing serious HDFN.

Vel system

Anti-Vel are often complement-activating IgM antibodies that cause severe immediate HTRs. **Vel– blood must be selected**.

There is one case of anti-Vel implicating severe HDFN[11] .

CD59 system

Anti-CD59 is a very rare antibody to an antigen of very high frequency. There is no information on clinical significance. **Serologically least incompatible blood should be used with extra caution.**

Er

Anti-Er^a and -Er3 are rare antibodies detecting antigens of high frequency; anti-Er^b detects a low, frequency antigen. There is no evidence that these antibodies are clinically significant, little clinical data are available. Er(a–) blood is not available in the UK. **Serologically least incompatible blood should be used with extra caution.**

Anti-Er^a and -Er^b have not been implicated in HDFN.

LKE

Anti-LKE detect an antigen of high frequency absent from P^k and p cells. These antibodies are generally only active at low temperature and there is no report of a HTR. **Serologically least incompatible blood may be used**.

Antibodies to antigens of low frequency (700 series)

Antibodies to low frequency antigens do not present a transfusion problem, as compatible blood is readily available.

Some of the antibodies in this series have caused HDFN: anti-JFV, -Kg, -JONES, -HJK, - and -REIT.

Antibodies to antigens of high frequency (901 series)

All the antibodies in this section detect antigens of very high frequency.

Anti-At^a has been reported to have caused immediate and delayed transfusion reactions. **At(a–) blood is not usually required for transfusion, but should be considered for strong examples of the antibody.** At(a–) blood is not available in the UK.

There is one report of anti-At^a causing mild HDN.

Anti-Emm. There is no evidence of clinical significance and **serologically least incompatible blood can be used.**

Anti-AnWj has caused severe HTRs. **IAT-compatible blood must be selected**. Red cells of the Lu$_{null}$ (dominant In(Lu) type) phenotype have very low expression of AnWj and are suitable for transfusion.

There is no report of anti-AnWj causing HDFN.

Anti-PEL. Only two examples of anti-PEL and two anti-PEL-like are known. *In vivo* survival studies suggest that anti-PEL would not cause a HTR. **Serologically least incompatible blood should be used.**

Anti-ABTI. Only three examples of anti-ABTI are known and there is little information on their clinical significance. Typed donor blood is not available. **Serologically least incompatible blood should be used.**

Anti-MAM is a very rare antibody. Only four examples of anti-MAM are known and are potent IgG antibodies. Anti-MAM has not caused a HTR, **but it has caused severe HDFN**. MAM– blood is not available **and serologically least incompatible blood with immunosuppressive therapy may be necessary.**

Sd^a

Anti-Sd^a detects an antigen with a frequency of about 91%. The strength of Sd^a is very variable. Although anti-Sd^a is not generally considered a transfusion hazard, and Sd(a–) red cells are not required for transfusion **serologically least incompatible red cells should be selected (avoid Sd(a+++) cells).**

Table 2 Antibodies to blood group antigens showing published clinical significance

Ag freq = Frequency of antigen detected. H = high. L = low. P = polymorphic.
HTR = haemolytic transfusion reaction. I = immediate. D = delayed.

Anti-		Ag freq	HTR	HDFN
ABO1	A	P	Yes. I	Possibly mild
ABO2	B	P	Yes. I	Possibly mild
ABO3	A,B	P	Yes. I	Usually mild
ABO4	A_1	P	Yes. I & D if active at 37 C	No report
MNS1	M	P	Yes. I & D if active at 37 C	Severe
MNS2	N	P	Yes. I & D if active at 37 C	Possibly mild (1 case)
MNS3	S	P	Yes	Severe
MNS4	s	P	Yes. D	Severe
MNS5	U	P	Yes. I & D	Severe
MNS6	He	P	No report	No report
MNS7	Mi^a	L	Yes. I & D	Severe
MNS9	Vw	L	Possibly	Severe
MNS10	Mur	P	Yes. I & D	Severe
MNS11	M^g	L	No report	No report
MNS12	Vr	L	No report	No report
MNS13	M^e	P	No report	No report
MNS14	Mt^a	L	No report	Yes
MNS15	St^a	L	No report	No report
MNS16	Ri^a	L	No report	No report
MNS17	Cl^a	L	No report	No report
MNS18	Ny^a	L	No report	No report
MNS19	Hut	L	No report	No report
MNS20	Hil	L	No report	Yes (1 case)
MNS21	M^v	L	No report	Yes
MNS22	Far	L	Yes (1 case)	Severe
MNS23	s^D	L	No report	Yes
MNS24	Mit	L	No report	No report
MNS25	Dantu	L	No report	No report
MNS26	Hop	L	No report	No report
MNS27	Nob	L	Minor symptoms (1 case)	No report
MNS28	En^a	H	Severe (1 case)	Severe (1 case)
MNS29	ENKT	H	No report	No report
MNS31	Or	L	No report	No report
MNS32	DANE	L	No report	No report
MNS33	TSEN	L	No report	No report
MNS34	MINY	L	No report	No report
MNS35	MUT	L	No report	No report
MNS36	SAT	L	No report	No report

Anti-		Ag freq	HTR	HDFN
MNS37	ERIK	L	No report	No report
MNS38	Os^a	L	No report	No report
MNS39	ENEP	H	No report	No report
MNS40	ENEH	H	No report	No report
MNS41	HAG	L	No report	No report
MNS42	ENAV	H	No report	No report
MNS43	MARS	L	No report	No report
MNS44	ENDA	H	No report	No report
MNS45	ENEV	H	Yes. D (1 case)	No report
MNS46	MNTD	L	No report	No report
MNS47	SARA	L	No report	Yes
MNS48	KIPP	L	No report	No report
P1PK1	P1	P	Yes. I & D if active at 37 C	No report
P1PK3	P^k	L	No report	No report
P1PK4	NOR	L	No report	No report
RH1	D	P	Severe	Severe
RH2	C	P	Yes. I & D	Yes
RH3	E	P	Yes. I & D	Yes
RH4	c	P	Severe	Severe
RH5	e	P	Yes. I & D	Yes
RH6	f	P	Yes. D	Yes
RH7	Ce	P	Yes	Yes
RH8	C^w	P	No report	Yes
RH9	C^x	L	No report	Yes, mild
RH10	V	P	No report	No report
RH11	E^w	L	No report	Yes
RH12	G	P	Yes	Yes
RH17	Hr_o	H	No report	Severe
RH18	Hr	H	Severe	Severe
RH19	hr^S	P	No report	No report
RH20	VS	P	No report	No report
RH22	CE	P	No report	No report
RH23	D^w	L	No report	No report
RH27	cE	P	No report	No report
RH29	total Rh	H	Yes	Severe
RH30	Go^a	L	Yes, D	Yes
RH31	hr^B	P	No report	No report
RH32	R^N	L	No report	Yes
RH33	Har	L	No report	No report
RH34	Hr^B	H	No report	No report
RH35		L	No report	No report
RH36	Be^a	L	No report	Severe
RH37	Evans	L	No report	Yes
RH40	Tar	L	No report	Yes
RH42	Cce^s	P	No report	Mild
RH44	Nou	H	No report	No report
RH45	Riv	L	No report	Mild
RH46	Sec	H	No report	Severe

Anti-		Ag freq	HTR	HDFN
RH47	Dav	H	No report	No report
RH48	JAL	L	No report	Mild
RH49	STEM	P	No report	Mild
RH50	FPTT	L	No report	No report
RH51	MAR	H	No report	Yes
RH52	BARC	L	No report	No report
RH53	JAHK	L	No report	No report
RH54	DAK	L	No report	No report
RH55	LOCR	L	No report	No report
RH56	CENR	L	No report	No report
RH57	CEST	H	No report	No report
RH58	CELO	H	No report	No report
RH59	CEAG	H	No report	No report
RH60	PARG	L	No report	No report
RH61	ceMO	H	No report	No report
LU1	Lu^{a}	P	Mild, D	No report
LU2	Lu^{b}	H	Mild, D	No report
LU3	Lu3	H	No report	No report
LU4	Lu4	H	No report	No report
LU5	Lu5	H	No report	No report
LU6	Lu6	H	No report	No report
LU7	Lu7	H	No report	No report
LU8	Lu8	H	Yes. I	No report
LU9	Lu9	L	No report	No report
LU11	Lu11	H	No report	No report
LU12	Lu12	H	No report	No report
LU13	Lu13	H	No report	No report
LU14	Lu14	L	No report	No report
LU16	Lu16	H	No report	No report
LU17	Lu17	H	No report	No report
LU18	Au^{a}	P	No report	No report
LU19	Au^{b}	P	No report	No report
LU20	Lu20	H	No report	No report
LU21	Lu21	H	No report	No report
LU22	LURC	H	No report	No report
LU23	LUIT	H	No report	No report
KEL1	K	P	Severe	Severe
KEL2	k	H	Severe	Severe
KEL3	Kp^{a}	P	Yes. D. Severe in one case	Yes, severe in two cases
KEL4	Kp^{b}	H	Yes, D	Yes, severe in two cases
KEL5	Ku	H	Severe	Yes (1 case)
KEL6	Js^{a}	P	Yes, D	Yes, severe in one case
KEL7	Js^{b}	H	Yes, D	Severe
KEL10	Ul^{a}	L	No report	Yes (1 case)
KEL11	K11	H	No report	Possibly
KEL12	K12	H	No report	No report
KEL13	K13	H	No report	No report
KEL14	K14	H	No report	No report
KEL17	K17	L	No report	No report
KEL18	K18	H	No report	Yes, mild (1 case)
KEL19	K19	H	No report	No report
KEL20	Km	H	No report	No report
KEL21	Kp^{c}	L	No report	No report

Anti-		Ag freq	HTR	HDFN
KEL22	K22	H	No report	Severe (1 case)
KEL23	K23	L	No report	No report
KEL24	K24	L	No report	No report
KEL25	VLAN	L	No report	No report
KEL26	TOU	H	No report	No report
KEL27	RAZ	H	No report	No report
KEL28	VONG	L	No report	Possible (1 case)
KEL29	KALT	H	No report	No report
KEL30	KTIM	H	No report	No report
KEL31	KYO	L	No report	No report
KEL32	KUCI	H	No report	No report
KEL33	KANT	H	No report	No report
KEL34	KASH	H	No report	No report
KEL35	KELP	H	No report	No report
KEL36	KETI	H	No report	No report
KEL38	KUHL	H	No report	No report
KEL39	KYOR	H	No report	No report
LE1	Le^a	P	Rarely, only abs active at 37 C	No report
LE2	Le^b	P	Rarely, only abs active at 37 C	No report
LE3	Le^{ab}	P	No report	No report
LE4	Le^{bH}	P	Rarely, only abs active at 37 C	No report
LE5	ALe^b	P	No report	No report
LE6	BLe^b	P	No report	No report
FY1	Fy^a	P	Yes. I & D	Yes, occasionally severe
FY2	Fy^b	P	Yes. I & D	Yes (1 case)
FY3	Fy3	P	Yes. I & D	No report
FY5	Fy5	P	Yes. D	No report
JK1	Jk^a	P	Severe. I & D	Not usually. 1 case severe
JK2	Jk^b	P	Yes. D	Not usually
JK3	Jk3	H	Severe. I & D	No report
DI1	Di^a	P	Possibly (1 case)	Severe
DI2	Di^b	H	Yes	Yes
DI3	Wr^a	L	Yes	Severe
DI4	Wr^b	H	No report	No report
DI5	Wd^a	L	No report	No report
DI6	Rb^a	L	No report	No report
DI7	WARR	L	No report	No report
DI8	ELO	L	No report	Severe
DI9	Wu	L	No report	No report
DI10	Bp^a	L	No report	No report
DI11	Mo^a	L	No report	No report
DI12	Hg^a	L	No report	No report
DI13	Vg^a	L	No report	No report
DI14	Sw^a	L	No report	No report
DI15	BOW	L	No report	No report
DI16	NFLD	L	No report	No report
DI17	Jn^a	L	No report	No report
DI18	KREP	L	No report	No report
DI19	Tr^a	L	No report	No report
DI20	Fr^a	L	No report	No report
DI21	SW1	L	No report	No report
DI22	DISK	H	No report	No report

Anti-		Ag freq	HTR	HDFN
YT1	Yt^a	H	Yes, D rarely	No report
YT2	Yt^b	P	No report	No report
XG1	Xg^a	P	No report	No report
XG2	MER2	P	No report	No report
SC1	Sc1	H	No report	No report
SC2	Sc2	L	No report	Yes, 2 cases, 1 severe
SC3	Sc3	H	No report	No report
SC4	Rd	L	No report	Yes
SC5	STAR	H	No report	No report
SC6	SCER	H	No report	No report
SC7	SCAN	H	No report	No report
DO1	Do^a	P	Yes. I & D	No report
DO2	Do^b	P	Yes. I & D	No report
DO3	Gy^a	H	No report	No report
DO4	Hy	H	Yes (1 case)	No report
DO5	Jo^a	H	No report	No report
DO6	DOYA	H	No report	No report
DO7	DOMR	H	No report	No report
DO8	DOLG	H	No report	No report
CO1	Co^a	H	Yes. I & D	Severe
CO2	Co^b	P	Yes. I & D (1 case each)	No report
CO3	Co3	H	Mild (1 case)	Severe
CO4	Co4	H	No report	No report
LW5	LW^a	H	No report	No report
LW6	LW^b	P	No report	No report
LW7	LW^{ab}	H	No report	No report
CH/RG			No report	No report
H1	H	H	Yes	Severe
XK1	Kx	H	Severe (anti-KL)	No report
GE2	Ge2	H	No report	No report
GE3	Ge3	H	Possibly	Yes
GE4	Ge4	H	No report	No report
GE5	Webb	L	No report	No report
GE6	Ls^a	L	No report	No report
GE7	An^a	L	No report	No report
GE8	Dh^a	L	No report	No report
GE9	GEIS	L	No report	No report
GE10	GEPL	H	No report	No report
GE11	GEAT	H	No report	No report
GE12	GETI	H	No report	No report
CROM1	Cr^a	H	Possibly	No report
CROM2	Tc^a	H	Possibly	No report
CROM3	Tc^b	P	No report	No report
CROM4	Tc^c	L	No report	No report

Anti-		Ag freq	HTR	HDFN
CROM6	Es^{a}	H	No report	No report
CROM7	IFC	H	No report	No report
CROM8	WES^{a}	P	No report	No report
CROM9	WES^{b}	H	No report	No report
CROM10	UMC	H	No report	No report
CROM11	GUTI	H	No report	No report
CROM12	SERF	H	No report	No report
CROM13	ZENA	H	No report	No report
CROM14	CROV	H	No report	No report
CROM15	CRAM	H	No report	No report
CROM16	CROZ	H	No report	No report
CROM17	CRUE	H	No report	No report
CROM18	CRAG	H	No report	No report
KN1	Kn^{a}	P	No report	No report
KN2	Kn^{b}	P	No report	No report
KN3	McC^{a}	P	No report	No report
KN4	Sl1	P	No report	No report
KN5	Yk^{a}	P	No report	No report
KN6	McC^{b}	P	No report	No report
KN7	Sl2	P	No report	No report
KN8	Sl3	P	No report	No report
KN9	KCAM	P	No report	No report
IN1	In^{a}	L	No report	No report
IN2	In^{b}	H	Yes, I (1 case)	No report
IN3	INFI	H	No report	No report
IN4	INJA	H	No report	No report
OK1	Ok^{a}	H	No report	No report
OK2	OKGV	H	No report	No report
OK3	OKVM	H	No report	No report
RAPH1	MER2	H	No report	No report
JMH1	JMH	H	No report	No report
JMH2	JMHK	H	No report	No report
JMH3	JMHL	H	No report	No report
JMH4	JMHG	H	No report	No report
JMH5	JMHM	H	No report	No report
JMH6	JMHQ	H	No report	No report
I1	I	H	No report	No report
GLOB1	P	H	Severe. I	No report
GLOB2	PX2	H	No report	No report
GIL1	Gill	H	No report	No report
JR1	Jr^{a}	H	Yes. D (mild)	Severe
LAN1	Lan	H	Yes. I (1 case)	No report
VEL1	Vel	H	Severe. I	Not usually. 1 case
CD55.1	CD55	H	No report	No report

Anti-		Ag freq	HTR	HDFN
COST1	Cs^a	P		
COST2	Cs^b	P	No report	No report
ER1	Er^a	H	No report	No report
ER2	Er^b	L	No report	No report
GLOB3	LKE	P	No report	No report
700002	By	L	No report	No report
700003	Chr^a	L	No report	No report
700005	Bi	L	No report	Possibly
700006	Bx^a	L	No report	No report
700015	Rd	L	No report	No report
700017	To^a	L	No report	No report
700018	Pt^a	L	No report	No report
700019	Re^a	L	No report	No report
700021	Je^a	L	No report	No report
700028	Li^a	L	No report	No report
700039	Milne	L	No report	No report
700040	RASM	L	No report	No report
700043	Ol^a	L	No report	No report
700044	JFV	L	No report	Yes (1 case)
700045	Kg	L	No report	Yes (1 case)
700047	JONES	L	No report	Yes (1 case)
700049	HJK	L	No report	Severe (1 case)
700050	HOFM	L	No report	Mild (1 case)
700052	SARA	L	No report	No report
700053	LOCR	L	No report	Mild (1 case)
700054	REIT	L	No report	Yes (1 case)
901001	Vel	H	Severe, I	No report
901002	Lan	H	Yes, I (1 case)	No report
901003	Ata	H	Yes, I & D	Mild (1 case)
901005	Jra	H	Possibly (1 case)	No report
901008	Emm	H	No report	No report
901009	AnWj	H	Severe	No report
901012	Sda	P	No report	No report
901013	Duclos	H	No report	No report
901014	PEL	H	No report	No report
901015	ABTI	H	No report	No report
901016	MAM	H	No report	Severe (1 case)

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