Annual SHOT Report 2023 – Supplementary Information

Chapter 21: Transfusion-Transmitted Infections (TTI)

The table below is an excerpt from the full tables 21.4 and 21.5 which can be viewed in the main report.

Case reports with further details of the 1 bacterial transfusion-transmitted infection incidents (from 2018 to 2023) and 7 viral transfusion-transmitted infection incidents (from 2018 to 2023) have been prepared by the NHSBT/UKHSA Epidemiology Unit and are described in the following pages. These include confirmed and probable transmissions reported in the SHOT Annual Report between 2018 and 2023, therefore the number of incidents per year will not match with the table.

Number of confirmed TTI incidents by year of transfusion in the UK reported to SHOT between 2018 and 2023

Year of transfusion*	Number of incidents (recipients) by infection											Implicated component				
	Bacteria	HAV	HBV	HCV	HEV	HIV	HTLV I	Parvovirus (B19)	Malaria	vCJD/ prion	Total	RBC	Pooled platelet	Apheresis platelet	FFP	Cryo
2018	0	0	0	0	1 (1)	0	0	0	0	0	**1 (1)**	0	0	1	0	0
2019	0	0	0	0	1 (1)	0	0	0	0	0	**1 (1)**	0	0	1	0	0
2020	0	0	0	0	0	0	0	0	0	0	**0**	0	0	0	0	0
2021	0	0	1 (2)	0	0	0	0	0	0	0	**1 (2)**	1	0	0	1	0
2022	0	0	0	0	0	0	0	0	0	0	**0**	0	0	0	0	0
2023	0	1	0	0	0	0	0	0	1	0	**2**	2	0	0	0	0
Total number of incidents (recipients)	0	1	1 (2)	0	2 (2)	0	0	0	1	0	**5 (6)**	3	0	2	1	0

Bacterial Case 1: *Staphylococcus epidermidis*

Infection	*Staphylococcus epidermidis*
Year of Transfusion	2018
SHOT report	SHOT report 2018
Component	Platelets - apheresis
Component Age	7 day
No. recipients	2 - one was patient had no evidence of an adverse reaction to the transfusion
Morbidity	Moderate
Source	Donor likely source but this could not be confirmed. Possible source donor skin.
Reason TTI occurred	**This is a case of probable transmission.** It is recognised that the donor arm cleansing procedure is not 100% effective. There is a small residual risk that bacteria may not be detected during bacterial screening.
Index case	A young child received one standard unit of a 7-day old apheresis platelet. The child was receiving blood components due to ongoing chemotherapy for an underlying medical condition.
Diagnosis	Within five minutes of the platelet transfusion being started the child experienced an anaphylactoid reaction including a rise in temperature to 40°C that lasted for 24 hours. This was treated empirically with intravenous antibiotics to cover the possibility of either a bacterial TTI or a central line infection. The patient made a good recovery and was discharged home within days to complete a week of antibiotics.
Investigation	*Staphylococcus epidermidis* was repeatedly isolated from recipient blood cultures and a transfusion reaction investigation was commenced by NHSBT. Routine bacterial screening of the transfused platelet unit was negative but on return to the NHSBT national bacteriology laboratory *Staphylococcus epidermidis* was isolated from the index pack. This isolate was sent for typing along with isolates from the recipient's blood cultures and they were shown to be indistinguishable. It is possible that this does not represent a TTI, but rather a central venous catheter infection in the recipient. In this case, the isolate in the recalled red cell pack might represent contamination with blood from the recipient. However, the chronology of the presentation, the clinical picture and the lack of reaction during an earlier red cell transfusion make a bacterial TTI probable in this case.

Viral Case 1: Hepatitis B

Infection	Hepatitis B virus (HBV)
Year of transfusion	2017
SHOT report year	SHOT Report 2018
Component	Red cells
No. recipients	1
Morbidity	Major - death
Source	New male donor in his forties.
Possible risk factor	May have been acquired as a child in the country of birth.
Reason TTI occurred	**This is a case of probable transmission.** A donor with no reported deferrable risks donating with an HBsAg negative infection undetectable by the screening tests in place at the time. Although HBV DNA is not a mandatory blood donation screening test it is included in the Triplex NAT screening test currently used on all donations. The level of HBV DNA was too low to be detected in the pooled NAT screening test.
Index case	A woman in her 70's received two units of red cells in response to a low haemoglobin level of 83g/l. She had multiple medical conditions including liver cirrhosis due to non-alcoholic steatohepatitis (NASH).
Diagnosis	Approximately six months later she was re-admitted to hospital with acute hepatitis and diagnosed with acute hepatitis B infection. She developed acute-on-chronic liver failure and unfortunately died about five weeks after the HBV diagnosis.
Investigation	The two donors associated with the units transfused to the patient were identified. One was a repeat donor who had an archive sample from the implicated unit and another archive sample for a subsequent donation, both tested negative for HBV. The other donor was a new donor, the archive sample from the implicated donation was retrieved and tested positive for anti-HB core antibodies but negative for HBV DNA using singleton NAT. The donor kindly provided a large volume sample which was concentrated, and HBV DNA was detected at a level below the level of detection of our routine screening tests.

Viral Case 2: Hepatitis E

Infection	Hepatitis E virus (HEV)
Year of transfusion	2018
SHOT report year	SHOT Report 2018
Component	Platelets - apheresis
No. recipients	1
Morbidity	Major morbidity
Source	Asymptomatic donor who donated very regularly.
Possible risk factor	Hepatitis E virus has been mainly associated with the consumption of raw or undercooked pork meat or offal, but also with wild boar meat, venison and shellfish. The donor had no clinical signs of hepatitis E before or after donation.
Reason TTI occurred	**This is a case of confirmed transmission.** This donation had been tested for HEV in a pool of 24 donations, as per normal screening procedures, and was issued as screen negative. The donor returned and gave another donation two weeks later when HEV RNA was detected on screening. A lookback investigation initiated by the blood service identified the previous donation as HEV RNA positive on singleton testing. The low viral load detected in this donation would have been below the level of quantification in the pooled screening, hence the screen negative result.
Index case	A haematology patient undergoing chemotherapy at the time of the transfusion.
Diagnosis	In late 2018, as part of routine screening, NHSBT identified a regular apheresis platelet donor who tested positive for HEV ribonucleic acid (RNA), indicating an acute HEV infection, and this donation was discarded. The donor had donated in the previous month and following the usual lookback process an archive sample from this previous donation was tested and found to be HEV RNA positive with a very low viral load.
Investigation	Both platelet packs from the previous low-level HEV positive donation had been issued and the hospitals were contacted, and recipients identified. One recipient had died shortly after the transfusion from their underlying conditions. The other patient was informed, and a blood sample was taken 11 weeks post transfusion, this tested positive for HEV RNA. Samples from the donor and recipient were sequenced and the hepatitis E virus isolated was found to be identical at the nucleotide level therefore confirming a TTI.

Viral Case 3: Hepatitis E

Infection	Hepatitis E virus (HEV)
Year of transfusion	2019
SHOT report year	SHOT Report 2019
Component	Platelets - apheresis
No. recipients	2
Morbidity	Major - death
Source	Asymptomatic repeat donor.
Possible risk factor	Hepatitis E virus has been mainly associated with the consumption of raw or undercooked pork meat or offal, but also with wild boar meat, venison and shellfish. The donor had no clinical signs of hepatitis E before or after donation.
Reason TTI occurred	**This is a case of confirmed transmission.** This donation had been tested for HEV in a pool of 24 donations, as per normal screening procedures, and was issued as screen negative. The donor returned and gave another donation less than a month later when HEV RNA was detected on screening. A lookback investigation initiated by the blood service identified the previous donation as HEV RNA positive on singleton testing. The low viral load detected in this donation would have been below the level of quantification in the pooled screening, hence the screen negative result.
Index case	A patient in their 40s with aplastic anaemia, excessive alcohol use and portal hypertension (without cirrhosis).
Diagnosis	In September 2019, as part of routine screening, NHSBT identified a regular apheresis platelet donor who tested positive for HEV ribonucleic acid (RNA), indicating an acute HEV infection, and this donation was discarded. The donor had donated in the previous month and following the usual lookback process an archive sample from this previous donation was tested and found to be HEV RNA positive with a very low viral load.
Investigation	Both platelet packs from the previous low-level HEV positive donation had been issued and the hospitals were contacted and recipients identified. One recipient was followed up for 6 months during which time there was no evidence of hepatitis E infection. The other recipient was diagnosed with HEV infection two months after the identified transfusion took place. The viral load in the sample of the index unit was too low to perform sequence analysis but this was possible on the donor's subsequent donation in late September. Sequence obtained from the virus infecting the recipient was identical to that obtained from the donor. Based on this it was confirmed that blood transfusion was the source of the patient's HEV infection.

Viral Case 4: Hepatitis B

Infection	Hepatitis B virus (HBV)
Year of transfusion	2015
SHOT report year	SHOT Report 2019
Component	Red cells
No. recipients	1
Morbidity	Major – chronic HBV infection
Source	Asymptomatic repeat donor.
Possible risk factor	The donor originates from an area with high HBV prevalence, particularly for the HBV genotype identified in the recipient.
Reason TTI occurred	**This is a case of probable transmission.** This donation had been tested for HBV, as per normal screening procedures, and was issued as screen negative.
Index case	A patient in their 70s with chronic HBV infection.
Diagnosis	In January 2019, the index case self-reported to NHSBT as they had been advised by a hospital that they might have acquired HBV from a blood transfusion in 2015. No other source could be identified.
Investigation	The index case received three units of red cells during surgery on their mitral valve in December 2015. No archived samples were available, but as all three donors had donated since, samples from their subsequent donations were retrieved. These samples were tested, and results showed no evidence of infection in donor 1 and 3 however the sample from donor 2 contained antibodies for HBV core but was negative for DNA. These results indicate a past infection in donor 2. The donor was resampled. A large volume was taken to increase the likelihood that any small levels of DNA would be detected, however no DNA could be detected. A later donation from the donor was traced back to a patient in their 80s. The patient was tested and found to be positive for anti-HBc antibodies indicating a past HBV infection. It is possible that they acquired this HBV infection via blood transfusion although this could not be proven.

Viral Case 5: Hepatitis E

Infection	Hepatitis E virus (HEV)
Year of transfusion	2019
SHOT report year	SHOT Report 2020
Component	Red cells
No. recipients	1
Morbidity	Recipient has now cleared the virus from her blood and has not developed a hepatitis. Clinically, the recipient has a difficult to treat form of aplastic anaemia.
Source	Donor was asymptomatic - no illness before or after donation.
Possible risk factor	The donor had no clinical signs of hepatitis E before or after donation. Hepatitis E virus has been mainly associated with the consumption of raw or undercooked pork meat or offal, but also with wild boar meat, venison and shellfish.
Reason TTI occurred	**This is a case of probable transmission.** HEV RNA was not detectable with the currently used screening assay (a detection limit around 500 IU/mLl), the sample tested was 31 IU/mL. Due to the small viral load, sequencing was not possible and not confirmed in this transmission. It is recognised that our current HEV screening will not be able identify donations with a very small amount HEV RNA.
Index case	Multitransfused 26-year-old lady with aplastic anaemia and Turners syndrome.
Diagnosis	Diagnosed with hepatitis E infection.
Investigation	HEV RNA (31 IU/mL) was retrospectively identified (30 donors investigated in total). This unit was tested correctly at the time of donation testing, but HEV RNA was not detectable with the currently used screening assay (a detection limit around 500 IU/mL). Due to the small viral load, sequencing could not be conducted and therefore cannot be confirmed as transmission. It is recognised that the current HEV screening will not be able identify donations with a very small amount HEV RNA.

Viral Case 6: Hepatitis B

Infection	Hepatitis B virus (HBV)
Year of transfusion	2019
SHOT report year	SHOT Report 2020
Component	Fresh frozen plasma (FFP)
No. recipients	1
Morbidity	Minor
Source	Recipient was born in an HBV endemic country; obvious source was not found.
Possible risk factor	Donor was born in an HBV endemic country, occult HBV infection in the donor, potential reactivation.
Reason TTI occurred	**This is a case of probable transmission.** All donations were positive for anti-HBc and HBsAg negative on screening, but no HBV DNA was detected at the time of donation. This is in keeping with an occult HBV infection in the donor. Unfortunately, HBV DNA was not detectable on the sample tested despite concentration (note low levels of fluctuating HBV DNA is typical in occult HBV). The recipient sample was identified as HBV genotype E; the common type identified in Sub-Saharan Africa and in keeping with transmission.
Index case	A male in his 50s who underwent routine dialysis. The patient had not been vaccinated against HBV and did not present with any symptoms.
Diagnosis	The recipient was diagnosed with an acute hepatitis B infection following a routine dialysis screening, which included testing for Hepatitis B surface antigen (HBsAg).
Investigation	Blood transfusions from the previous six months were identified; these included 11 donor exposures. A total of 10 returning donors tested negative for anti-HBc, whereas the remaining blood donor tested positive for anti-HBc. They had donated 3 times and donations were positive for anti-HBc. HBV DNA was detected in implicated red cell donation at 8.6IU/ml; lookback into fresh frozen plasma (FFP) and two HBV DNA-negative donations are still on-going. All donations were HBsAg negative on screening, and no HBV DNA was detected at the time of donation. This is in keeping with an occult HBV infection in the donor, who was born in an HBV endemic country. A large volume follow-up sample was obtained from this donor to allow further sequence comparison between their sample and recipient sample. Unfortunately, HBV DNA was not detectable on that sample despite concentration (note low levels of fluctuating HBV DNA is typical in occult HBV). The recipient sample was identified as HBV genotype E; the common type identified in Sub-Saharan Africa and keeping with transmission.

Viral Case 7: Hepatitis B

Infection	Hepatitis B virus (HBV)
Year of transfusion	2021
SHOT report year	SHOT Report 2022
Component	Fresh frozen plasma (FFP) (1) and red cells (1)
No. recipients	2
Morbidity	Major – one acute HBV infection and one chronic HBV infection
Source	Recipient 1 had progressive kidney disease and underwent regular dialysis. Blood transfusion was considered the most likely source of infection. Recipient 2 had severe fibrosis due to non-alcoholic fatty liver disease. Their infection was detected through a lookback investigation and no other sources or risk factors for HBV were identified.
Possible risk factor	The implicated donor had an occult HV infection characterised with a very low viral load in the absence of HBV surface antigen. Donor was aged 50+ and of other white ethnicity. An accident leading to hospitalisation was noted where their liver function was investigated at the time due to a slow recovery. No other risk factors were identified.
Reason TTI occurred	**This is a case of confirmed transmission.** The donation was negative on pooled NAT when originally tested. On retesting this donation tested positive for anti-HBc and HBV DNA detected on individual donation NAT.
Index case	A male in his 50s who underwent routine dialysis. The patient had not been vaccinated against HBV and was found to have an increased ALT following a liver function screen. They were found to have an acute asymptomatic infection.
Diagnosis	Recipient 1 was diagnosed with an acute hepatitis B infection following a liver function screen, which revealed an increased ALT. HBV testing was performed in response to this result. Recipient 2 was diagnosed with a chronic HBV infection following HBV testing instigated by a HBV lookback investigation.
Investigation	Recipient 1 received 28 units of fresh frozen plasma over two months in 2021, all of which were investigated. Six non-returning donors and 22 returning donors. One of the returning donors tested positive for anti-HBc and HBV DNA on individual donation NAT. Recipient 2 was identified as the recipient of the red cell component produced from the same donation. Nine months post transfusion the recipient was tested and found to be positive for HBsAg, HBaAg, and anti-HBc. HBV DNA was also detected at a very high level. They had tested negative for HBsAg in May 2017, and no other source or risk factors for HBV were identified. Sequencing analysis showed high similarity between the virus obtained from the implicated donor and the two recipients and confirmed transfusion as the source.

Viral Case 8: Hepatitis A

Infection	HAV (**PTA/13/23)**
Year of transfusion	2023
SHOT report year	SHOT Report 2023
Component	Red cells
No. recipients	1
Morbidity	Moderate morbidity
Source	Post-donation information prompted this lookback investigation. A regular donor was diagnosed with an acute hepatitis A (HAV) infection 21 days after their most recent blood donation.
Possible risk factor	Most likely source contaminated food
Reason TTI occurred	**This is a case of confirmed transmission.** Donor and recipient virus sequences were identical; both were infected with a rare 1B subgenotype virus, confirming that this hepatitis A infection was transmitted via the blood transfusion
Index case	The implicated donor was deferred from donation for 6 months, but they are eligible to continue to donate after that as HAV (like HEV) does not cause a chronic infection in healthy individual
Diagnosis	The recipient was identified and followed up for HAV testing. They subsequently developed significant transaminitis with a peak ALT of 73
Investigation	A lookback investigation of a regular donor diagnosed with HAV infection after a blood donation was initiated. HAV IgM antibodies and RNA were detected.

Viral Case 9: Hepatitis E

Infection	HEV **(PTE/05/23)**
Year of transfusion	2022
SHOT report year	SHOT Report 2023
Component	Red cells, FFP
No. recipients	1
Morbidity	Major morbidity
Source	A renal transplant recipient was diagnosed with HEV infection following abnormal liver function tests. HEV infection of transplanted organs had been excluded and hence it was considered whether they might have acquired it via plasma exchange in August 2022
Possible risk factor	Likely source contaminated food although neither donor aware of their infection at the time of donation
Reason TTI occurred	**This is a case of probable transmission.** Due to a lack of sequence confirmation, this case is reported as probable transmission
Index case	Both donors have now resolved their infection and are eligible to continue donating again.
Diagnosis	HEV infection
Investigation	A total of 86 donor exposures were identified for investigations. Two of these donors tested positive for HEV RNA, but due to very low viral loads, sequencing of donor virus was not successful. No stored sample was identified for the recipient.

Viral Case 10: Hepatitis B

Infection	HBV **(PTY/01/23)**
Year of transfusion	2022
SHOT report year	SHOT Report 2023
Component	Red cells
No. recipients	1
Morbidity	Major morbidity
Source	The elderly recipient was diagnosed with acute HBV infection during their hospital admission in December 2022. They had received multiple transfusions six months prior to diagnosis of HBV
Possible risk factor	Blood transfusion was considered as the only source of their HBV infection
Reason TTI occurred	**This is a case of probable HBV transmission** HBV DNA was not detected in either donor. It is probable that the recipient acquired the hepatitis B infection via the blood transfusion from donor II. Transmission could not be confirmed but circumstantial evidence of this donor originating from the region where recombinant genotype D/E is prevalent, the same genotype as that identified in the patient, further supports transmission
Index case	
Diagnosis	
Investigation	33 donor exposures were investigated. Two of the donors tested positive for anti-HBc antibodies, one donor had evidence of past HBV infection with high levels of anti-HBs antibodies (999 IU/ml) whereas another donor had HBV infection with low levels of anti-HBs antibodies (donor II). HBV DNA was not detected in either donor

Viral Case 11: Hepatitis C

Infection	HCV **(PTW/16/22)**
Year of transfusion	1983
SHOT report year	SHOT Report 2023
Component	Red cells
No. recipients	1
Morbidity	Moderate morbidity
Source	A recipient with transfusion dependent beta thalassaemia regularly transfused in the UK was noted to have abnormal LFTs in September 2021. Although it was initially considered to be due to transfusion related iron overload, subsequent diagnosis of past HCV infection was obtained
Possible risk factor	Transfusion history over many decades, note that the risk of acquiring HCV via blood transfusion in the UK was highest before the screening for HCV antibodies was introduced in 1991 and for HCV RNA in 1999
Reason TTI occurred	**This is a case of possible HCV transmission** Testing all previous donations was not possible as the archive samples no longer existed for the donations taken prior to the implementation of screening. It is therefore possible that this individual acquired the HCV infection via blood transfusion
Index case	
Diagnosis	
Investigation	This patient had previously been identified as part of the HCV lookback

Parasitic Case 1: Malaria

Infection	Malaria (**PT/MAL/12/23)**
Year of transfusion	2023
SHOT report year	SHOT Report 2023
Component	Red cells
No. recipients	1
Morbidity	Moderate morbidity
Source	Donor had lived for many years in a part of Africa where malaria is endemic. Donor had never had a diagnosis of malaria but reported that they had had previous feverish episodes
Possible risk factor	Country of birth and multiple visits to an endemic country.
Reason TTI occurred	**This is a case of confirmed malaria transmission**
Index case	Diagnosed with Beta Thalassaemia, multiple transfusions from an early age
Diagnosis	Transfused due to low haemoglobin. Blood film was positive for *Plasmodium malariae*
Investigation	Transfusions from over an eight-month period in 2023 identified 33 total donor exposures. 6 donors had reactivity on an additional malaria antibody test but negative on routine screening. One donor had evidence of malarial DNA.

Transfusion-Transmitted Infections (TTI) - Previous Recommendations

Year first made	Action	Recommendation
2013	**Hospital Transfusion Teams (HTT), Trust/Health Board Chief Executive Officers and Medical Directors responsible for all clinical staff**	Clinical staff requesting investigation of a possible transfusion-transmitted infection (TTI) by the UK Blood Services are reminded to report as soon as practical to Serious Adverse Blood Reactions and Events (SABRE) and SHOT. The reporter should remember to tick the SHOT box to prompt SHOT reporting. Reporters should update their report once the outcome of the UK Blood Services investigation is known. These should be reported even if not currently screened for by the Blood Service
2012	**Clinicians, Transfusion and Microbiology Laboratory Managers**	Retain suspected bacterially contaminated packs, even if near empty, for return to the Blood Service as the residue can be washed out and cultured. Report a suspected bacterial TTI promptly to the Blood Service to allow recall of any associated packs for testing. If sampling packs locally for bacterial testing, use ports rather than breaching the pack to minimise environmental contamination of the pack
2012	**Clinicians, Transfusion Laboratory Managers, Hospital Transfusion Team (HTT)**	Hospitals and Blood Centres investigating a possible viral TTI are reminded of the importance of locating any archived recipient samples (transfusion-related or not) for testing. It is important that laboratories facilitate access to those samples (with due consent of appropriate parties including the patient)
2012	**HTTs, Clinicians**	Even if TTI is excluded in a case of ATR, the case should still be reported to SHOT as an ATR If necessary
2012	**Clinicians, UK Blood Services**	Clinicians investigating suspected viral TTIs should explore all possible risk exposures in parallel with the Blood Service investigations, in order to determine the patient's most likely source of infection. This includes checking

		records and testing samples taken prior to the implicated transfusion(s) to check that the recipient was not infected prior to transfusion
2010	**Hospital microbiology laboratories**	Attention should be paid to the sampling and storage of implicated units or their residues to avoid sampling or environmental contamination of the pack
2010	**HTTs, clinicians**	Even if TTI is excluded in a case of ATR, the case should still be reported to SHOT as an ATR
2010	**Clinicians, UK Blood Services**	Clinicians investigating suspected viral TTIs should explore all possible risk exposures in parallel with the Blood Service investigations, in order to determine the patient's most likely source of infection. This includes checking records and testing samples taken prior to the implicated transfusion(s) to check that the recipient was not infected prior to transfusion.
2009	**HTTs**	Staff should maintain a high index of suspicion for bacterial causes when managing acute transfusion reactions. Symptoms may appear to be related to the patient's underlying condition, and temperature rises may be small or absent altogether. A BSH guideline on the management of acute transfusion reactions has been prepared.
2009	**HTTs, UK Blood Services**	Processing and issues teams at the UK blood services and hospital transfusion teams should be vigilant to any abnormalities or clumps present in packs prior to transfusion, as highlighted by the Near Miss case in 2009.
2009	**HTTs, UK blood services**	Cleaning protocols for cold rooms and processing and storage areas should be reviewed regularly. Compliance with these should be audited.
2009	**Clinicians, UK Blood Services**	Clinicians investigating suspected viral TTIs should explore all possible risk exposures in parallel with the blood service investigations, in order to determine the patient's most likely source of infection.
2008	**Hospital transfusion teams**	Staff must maintain a high index of suspicion of bacterial causes when managing acute transfusion reactions. Symptoms may appear to be allergic in nature, but cultures must still be performed whenever bacterial contamination is a possibility.
2005, 2008, 2009	**Hospital transfusion teams, UK blood services**	Where bacterial contamination is suspected, staff should report the incident to the blood services as soon as possible in order to facilitate the return of implicated packs and the recall of any associated units. Attention should be paid to the sampling and storage of implicated units or their residues to avoid environmental contamination of the pack.

2003, 2008	**UK blood services, SaBTO, blood collection teams, hospital transfusion laboratories, staff undertaking pre-transfusion bedside checking**	Strategies to reduce bacterial contamination of blood components should continually be reviewed. These include: - Diversion of the first 20–30 mL of the donation (likely to contain any organisms entering the collection needle from the venepuncture site) - Enhanced donor arm cleansing using chlorhexidene - Consideration of bacterial screening interventions and/or pathogen inactivation - Adherence to BSH guidelines (2009) with regard to the visual inspection of blood components for any irregular appearance immediately prior to transfusion