NHS
Blood and Transplant

Donor Characterisation Review Report

May 2017

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1. Donor Characterisation Review

1.1 Executive Summary

The Taking Organ Transplantation to 2020 strategy[1] (TOT2020) aims to increase organ donation and transplantation rates to enable the UK to match world class performance in organ donation and transplantation. A specific action of the TOT2020 strategy was to review the processes for donor characterisation.

This Review has examined the provision for microbiological screening and HLA typing in the context of deceased organ donation. To achieve the aims of the TOT2020 strategy a robust and efficient laboratory service is essential to support organ transplant programs.

These services are now under pressure and fragile. The responsibility for the testing of deceased donor blood samples is unclear as there is no transparent funding or commissioning pathway making it difficult to instigate change and improve the service.

If the current concerns within the donor characterisation service are not resolved, the ability of laboratories to meet future demands of the organ donation and transplant programmes is uncertain. The consequences of this uncertainty will be felt primarily, if not totally within NHSBT since errors and incidents reflect on the donation and transplant pathway attributed to our organisation.

NHSBT/ODT should lead and work collaboratively with commissioners, laboratories and transplant centres to ensure a resilient and sustainable donor characterisation service. The service must be capable of delivering robust results, be responsive to changing testing requirements, support all possible organ donations and ensure the safety of transplant recipients.

The Review provides a timely opportunity to streamline, standardise and future-proof laboratory service provision and improve the quality and safety of organs for transplantation.

The findings and recommendations from the Donor Characterisation Review were presented to the NHSBT Board in May 2017. The presentation emphasised the importance, concerns and problems of the current laboratory service provision for donor characterisation and the roles and responsibilities of the laboratories, Commissioners and NHSBT.

The Board agreed to support the Organ Donation and Transplantation Directorate to work with NHS England, other Commissioners and key stakeholders to establish a commissioning pathway for Donor Characterisation.

[1] *http://www.nhsbt.nhs.uk/to2020/resources/nhsbt_organ_donor_strategy_long.pdf*

1.2 Summary of Concerns

Donor characterisation is an absolute requirement for safe organ allocation and is mandated in law under the Safety and Quality of Organs and Tissues Intended for Transplantation (2012)[2]. The majority of organs cannot be offered or allocated to recipients until the results for the donor HLA type and microbiology screen are reported. A robust and efficient laboratory service providing deceased donor characterisation is essential to support organ offering and subsequent transplantation.

Laboratory services for the testing of deceased donor blood samples are now under pressure and are fragile mostly because of the increase in the number of organ donors and requirements for an increased repertoire of tests necessary to characterise donors. These pressures will continue to increase as the aims of the TOT2020 strategy are achieved.

There are evident deficiencies in the current service which need to be addressed.

- There is a requirement to improve patient safety by reducing errors that can potentially cause death or serious harm to the recipient of a transplanted organ as evidenced in recent Serious Untoward Incidents (SUI).
- Although there is generic oversight of laboratories through accreditation there is no commissioning accountability for the donor characterisation testing service. Errors in the results or failure to meet the full repertoire of tests can result in organs being incorrectly allocated and transplanted, leading to transplant failure or even the death of a recipient.
- Microbiology laboratories vary in their ability to confirm a reactive/positive result before donation or provide access to expert consultant advice out of hours. The inability to promptly investigate an initially reactive result can cause delays in organ allocation, result in lengthening of the donation pathway or in organs being unnecessarily declined for transplantation.
- The testing of deceased donor blood samples is mainly provided as an out of core working hour's service. There is evidence to suggest that some laboratories have been unable to maintain an out-of-hours service due to a lack of suitably qualified scientists and difficulties in recruitment. This has led to a withdrawal of a service at short notice with inadequate alternative arrangements leading to the diversion of blood samples to other laboratories. This leads to delays and consequent lengthening of the organ donation pathway with the risk that donor families withdraw their consent/authorisation for donation.
- The efficiency of the system needs to be improved and the cost effectiveness examined. Currently there is a lack of clarity in the funding for donor characterisation and no clear commissioning pathway. Trusts working under increasing financial restraints are questioning laboratory payments for donor characterisation especially when the direct benefits to the Trust are not easily visible.
- Failure to address these deficiencies will lead to an inadequate donor characterisation service, that is unable to respond to changing needs and ensure the safe allocation and transplantation of organs with the risk of reputational damage or litigation for NHSBT.

[2] *http://www.legislation.gov.uk/uksi/2012/1501/contents/made*

1.3 Review recommendations

Recommendation 1. NHSBT and the Commissioners of the 4 UK Health Departments work together to establish a commissioning pathway for Microbiology screening and HLA typing to ensure a safe and sustainable laboratory configuration able to meet future demand for deceased donor characterisation.

Recommendation 2. A service specification for laboratories delivering donor characterisation services will be developed and agreed with key stakeholders. The service specification should be evidence based, consistent with current guidance and legislation and be reviewed annually.

The following areas should be included:

- A defined minimum repertoire of tests that must be undertaken
- Agreed nomenclature and timeframes for reporting results
- Defined protocol for the storage and retention of donor samples
- Availability of 24/7 Consultant advice for interpretation of donor testing results
- Business continuity plans to ensure appropriate alternative arrangements if a laboratory is temporarily unable to perform testing for donor characterisation
- Agreed Key Performance Indicators (KPI) with appropriate monitoring systems
- Collaborative meetings with service users

Recommendation 3. Donor testing results should be electronically communicated throughout the testing and reporting process, eliminating the need for manual transcription.

Recommendation 4. NHSBT, Commissioners and laboratories should work collaboratively to decide the best option to provide confirmatory donor characterisation testing, where there is a requirement, within a clinically relevant timeframe.

2. Background

2.1 The requirement for donor characterisation

To ensure compliance with legislation all deceased organ donors must be characterised[3]. Donor Characterisation is the process of collecting relevant information about the donor to evaluate suitability for organ donation. The information provided ensures recipient patient safety, minimises the risk of disease transmission, enables risk mitigation and through allocation processes ensures equity of access to organs.

Information relating to the donor is used by a transplant clinician in making the decision to either accept or decline an organ and by the potential recipient to inform a decision to either consent to or refuse a transplant from a particular donor.

The scope of the Review included two aspects of the donor characterisation process, microbiological screening and donor HLA typing. The Terms of Reference and membership of the Project Board and Working Groups for the Review can be found in **Annex A**.

2.2 Microbiological screening

Organs from deceased donors can transmit disease and a minimum repertoire of microbiological screening tests is undertaken as mandated by the European Union Organ Donation Directive[4] and recommended by The Advisory Committee on the Safety of Bloods Tissues and Organs (SaBTO)[5]. Additional testing may be performed when specific risks have been identified e.g. through epidemiological or travel history.

2.3 Donor HLA typing

The donor Human Leukocyte Antigen (HLA) type is crucial for the safe allocation of organs. It is required for donor and recipient HLA matching and in ensuring safe transplantation of patients with pre-existing HLA antibodies. A specification for donor HLA typing has previously been agreed by the British Society for Histocompatibility and Immunogenetics (BSHI), British Transplantation Society (BTS) and NHS Blood and Transplant (NHSBT).

[3] *https://www.hta.gov.uk/policies/eu-organ-donation-directives-euodd-regulations-and-framework*

[4] *http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32010L0053*

[5] *https://www.gov.uk/government/groups/advisory-committee-on-the-safety-of-blood-tissues-and-organs*

3 The Case for Change

3.1 Demand and activity

NHSBT published a detailed strategy in 2013, Taking Organ Transplantation to 2020 (TOT2020). This strategy built on the achievements from implementing the recommendations of the Organ Donation Taskforce Report[6] (2008), whereby organ donation had increased by 50%. This increase put pressure on the infrastructure for donor characterisation.

To meet the target for deceased donors of 26 pmp set in the TOT2020 strategy, an increase of 22% on current year to date activity is necessary, equating to approximately an additional 440 donors by 2020. The year to date performance in relation to the TOT2020 strategic targets is shown in **Table 1**.

Table 1: Performance against TOT2020 Strategic Targets

Objective	2020 Target	YTD Dec 2016
Consent Rate	80%	61.5%
Deceased Donors, pmp	26 pmp	21.32 pmp
Organ Utilisation	Increase of 5%	0.0%
Deceased donor transplants, pmp	74 pmp	55.0 pmp

There are approximately 2000 consented/authorised potential deceased donors per annum and over the last three years approximately 67% of consented/authorised donors proceed to donate organs. The majority for donors that do not proceed to donate are Donation after Circulatory Death (DCD) donors where the donor does not die in the necessary timeframe. However, the majority of consented/authorised donors are HLA typed and microbiologically screened because delaying testing until it is certain that donation will proceed would mean results were not available in time to meet the requirements to reduce ischemia time, ensure efficient allocation and good transplant outcomes.

3.2 Laboratory services

All laboratories providing services for donor characterisation conform to the standards set by the relevant accreditation bodies, United Kingdom Accreditation Service (UKAS), Clinical Pathology Accreditation (CPA), and participate in National External Quality Assurance Schemes (NEQAS).

Routine microbiological screening is undertaken in 18 NHS diagnostic microbiology laboratories across the UK, none of which are NHSBT laboratories. One NHSBT laboratory undertakes specialist reference work e.g. screening for malaria or Chagas disease, discrepant analysis and confirmatory testing, but not routine screening of potential organ donors.

The deceased donor HLA typing service is provided by 20 Histocompatibility and Immunogenetics (H&I) laboratories. Of the 6 NHSBT H&I laboratories 4, (Newcastle, Birmingham, Sheffield and Tooting), perform donor HLA typing. The proportion of donors typed by NHSBT H&I laboratories is approximately 30% of all the donor HLA types performed.

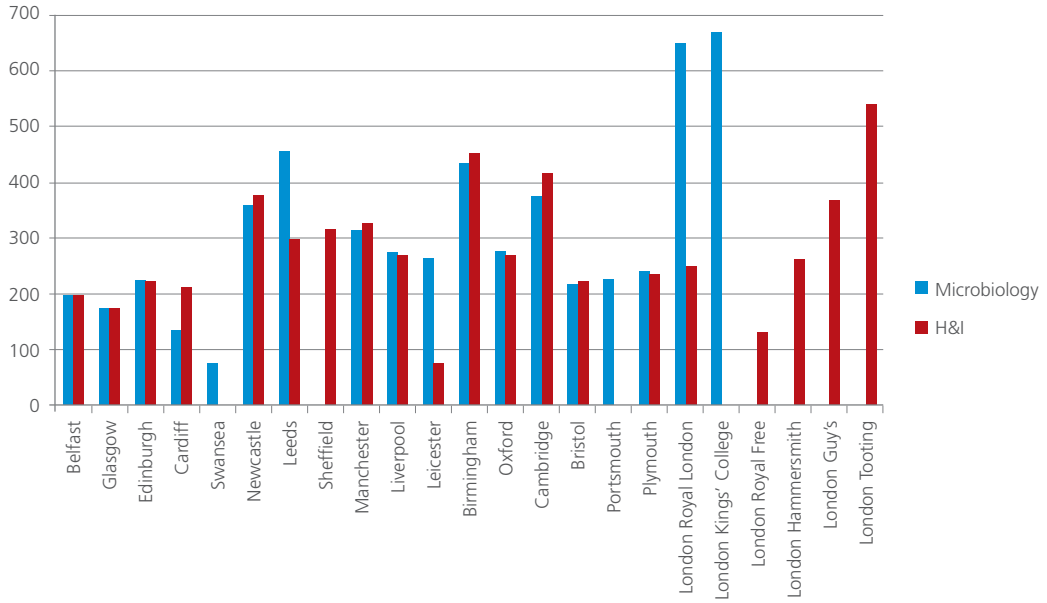
[6] *http://www.nhsbt.nhs.uk/to2020/resources/OrgansfortransplantsTheOrganDonorTaskForce1streport.pdf*

The map and table in **Annex B** Indicate the H&I and microbiology laboratories sited in the same hospital, in different hospitals but in the same city and laboratories which are sited alone.

The deceased donor HLA typing and microbiology screening activity over a 3 year period from 1st April 2013 to 31st March 2016 is shown in **Figure 1**. There is a wide regional variation in the activity of both the H&I and microbiology laboratories ranging between 0.5 and 4.5 donors per week.

There is clearly an imbalance in some of the regions in relation to the numbers of organ donors and laboratories **(Figure 1)**. For example, in South Wales there are two microbiology laboratories, but this activity is covered by one H&I laboratory and in London the microbiology activity is covered by two laboratories whereas there are 5 H&I laboratories.

Figure 1: Laboratory activity over a 3 year period: 1st April 2013 - 31st March 2016



3.3 Timing of Donor Characterisation Testing

In order to understand the pressures on the service, the timings within the donation pathway were collated and expressed as heat maps where darker areas demonstrate higher levels of activity. **(Figure 2)**. Timings were obtained from the Potential Donor Audit (PDA), the National Transplant Database (NTxD) and from 15/20 H&I laboratories. Timings were not available from the microbiology laboratories therefore an assumption was made that since blood samples are collected at the same time, they arrive in the microbiology laboratories within a similar timeframe.

Using current technology the time taken from receipt of blood sample in the laboratory to reporting the results is 1-2 hours for a microbiology result and 4 hours for an HLA type. The data clearly demonstrate that the peak activity for the testing of donor samples occur out-of-hours and shows that 95% of donor HLA typing has an out-of-hours component. This is important information in understanding the pressure on the service and demonstrates the requirement for a robust out-of-hours service.

Figure 2: Data from 1st April 2013 – 31st March 2016

Darker areas of the heat map show higher levels of activity

Figure 2a: Time potential donor referred to a SNOD (PDA data)

Day	Time of day																							Total
	hr 0	hr 1	hr 2	hr 3	hr 4	hr 5	hr 6	hr 7	hr 8	hr 9	hr 10	hr 11	hr 12	hr 13	hr 14	hr 15	hr 16	hr 17	hr 18	hr 19	hr 20	hr 21	hr 22	hr 23	
Monday	31	23	29	20	17	21	21	33	148	398	448	283	258	195	186	184	215	132	119	61	66	46	38	26	2998
Tuesday	29	33	27	20	14	14	22	32	168	414	439	301	243	195	218	229	204	137	127	75	56	49	52	28	3126
Wednesday	30	21	23	16	16	15	20	24	158	491	436	286	247	191	177	188	190	134	106	77	61	55	42	22	3026
Thursday	20	18	31	15	18	13	20	29	151	417	407	295	244	180	188	191	192	151	101	68	60	50	47	31	2937
Friday	24	36	21	21	20	16	21	33	131	423	417	297	260	187	184	196	215	152	106	77	54	50	49	31	3021
Saturday	25	24	25	14	16	25	28	32	73	206	233	203	164	148	146	149	135	105	82	68	59	59	47	49	2115
Sunday	24	32	26	18	20	22	18	27	88	217	235	192	205	153	168	130	122	80	102	72	68	56	56	43	2174
Total	183	187	182	124	121	126	150	210	917	2566	2615	1857	1621	1249	1267	1267	1273	891	743	498	424	365	331	230	19397

Figure 2b: Time when consent/authorisation was established (PDA data)

Day	Time of day																							Total
	hr 0	hr 1	hr 2	hr 3	hr 4	hr 5	hr 6	hr 7	hr 8	hr 9	hr 10	hr 11	hr 12	hr 13	hr 14	hr 15	hr 16	hr 17	hr 18	hr 19	hr 20	hr 21	hr 22	hr 23	
Monday	4	6	5	1	2	0	2	1	3	5	25	54	64	74	85	91	84	74	54	43	35	17	11	14	754
Tuesday	5	2	4	1	3	0	1	2	1	13	29	67	78	97	120	109	76	74	53	37	22	16	11	13	834
Wednesday	4	3	3	4	1	1	1	2	2	10	26	61	97	103	111	110	101	46	70	32	15	19	12	10	844
Thursday	5	6	1	3	0	1	1	1	1	5	32	64	67	91	93	89	96	61	54	35	32	25	12	14	789
Friday	7	6	2	1	3	1	4	1	7	12	36	56	75	65	94	92	77	78	53	42	29	17	15	14	787
Saturday	3	9	4	1	1	2	2	2	4	6	24	40	52	72	69	66	53	49	37	22	21	15	14	9	577
Sunday	6	1	2	5	4	3	0	2	5	8	17	44	47	85	58	78	53	39	35	29	25	20	11	6	583
Total	34	33	21	16	14	8	11	11	23	59	189	386	480	587	630	635	540	421	356	240	179	129	86	80	5168

Figure 2c: Time donor samples were taken (Laboratory data)

Day	Time of day																							Total
	hr 0	hr 1	hr 2	hr 3	hr 4	hr 5	hr 6	hr 7	hr 8	hr 9	hr 10	hr 11	hr 12	hr 13	hr 14	hr 15	hr 16	hr 17	hr 18	hr 19	hr 20	hr 21	hr 22	hr 23	
Monday	5	6	4	2	2	5	4	2	2	3	10	17	26	35	46	40	46	55	33	45	36	22	23	15	484
Tuesday	13	6	7	2	1	4	1	1	4	4	8	17	24	36	43	68	74	64	46	40	35	26	26	15	565
Wednesday	10	3	5	1	1	3	3	0	1	3	6	18	32	50	67	59	75	51	54	35	36	23	23	15	574
Thursday	9	4	7	6	2	4	1	0	3	5	5	16	33	38	39	54	50	59	53	46	28	31	22	19	534
Friday	10	14	4	5	3	2	1	3	1	10	8	29	27	35	57	63	56	40	43	41	29	17	23	17	538
Saturday	7	6	3	2	3	4	4	2	1	4	9	12	20	29	35	29	47	39	32	36	29	26	23	17	419
Sunday	3	7	5	3	3	0	4	3	1	4	9	14	21	29	42	43	40	49	40	31	17	22	13	22	425
Total	57	46	35	21	15	22	18	11	13	33	55	123	183	252	329	356	388	357	301	274	210	167	153	120	3539

Figure 2d: Time samples received by the laboratories (Laboratory data)

Day	Time of day																							Total
	hr 0	hr 1	hr 2	hr 3	hr 4	hr 5	hr 6	hr 7	hr 8	hr 9	hr 10	hr 11	hr 12	hr 13	hr 14	hr 15	hr 16	hr 17	hr 18	hr 19	hr 20	hr 21	hr 22	hr 23	
Monday	13	15	10	5	8	5	3	3	3	4	5	6	5	20	21	32	31	50	43	62	59	46	37	29	515
Tuesday	25	15	13	11	3	2	5	2	4	2	2	5	7	10	22	37	54	65	65	80	60	41	48	36	614
Wednesday	28	17	9	9	4	5	1	1	1	4	3	1	8	12	29	46	53	74	72	73	60	57	38	34	639
Thursday	22	12	16	10	7	6	3	0	2	4	2	7	9	18	32	31	45	46	58	74	59	52	37	30	582
Friday	25	15	17	14	7	3	4	5	2	3	2	9	10	15	21	47	60	60	64	54	62	42	32	30	603
Saturday	24	19	8	13	4	1	2	5	3	3	4	5	5	11	25	26	28	44	51	33	47	44	24	23	452
Sunday	30	17	7	10	6	1	4	1	2	3	6	2	4	15	17	37	42	42	54	45	37	39	28	25	474
Total	167	110	80	72	39	23	22	17	17	23	24	35	48	101	167	256	313	381	407	421	384	321	244	207	3879

Figure 2e: Time deceased donor offer HLA types reported to ODT (NTxD data)

Day	Time of day																							Total
	hr 0	hr 1	hr 2	hr 3	hr 4	hr 5	hr 6	hr 7	hr 8	hr 9	hr 10	hr 11	hr 12	hr 13	hr 14	hr 15	hr 16	hr 17	hr 18	hr 19	hr 20	hr 21	hr 22	hr 23	
Monday	63	49	45	42	40	15	15	10	11	5	5	7	2	9	5	6	10	21	28	38	52	62	68	74	682
Tuesday	90	74	61	59	46	23	15	12	11	12	7	3	10	4	9	4	21	18	40	46	74	81	75	85	880
Wednesday	96	72	77	50	48	32	14	17	9	13	10	2	5	4	5	5	14	25	32	65	82	83	97	87	944
Thursday	70	87	57	50	49	33	22	17	16	6	9	1	6	5	6	10	13	26	34	44	78	60	72	82	853
Friday	77	84	59	49	39	33	17	21	10	7	7	7	6	10	5	8	19	17	35	56	72	85	68	72	863
Saturday	81	65	41	62	40	35	22	13	13	11	2	10	6	4	3	6	14	6	28	31	58	63	55	68	737
Sunday	56	40	48	28	35	23	14	13	13	4	5	6	9	6	8	10	9	11	27	41	54	53	77	65	655
Total	533	471	388	340	297	194	119	103	83	58	45	36	44	42	41	49	100	124	224	321	470	487	512	533	5614

Microbiological screening of deceased organ donors accounts for less than 1% of the overall laboratory workload, but can account for up to 80% of out-of-hours work. In a number of microbiology laboratories deceased donor characterisation is the main reason for provision of an out-of-hours on call service. In a typical H&I laboratory that provides services for kidney transplantation, donor HLA typing accounts for approximately 20% of the out-of-hours workload episodes.

The fragility of the current service provision is demonstrated by evidence presented to the review revealing that over the last year, 3 H&I laboratories and 2 microbiology laboratories have been unable to provide an out-of-hours deceased donor characterisation service and samples have been diverted to alternative laboratories. Lack of sufficient appropriately trained scientists for the out-of-hours service has been the main reason cited.

Notification that a laboratory is unable to process samples has happened at short notice leading to the requirement for urgent changes to Specialist Nurse for Organ Donation (SNOD) team processes to divert blood samples to alternative laboratories. This practice is associated with considerable risk as alternative laboratories need to undertake additional work on top of the demands already on their service. This has been cited as the reason for an error in a recent donor HLA type submitted to ODT. There is also evidence to show that diverting blood samples can delay organ offering with a consequent lengthening of the overall organ donation pathway. This is undesirable from a clinical viewpoint and can lead to families withdrawing consent/authorisation for donation.

The review recommends that all laboratories undertaking testing of deceased donor samples develop business continuity plans to ensure appropriate alternative arrangements are in place to provide a comprehensive service. There should be timely and formal notification to ODT if a laboratory cannot undertake the processing of samples (Recommendation 2).

3.4 Collecting and transport of samples

Blood samples for donor characterisation and ABO blood grouping are routinely taken by the SNOD. A number of operational issues were identified during the course of the Review, for example the timing, volume and dispatch of blood samples and the transport arrangements. Similar issues were identified during a parallel consultation conducted by ODT on the length of the donation process. These matters will either be progressed as part of the action plans for that work or dealt with under business as usual.

3.5 Microbiology testing

There is no agreed set of requirements for the delivery of microbiological screening across the UK and no standardisation of laboratory practice for deceased organ donor screening. Microbiological laboratories are expected to be compliant with SaBTO guidance, but there is no oversight of how screening is undertaken or the mechanism for Consultant advice, support and guidance in the interpretation of results.

Not all microbiology laboratories screen for a full set of infectious markers before donation. Responses from 12 of 18 laboratories providing microbiological screening services demonstrate that 10 of 12 laboratories report the non-mandated but routinely performed anti-EBV and 11 of 12 laboratories *anti-T. gondii* testing before donation **(Table 2)**. A full set of results prior to transplantation can enable better planning of recipient management or intervention either to prevent transmission of infection or to reduce the risk of infection in the recipient.

Table 2 – Screening and confirmation of markers of transmissible infection before donation. Data from 12/18 microbiology laboratories

Infection	Marker of transmissible infection	Laboratories performing screening before donation	Laboratories confirming reactive/ positive results before donation
HBV	HBsAg	12/12 (100%)	9/12 (75%)
HBV	anti-HBcore	12/12 (100%)	6/12 (50%)
HCV	Anti-HCV	12/12 (100%)	7/12 (60%)
HIV	Anti-HIV	12/12 (100%)	9/12 (75%)
HTLV1/2	Anti-HTLV	12/12 (100%)	0/12 (0%)
CMV	Anti-CMV	12/12 (100%)	2/12 (16%)
EBV	Anti-EBV	10/12 (80%)	0/12 (0%)
T. gondii	Anti-T gondii Ab	11/12 (90%)	0/12 (0%)
T. pallidum	Anti-T pallidum	12/12 (100%)	1/12 (8%)

Laboratories also vary in their ability to confirm a reactive/positive result before donation, particularly out-of-hours **(Table 2)**. The inability to confirm a reactive result can cause delays in organ allocation or in organs being unnecessarily declined for transplantation. Over the last 3 years at least 16 indeterminate or initially reactive results influenced a decision to decline organs for transplantation, but confirmatory testing subsequently showed those results to be false-reactive/ positive, thus those patients were denied a transplant.

Most laboratories report results to the SNODs by secure email, but in 3 regions results are still verbally reported by telephone, increasing the risk of error. This was highlighted in a recent Human Tissue Authority (HTA) audit of Organ Donation and Transplantation (ODT) Directorate.

The results are entered into DonorPath (the donor registration application) by the SNODs. The results are then available to the transplant centre via the Electronic Offering System (EOS). There is no standardised reporting of results from the microbiology laboratories because of the different testing methodologies and hospital IT systems. As shown in **Table 3** multiple terms are used by laboratories to describe a particular result, but DonorPath only has the capability to describe 'Positive', 'Negative' or 'Indeterminate'. The SNOD therefore has to interpret the terminology, potentially leading to errors in interpretation and transcription of the results.

Table 3: Terms used to report microbiology results

Term	DonorPath
Reactive	Positive
Detected	
Positive	
IgG/IgM Positive	
Non Reactive	Negative
Not detected	
Negative	
IgG/IgM Negative	
Equivocal	Indeterminate
Indeterminate	
Inconclusive	

Evidence gathered has demonstrated that there is significant variation in the access to out-of-hours specialist Consultant advice for interpretation of results in the context of organ donation and transplantation. In some areas such advice is not available leading to delays in the organ donation pathway and unnecessarily declined organs.

Microbiology results unavailable prior to donation are followed up by the Donor Records Department with processes to ensure results are reviewed by the SNOD and reported to recipient centres. It is recommended that all microbiology results are available before transplantation of organs, providing the implanting surgeon with information to enable intervention to reduce the risk of disease transmission if appropriate. The result should be reported electronically using a common set of terms with a 24/7 access to Consultant advice for interpretation of the result in the context of a particular patient (Recommendations 2 and 3).

3.6 HLA typing

A Minimum Repertoire and Resolution for Donor HLA Typing was agreed nationally and introduced in 2006, endorsed through the NHSBT Clinical Advisory Group framework. Compliance with this requirement is monitored and deceased donor HLA types used for allocation purposes are >99% compliant.

However there is a requirement for the repertoire and resolution of HLA typing to be increased. The technology for detection and specification of HLA antibodies has improved and patients may be shown to have pre-existing antibodies to HLA antigens which were not included in the 2006 minimum repertoire. These antibodies are often a contraindication to transplantation and can lead to a positive crossmatch and consequent reallocation of organs. In five year period 2010-2015, 54/150 positive crossmatches were caused by specificities outside the required repertoire. Because the funding stream for donor HLA typing is not clear, some laboratories are unable to increase the resolution and repertoire of out-of-hours deceased donor HLA typing. This disadvantages patients with antibodies for HLA specificities that are not included in the current repertoire.

The donor HLA type is reported to the Duty Office on a standard ODT form. This report form is different to the laboratory's standard report form and whilst reducing errors in interpretation, causes transcription errors in laboratories where the results are manually transferred onto the form. In some laboratories this source of error has been removed as in-house IT solutions have been put in place to download the results electronically from the laboratory information system onto the ODT form. This form is then sent to the Duty Office where the information is manually entered onto the National Transplant Database. The Review recommends end-to-end electronic transfer of results (Recommendation 3).

Consultant advice is available 24/7 in all of the H&I laboratories.

Laboratories use a variety of methodologies to achieve the results. The review considered that standardising testing methodologies would ensure that all laboratories performing deceased donor HLA typing use the most robust and efficient typing systems available. It would potentially allow the centralised procurement of necessary equipment and kits. Standardised equipment would also help facilitate the end-to-end electronic transfer of results from laboratory to ODT, eliminating clerical errors. If there was a move towards standardisation and central procurement, robust backup procedures would be necessary to cover equipment failure or shortages of consumables.

3.7 Laboratory service specification

It is recommended that a detailed service specification is developed for laboratories performing donor microbiology screening and HLA typing which will define the minimum repertoire of tests and the reporting nomenclature for donor characterisation before retrieval of organs. The service specification will be agreed with key stakeholders in line with current guidance and should be reviewed on a yearly basis (Recommendation 2).

There is a Royal College of Pathologists Key Performance Indicator for the turnaround time for reporting deceased donor HLA typing results, for NHSBT laboratories this KPI is reported to the Board. Further Key Performance Indicators should be developed around the service specification and agreed, focusing on processes, quality of service and outcomes (Recommendation 2).

3.8 Confirmatory Testing

Errors in the results of donor microbiology screening and HLA typing have the potential to cause serious recipient harm or even death. Deceased donor blood samples are frequently retested by the local laboratories at the recipient centre.

There is a well-established governance framework ensuring that donor HLA types performed at recipient centres are compared with the donor offer HLA type and any discrepancies communicated urgently to all the transplant centres receiving organs from the donor. The reasons for the discrepancies are routinely investigated and reported to ODT. Current audit data shows that there is a 1% discrepancy rate in donor HLA types used by ODT for organ allocation. 50% of discrepancies are clerical errors caused by transferring information from laboratory systems onto the ODT report form and 50% are technical errors.

Microbiology laboratories and transplant centres are made fully aware of the requirement to report events, such as discrepant results, to NHSBT/ODT. Despite this, under-reporting still occurs as evidenced in a recent SUI which unfortunately resulted in a patient death.

There is no standard timeframe for reporting confirmatory donor HLA and microbiology results. Therefore errors are not necessarily identified in a clinically relevant timeframe and intervention is delayed, potentially resulting in serious harm or death of the recipient. As retyping and retesting of a single donor may be performed in multiple laboratories the status quo is not a cost effective method for confirmation of the donor offer results.

There are a number of options for providing confirmation of results

- Use laboratories running a 24/7 shift system thus avoiding lone working
- Use simultaneous dual testing in two laboratories local to the donor hospital
- Identify a second laboratory that is mandated to provide a confirmatory result. This laboratory could be local, regional or national

The Review recommends that options for confirmatory testing are explored and there is a robust mechanism for reporting the results to ODT within a clinically relevant timeframe. In the event of a discrepancy, ODT will be responsible for informing other recipient centres in a timely manner (Recommendation 4). Donor blood samples should be stored for a minimum of 10 years, as recommended in the SaBTO guidance, to allow repeat testing if necessary (Recommendation 2).

3.9 Laboratory Configuration

The Review Working Group discussed and recognised the need to reconfigure and realign the laboratories undertaking donor characterisation. The current arrangements are historical and the activity between laboratories varies significantly. There are no clear criteria defining how many laboratories are required, their location and the level of service required.

A realignment of laboratory services and clarification of the funding and commissioning processes would have many advantages including: reducing variation in practice by introducing a service specification, ensuring the full repertoire of testing is undertaken in all laboratories, concentrating resources and ensuring a robust out-of-hours service with access to 24/7 Consultant advice and guidance (Recommendations 1 and 2).

In reconfiguring the service there are a number of important considerations. There should be an appropriate balance in the activity levels between laboratories, minimal extension of travel times and no significant increase in costs. It would be necessary to identify appropriate funding from existing sources/budgets to implement and sustain the above benefits.

3.10 Patient Safety

Organ transplantation is associated with known risks, however when errors in donor characterisation occur they can have serious consequences for the recipient of an organ. Errors in an HLA type can impact in several ways. HLA matching is an important feature of allocation schemes and an error can lead to patients missing the offer of a transplant or a patient receiving a transplant with a different mismatch grade to that in the intended offer. If the patient has pre-existing HLA antibodies an error in the donor HLA type could lead to the offer of an HLA incompatible organ. This is particularly important if the patient is transplanted following a virtual crossmatch in which a patient's pre-existing HLA antibodies are compared to the donor HLA type without a prospective laboratory crossmatch test.

In cardiothoracic transplantation patients are frequently transplanted following a virtual crossmatch because there is no time to perform the laboratory test due to the requirement for short timescales to ensure the success of the transplant. Accuracy is crucial as an error in the donor HLA type could result in hyperacute rejection of the organ and serious patient harm. The monitoring of discrepancies in donor HLA types shows there is a 1% error rate in the HLA types of donors used for allocation.

Errors in the results of microbiology screening can result in the transmission of infection between donor and recipient or mis-management of recipients. In the 3 year period April 2013 – March 2016, 36 incidents relating to donor microbiology screening were reported and investigated through the governance framework. 22/36 (61%) were transcription errors either made by the laboratory or the SNOD.

Failure to be able to increase or modify the repertoire of testing is a very real problem. For example if a patient has an HLA antibody against an HLA specificity not included in the repertoire then that particular specificity cannot be taken into account in the allocation process. In the case of a cardiothoracic patient, where organs have to be transplanted in a short timeframe, there is no time to perform further testing and therefore patients with antibodies to specificities not included in the repertoire may never be offered a transplant and die whilst waiting.

In relation to microbiology screening, timely access to a broader specialist repertoire of tests would facilitate better informed decisions and increased use of donors with perceived risk e.g. risks of emerging infections such as Zika, West Nile and Dengue viruses.

The incompatibility of the IT systems between ODT and the testing laboratories means that results have to be transcribed. This is a source of errors. It is recommended that results are transferred electronically to ODT to minimise the risk of transcription errors (Recommendation 3).

The Review proposes that a requirement of the service specification would be to hold collaborative meetings between laboratories, Specialist Nurses and transplant centres to share information, best practice and learning (Recommendation 2).

3.11 Funding

The current service provision for donor characterisation is fragile and does not have the capacity to meet current and future demands from increased activity and requirements to increase the repertoire of testing. The weaknesses in the service have been identified in the past and there have been attempts to resolve this matter in previous discussions between NHSBT and Commissioners. There is no clarity in the funding arrangements for donor HLA typing and microbiological screening. The funding for donor characterisation is based on historical arrangements developed before national allocation of organs. Historically donor characterisation testing was funded locally, mostly through renal transplant units. There is no contribution from cardiothoracic and liver transplant units.

There is variation in the mechanism by which laboratories recoup the cost of testing across the country. In England, Scotland and Northern Ireland there is no separate or identifiable funding stream for donor characterisation testing. In several laboratories, donor screening is included in the general pathology budget, while others have an SLA with their local transplant centre and cross charge per test. In Wales the cost of microbiology testing is covered in the laboratory budget but for donor HLA typing it is included in an SLA between the Welsh Blood Service and the transplant unit to fund an agreed number of donor HLA types and recipient tests. Anything over and above this number is invoiced per test.

NHSBT has one Service Level Agreement with a single laboratory in the South East of England to provide donor microbiological screening services. This is a unique situation and is based on historical arrangements and represents a cost pressure for the two SNOD teams invoiced per test.

There is a lack of transparency in the costs of donor typing. It is difficult to establish an exact cost for the testing as there is no funding line in budgets. Work performed in 2015 suggested that HLA typing costs approximately £550 and microbiological screening testing £450/donor. Recent information shows that the average cost of transporting blood samples is £150/donor. There are additional costs to consider, for example staffing of laboratories and the maintenance of out-of-hours rotas.

The donor reimbursement fund contains £35 allocated for microbiological screening and £36 to cover the cost of transporting blood samples from the donor hospital to the laboratory. There is no evidence this reimbursement is recouped by the microbiology laboratories undertaking the testing. There is no allocated funding for donor HLA typing. Transport costs are variably covered by NHSBT, renal transplant centres and the donation hospital.

Evidence suggests that for most renal transplant centres there is a balance between the number of donors undergoing HLA testing in local laboratories and the number of transplants performed in the associated renal transplant centre. A small number of transplant centres benefit and import more kidneys than are typed locally. This means they receive organs when they have not made a financial contribution to the donor characterisation testing.

Several Trusts have recently questioned payment of the costs associated with donor characterisation, which has jeopardised the provision of donor testing in local laboratories.

Many of the recommendations made by the Review are dependent on clarifying the commissioning process ensuring transparency and fairness. Clarification of the funding stream and commissioning processes for donor characterisation are fundamental in ensuring a safe, sustainable, reliable and resilient laboratory service. NHSBT/ODT should take the lead and work with the Commissioners of the 4 UK Health Departments and other key stakeholders to ensure there is a clear commissioning pathway for donor characterisation testing (Recommendation 1).

3.12 Risks

A number of risks and concerns have been highlighted and articulated during the Review. Serious incidents can and do occur with the potential to cause death and serious harm to the recipients of transplanted organs leading to reputational damage and the risk of litigation for NHSBT and other organisations performing testing.

Identified risks in the current service include:

- Incorrect information shared at the time of organ offering caused by errors in the reported results. There is the potential for death or serious harm to the recipient due to transmission of infection or hyperacute rejection of an organ because the incorrect donor HLA type was reported.
- Inability for laboratories to meet the increased requirements of the testing repertoire. There are a number of potential consequences:
  - potential for transmission of infection
  - suitable recipients may be denied the chance of a transplant as the organ is allocated to another patient
  - a risk of death on the waiting list for cardiothoracic patients with HLA antibodies as they do not receive suitable organ offer
  - an increase in the number of positive cross matches leading to increased organ ischaemic times when the organ is reallocated
- Some microbiology laboratories are unable to confirm reactive results or provide expert consultant specialist advice to the transplant clinician. There is no narrative or interpretation of results. There is therefore the risk that organs will unnecessarily be declined due to the inability to confirm false positive results.
- No standard reporting by microbiology laboratories with multiple terms to describe positive and negative results, and no interpretative comments. This leads to confusion in the interpretation of results by the SNOD team and incorrect recording of results and communication to the transplant centres. This results in the risk of either transmitting infection, or denying patients a transplant if organs are incorrectly declined.
- Laboratories unable to provide an out of core working hours service because of a lack of trained scientists. This can lead to a laboratory service being unavailable at short notice leading to potential operational difficulties, increase in travel times and lengthening of the donation process.
- Due to the increase in the number of consented/authorised organ donors and a lack of clarity in the funding, laboratories may withdraw testing services jeopardising testing in some regions. This leads to an increase in travel times, lengthening the donation process and may result in families withdrawing consent/authorisation. There are also cost implications with the increase in travel times

The Recommendations of this Review can provide a framework for future governance of the service ensuring there is the opportunity to share learning and inform best practice across NHSBT and laboratories.

4 Future service provision

The recommendations of this review are informed by evidence and the views of transplant professionals and other key stakeholders. The future service requirements should focus on achieving a robust, sustainable, quality service, which can support the predicted increase in the number of patients who are successfully transplanted.

The funding for donor characterisation should be fair, transparent, equitable and consistent for the providing laboratories across the UK. Dedicated funding for donor characterisation will enable the laboratories to adapt and be more responsive to accommodate future service requirements including the introduction of new tests and technologies.

A Service Specification should set standards and requirements for laboratories across the UK, so that the quality of the service is universal and variation is removed or reduced.

Options for reconfiguring and realigning laboratories should be considered to ensure that the future service is safe, sustainable and efficient. The service should be able to meet the future demands for organ donation and transplantation while at the same time not prolonging the organ donation process.

A focus on improving the communication between the Specialist Nurse Teams, laboratories and transplant units was evident during the Review. NHSBT should encourage and support more consistent sharing of information and learning.

5 Measuring success

The success of the future service provision can be measured by the following outcomes:

- There is a high quality, resilient, sustainable and flexible laboratory service that can meet the requirements of increasing donor numbers whilst adapting to new technologies and testing requirements to ensure as many patients as possible receive a safe, life-saving transplant.
- The costs and funding for donor characterisation testing are fair, transparent and equitable with a clear commissioning pathway.
- Laboratories have the resources to match activity and have an appropriately trained and competent workforce to provide an out-of-hours service.
- There is an improvement in the communication and the sharing of learning and information between the laboratories, SNOD teams and transplant centres.
- A reduction in the frequency of errors and SUIs

6 Conclusion

The Review has engaged and worked with a wide range of stakeholders involved in the donor characterisation pathway. All those involved have given their time and expertise to the Review and we are enormously grateful for their contributions.

The commitment and dedication of healthcare professionals involved in the donor characterisation service, mainly undertaken during unsocial hours, is acknowledged and appreciated.

There are clear deficiencies in the current service which are described in this report. Resolution of these deficiencies in deceased donor microbiological screening and HLA typing is largely dependent on clarifying funding and establishing commissioning processes. It is necessary that there is a safe and sustainable laboratory service with the ability and capacity to deliver a service that continues to support the organ donation and transplant programs.

Annex A

Donor Characterisation Review Terms of Reference (ToR)

Aim and objectives

The Review will examine the current service provision and make recommendations in line with the following aims and objectives:

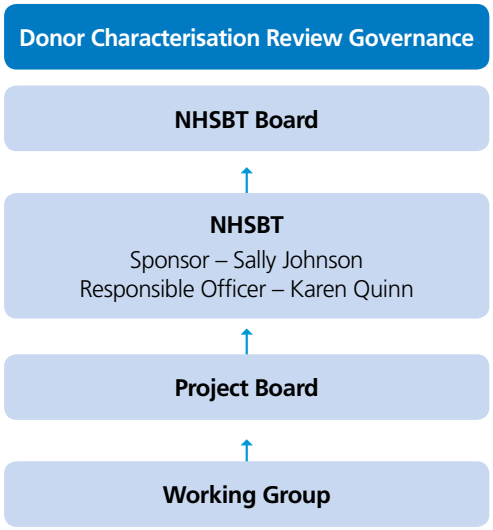
1. Gather information from stakeholders including users, providers, and others about the potential key requirements and desirable features of a future service
2. Map the current service against future requirement to identify gaps and opportunities and to establish areas of priority for the Review
3. Identify the strengths and weaknesses of the current service and practice
4. To reduce variation, recommend a set of standards for testing and reporting of results by laboratories. Identify standards and mechanisms for monitoring and audit
5. Ensure there is sufficient flexibility to cope with peaks/troughs in activity and with new scientific developments/technologies
6. Gather evidence about where errors have occurred and make recommendations that can be measured and will improve patient safety
7. Understand the reasons for any differences in the effect HLA and microbiological testing and the reporting of results to ODT has on the DCD and DBD offering process. Examine the provision for ABO group testing for deceased donors to understand when in the process it is undertaken
8. Recommend processes for the fair reimbursement of costs for donor HLA typing and microbiological screening
9. Review and recommend commissioning processes for HLA typing and microbiological screening relating to organ donation and transplantation
10. Any recommendations must support the requirements of the organ allocation process

Scope

The scope of the review will include examination of the current service provision for donor characterisation, namely HLA typing and microbiological screening.

The scope will start on referral of a potential deceased organ donor to the Specialist Nurse for Organ Donation (SNOD) and will include any further testing that is necessary and end with the acceptance of the organ for transplantation. The scope will exclude any recipient or cross match testing.

Governance



Project Board Membership

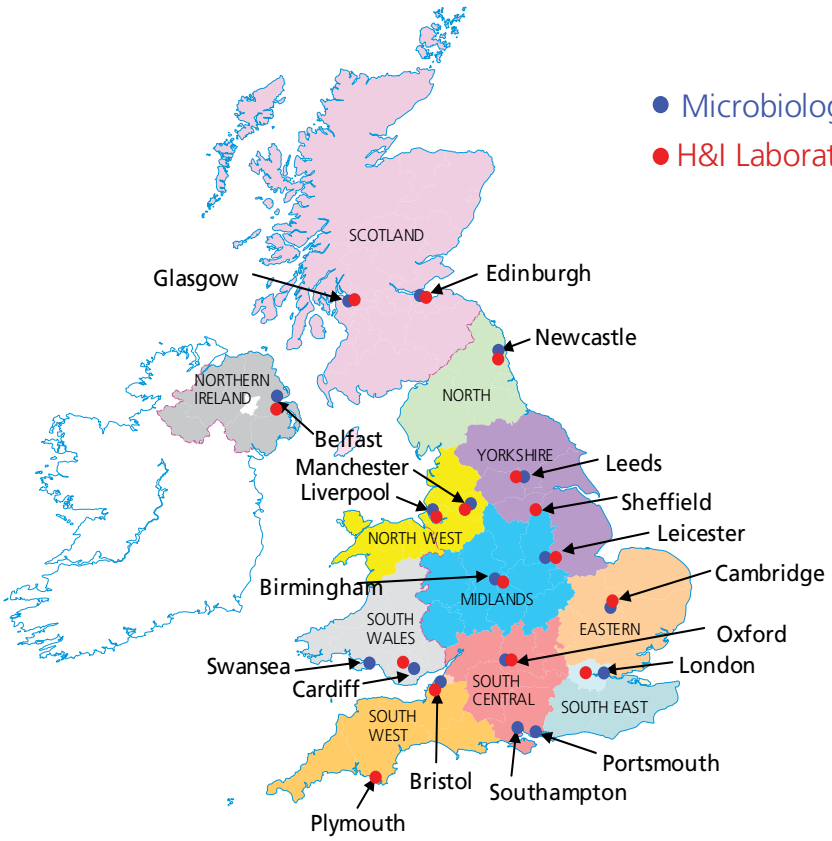
- Professor Susan Fuggle – Chair
- Professor John Forsythe – Medical Director, ODT
- Professor Chris Watson – Professor of Tranplantation, Cambridge and Chair, Kidney Advisory Group
- Karen Quinn – Assistant Director UK Commissioning
- Mark Roberts – Project Lead
- Dr Andrea Harmer – Co-chair Donor HLA Working Group
- Dr Tracey Rees – Co-chair Donor HLA Working Group
- Dr Ines Ushiro-Lumb – Chair Microbiology Working Group
- Susan Hannah – SNOD Team Manager Scotland
- Roberto Cacciola – Associate National Clinical Lead Retrieval
- Rachel Johnson – Head of Organ Donation and Transplantation Studies
- Malcolm Watters – Regional Clinical Lead for Organ Donation
- Kathleen Preston – Lay Member
- Lesa Hall – Administration
- Representation from the four UK health departments commissioning groups

Working Group Membership

- Professor Susan Fuggle – Chair
- Dr Andrea Harmer – Co-chair Donor HLA Working Group
- Dr Tracey Rees – Co-chair Donor HLA Working Group
- Dr Ines Ushiro-Lumb – Chair Microbiology Working Group
- Mark Roberts – Project Lead
- Stephen Bond – Recipient Coordinator, Cambridge
- Chloe Brown – Statistician, NHSBT
- Dr Brendan Clarke – Consultant Clinical Scientist, Leeds
- Ben Cole – SNOD Team Manager, Midlands
- Dr Matthew Donati – Consultant Medical Virologist, Bristol
- Jeanette Foley – Clinical Governance Manager, NHSBT
- Vicky Gauden – Quality Assurance Manager, NHSBT
- Dr Tony Hale – Consultant Medical Virologist, Leeds
- Professor Derek Manas – British Transplantation Society
- Dr Jayan Parameshwar – Consultant Cardiologist, Papworth
- Dr Sarah Peacock – Consultant Clinical Scientist, Cambridge
- Mr James Powell – Consultant Transplant Surgeon, Edinburgh
- Mr Keith Rigg – Consultant Transplant Surgeon, Nottingham
- Dr Deborah Sage – Consultant Clinical Scientist, Tooting
- Anne Sheldon – Head of Referral and Offering, NHSBT
- Linda Shelper – Senior Scientific Support Officer, NHSBT
- Dr Kate Templeton – Consultant Clinical Scientist, Microbiology, Edinburgh
- Dr David Turner – Consultant Clinical Scientist, Scotland
- Rebecca Westlake – SNOD Team Manager, London

Annex B

Map of Laboratories in the UK



● Microbiology Laboratories

● H&I Laboratories

2 microbiology labs in London

5 H&I labs in London

H&I and Microbiology: Same hospital	H&I and Microbiology: different hospitals, same city	H&I Lab. only	Microbiology Lab. only
Belfast	Birmingham	Guy's Hospital	King's College Hospital
Cambridge	Bristol	Hammersmith Hospital	Portsmouth
Edinburgh	Glasgow	Royal Free Hospital	Swansea
Liverpool	Leeds	Sheffield	University Hospital of Wales
Manchester	Leicester	Tooting	
Plymouth	Oxford	Welsh Blood Service	
Royal London	Newcastle		

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