

Stem Cell Donation and Transplantation

Strategic Refresh
2016 – 2022

Draft

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1. Executive Summary

1.1 Core Purpose

Stem cell transplantation is the only curative option for many patients with inherited and malignant bone marrow disorders. The majority of these patients do not have a suitably matched family donor. **SCDT's core purpose is to save the lives of these patients by providing stem cells from unrelated adult donors and from cord blood.**

1.2 Strategy

SCDT comprises the British Bone Marrow Registry (BBMR) and the NHS-Cord Blood Bank (NHS-CBB). Building on NHSBT's core competencies, the BBMR provides stem cells from adult blood donors, and the NHS-CBB provides stem cells from cord blood donations.

- Adult donations remain the preferred option for the majority of Caucasian patients;
- Cord blood is particularly effective in meeting the needs of black, Asian and minority ethnic (BAME) patients. In part this is due to NHSBT's strategy of collecting cord blood from maternity units where 40% of women are non-Caucasian.

The BBMR and NHS-CBB have been providing stem cells for 30 and 20 years respectively, providing over 3,600 donations and saving around 2,000 lives over the period. NHSBT currently meets around 12% and 28% of the UK requirement for adult and cord blood transplants respectively, up from around 10% and 10% respectively in 2010/11.

The Strategic Plan for SCDT was approved by the Board in 2015¹. Key elements are to:

1. Improve the equity of access to well matched stem cells for BAME patients by building an inventory of 20,000 cord blood donations by 2019;
2. Increase the utilisation of the BBMR by recruiting 10,000 young male Caucasian donors each year;
3. Precisely match donors and patients by using next generation sequencing (NGS) for donor typing;
4. Reduce the requirement for centralised funding by maximising income from the provision of stem cells to overseas registries.

1.3 Performance

Through 2015, stem cell provision was adversely affected by complex commissioning arrangements for cord blood transplantation in England (now resolved), the slowing of cord blood transplantation in the US (but not the UK), and increased competition from overseas registries. Initiatives such as the phased introduction of NGS-based typing of adult donors (from April 2015) and cord blood (from April 2016), and improved IT interoperability with the US has, during 2016, resulted in cord blood provision being ahead of 2016/17 plan² although still behind original 2015 strategic plan targets. The focused recruitment of young male Caucasian donors to the BBMR is proving particularly effective; these donors are six times more likely to go on to donate than donors on the rest of the registry. However, adult donor provision was behind plan during 2015/16.

The shortfall in donor and donation provision during 2015/16 accounted for a £1.2m adverse income position for SCDT, £1.1m of this being attributable to a shortfall in exports. During 2015/16, SCDT generated a net deficit of £0.3m. During 2016/17, SCDT is forecast to

¹ The provision and manipulation of stem cells for transplantation and regenerative medicine. Strategic Plan 2015 - 20

² Targets were re-set in 2015

generate a £2m surplus, this change being driven by increased income and reduced indirect costs and overhead allocation. This surplus reduces SCDT's requirement for grant-in-aid funding.

1.4 Recommendation

Reflecting on developing trends and on performance to date, the merits of accelerating or disinvesting in aspects of SCDT's strategy have been assessed. **It is recommended to continue to pursue the extant strategy - developing a cord blood inventory of 20,000 clinical grade donations by 2019, and recruiting 10,000 young male donors to the BBMR each year.** At current inventory and registry utilisation rates, this strategy is forecast to result in the provision of around 580 cord blood donations and 1,550 adult donors over the next five years compared to around 166 cord blood donations and 540 adult donors were NHSBT to disinvest in cord blood banking and adult donor recruitment. Financially, the recommended option is forecast to generate a net surplus of £5.5m over five years while substantively reducing SCDT's requirement for grant-in-aid funding. **In the event that BBMR utilisation rates exceed current levels, then modelling suggests that there may be merit in deploying additional sales income to accelerate the recruitment of young male Caucasian donors; this should be evaluated on an annual basis.**

2. SCDT's Core Purpose

2.1 Stem Cell Transplantation

Haemopoietic stem cell transplantation is the only life-saving option for a range of malignant and non-malignant bone marrow diseases. It is a testament to the power and potential of regenerative medicine.

SCDT's core purpose is to maximise the number of NHS patients offered a potentially curative stem cell transplant by providing an effective, affordable and financially sustainable supply of well-matched unrelated donor stem cells. SCDT's business model aims to minimise the cost of stem cell provision to NHS patients by maximising sales income through the provision of stem cells to overseas registries.

The BBMR lists 340,000 blood donors as potential stem cell donors. Because young male donors are preferentially selected for stem cell donation, the BBMR only recruits donors under 40 years of age. BAME donors of both genders are recruited while only Caucasian donors who are male are recruited; the latter are referred to as "fit panel" donors. Fit panel donors are around six times more likely to be selected to donate than other donors listed on the BBMR. All newly recruited donors are HLA typed at an allelic level using NGS; the BBMR was the first registry in the world to do this, although others have since started.

The NHS-CBB collects cord blood from six maternity units in London³. Donations are triaged at Colindale, and clinical donations (those containing over 14×10^8 total nucleated cells) are transported to Filton where they are processed and stored.

2.2 Current Strategy

The cost-effective provision of stem cells for NHS patients requires access to motivated donors who reflect the ethnic diversity of the UK. SCDT's ability to recruit adult stem cell donors from blood donors also results in:

- Very low recruitment costs compared to organisations who need to campaign for donors;

³ Barnet General, Watford General, Northwick Park, UCL, St George's, Luton and Dunstable.

- Excellent donor retention and commitment (BBMR donors are around twice as likely to agree to donate compared to Anthony Nolan and overseas donors);
- Access to contemporaneous donor information including CMV status (not routinely available on Anthony Nolan donors).

Access to donors needs to be combined with organisational competencies in IT, quality assurance, regulatory compliance, donor microbiology, and molecular genetics including NGS. NHSBT has strengths in all these areas. Moreover, SCDT works closely with NHSBT's H&I laboratories who advise on the selection of unrelated stem cell donors for around half of NHS patients. SCDT's strategy therefore remains predicated on the underpinning assumption that it would not be feasible or desirable for NHSBT to divest its donor provision activities to an alternative provider such as Anthony Nolan.

The 2015 strategic plan for SCDT therefore sets out three strategic objectives collectively intended to ensure that NHS patients have access to high quality precisely matched stem cells reflecting the ethnic diversity of the UK population. The strategy also seeks to ensure financial sustainability by maximising the provision of SCDT's donors and donations to overseas registries.

The three strategic objectives can be summarised;

1. To improve the quality of the adult donor registry and cord blood inventory by:

- Recruiting around 10,000 young male Caucasian donors to the BBMR each year.
- Banking around 2,300 high quality cord blood donations until 2019.

2. To improve the selection of precisely matched donors and donations by:

- Typing all new donors and cord blood donations at an allelic level using NGS.

3. To promote the selection of donors and donations by:

- Completing the implementation of EMDIS-cord⁴;
- Migrating adult donor data to the US stem cell registry (NMDP).

2.3 UK Perspective

NHSBT works in close collaboration with Anthony Nolan and the Welsh Bone Marrow Donor Registry (WBMDR) to deliver a coherent strategy for the UK. Anthony Nolan coordinates the provision of adult donor and cord blood stem cells for NHS patients on behalf NHSBT and the WBMDR⁵. This close alignment of organisational roles is part of an overarching UK strategy for unrelated donor stem cell transplantation, endorsed by ministers and funded in part by the DH. The UK strategy is monitored by the UK Stem Cell Strategy Oversight Committee and comprises two complementary approaches namely:

1. The improved provision of **adult donor** stem cells to **benefit the majority** of patients;
 2. The improved provision of **cord blood** stem cells to **improve equity of access** to transplantation for BAME patients⁶.
- In 2014, the Oversight Committee confirmed the effectiveness of this approach. It reported the increased and accelerated the provision of UK-sourced stem cells for UK patients, saving more lives, reducing costs, and improving equity of access to matched donors for

⁴ European Marrow Donor Information System.

⁵ SCDT continues to manage the provision of donors and donation for export.

⁶ This exploits the genetic diversity of the inventory, and the reduced requirement for precise HLA-matching (compared to adult donor-derived stem cells).

BAME patients⁷. In particular, the Committee noted that around 21% of BAME patients now receive a cord blood transplant (compared to around 4% of Caucasian patients). Registry data show that around 40% of patients receiving cord blood are of a BAME background.

- Since 2010, the number of patients in the UK able to proceed to a potentially life-saving stem cell transplant has increased by over 30%. Around 60% of BAME patients are now able to find a well-matched stem cell donation compared to 40% in 2010 and compared to around 80% of Caucasian patients currently. Addressing this inequality through improved access to UK-sourced cord blood remains a government priority.
- Nevertheless, against the growing number of UK patients now eligible for a life-saving transplant, around 355 patients⁸ each year are still unable to find a well-matched donor in a timely way.
- Unrelated donor stem cell transplantation is a cost-effective way of saving lives (see section 3.3).

2.4 Funding

SCDT is currently (2016/17 forecast) funded from a combination of grant-in-aid (£4.2m), additional (non-recurring) DH programme funding (£1.4m) and sales income (£4.2m) derived from the supply of stem cells to UK transplant centres (via the Anthony Nolan) and international registries. Central funding primarily supports the ongoing development of the cord blood inventory (*circa* £3.3m during 2016/17).

The current strategy envisages the need for continued investment in cord blood banking until an inventory of 20,000 donations is achieved in 2019; thereafter maintenance of the inventory will be funded solely through sales income. At that time, grant-in-aid would be redeployed to fund other NHSBT activities.

3. Market Analysis and Health Economics

3.1 Stem Cell Transplantation in the UK

Figure 1 shows recent trends in the provision of unrelated donor stem cells for UK patients. Historically, the number of transplants performed has increased at a rate of around 5% *per annum* although there was a decline in 2014/15. NHSBT currently meets around 12% and 28% of the UK requirement for adult and cord blood respectively, up from around 10% and 10% respectively in 2010/11, the remainder being sourced from overseas registries or other UK providers (principally Anthony Nolan).

Trends are broadly similar in the US with unrelated donor stem cell transplantation increasing by 1.9% between 2014 and 2015, and cord blood transplantation increasing by 3.3% over the same period⁹.

3.2 Trends in Stem Cell Transplantation

Cord Blood Provision

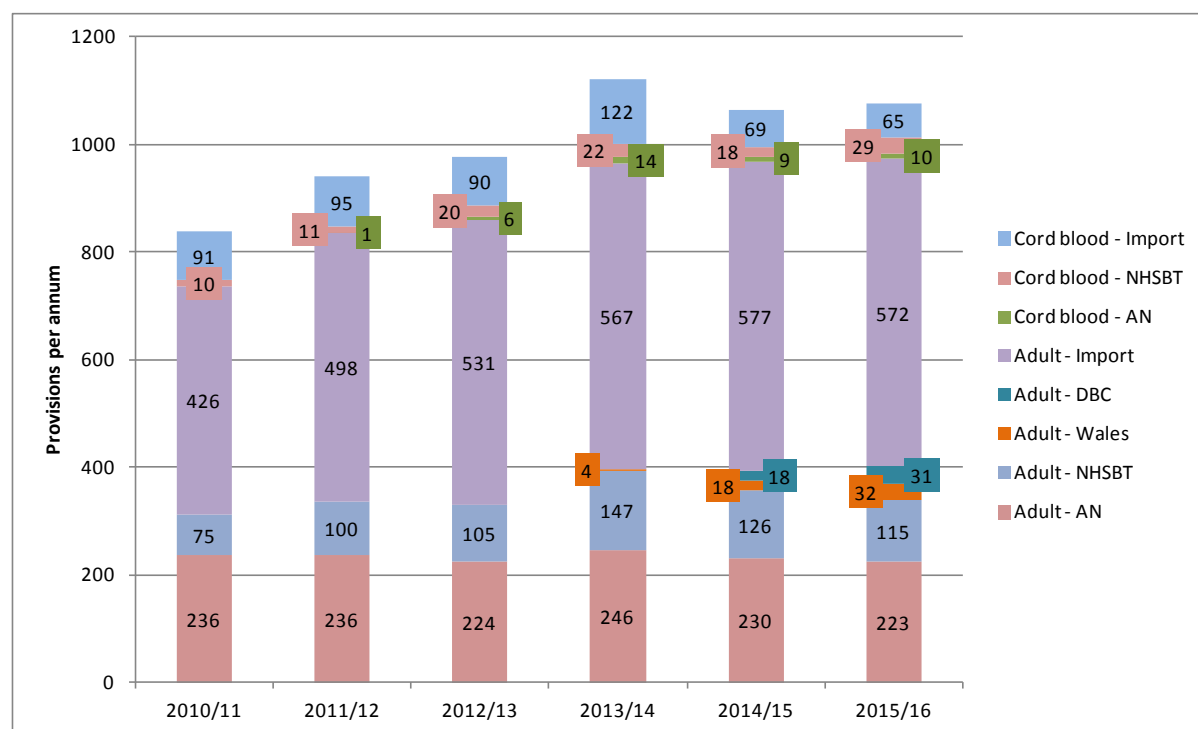
⁷ Unrelated Donor Stem Cell Transplantation in the UK. Effective, Affordable, Sustainable. UK Stem Cell Strategy Oversight Committee (November 2014).

⁸ In 2010, the Strategic Forum estimated unmet need to be around 440 patients *per annum*.

⁹ Data from National Marrow Donor Programme

Extrapolating from the current position, and accounting for impact of the planned increase in inventory size and quality, the targets set out in the 2015 strategic plan for the provision of cord blood to UK and overseas patients remain reasonable and achievable as the planned benefits of EMDIS-cord and NGS start to be realised (see also section 4.3).

Figure 1. Unrelated Donor Stem Cell Provision for UK patients¹⁰



Key:

AN = Anthony Nolan. DBC = Delete Blood Cancer

Adult Donor Provision

By international standards¹¹, the BBMR is a relatively efficient register with an annual utilisation rate of 0.061% compared to the global average of 0.036%. BBMR's fit panel has an annual utilisation rate of 0.32%, around nine fold greater than the global average.

International Reciprocity

The UK, in common with all developed countries, imports more stem cell donations than it provides domestically. Because every patient's genetic profile is unique, developed countries worldwide (55 currently) contribute their donors and cord blood donations to a worldwide "market place" of more than 28 million donors (up from 18.5 million in 2010) in this way maximising the chances of a patient, anywhere in the world, of finding a well matched donor. This market place is administered and harmonised through the World Marrow Donor Association (WMDA); SCDT is fully accredited to WMDA standards, and the quality of SCDT's donors and services means that the National Marrow Donor Programme (the US registry) now seeks to provide a UK donor before searching other non-US registries.

Haploidentical Stem Cell Transplantation

¹⁰ Data from Anthony Nolan

¹¹ Data from the World Marrow Donor Association (2016)

Haploidentical transplants use donations derived from partially-matched family donors; they have the potential to reduce the requirement for stem cells from unrelated donors, particularly for patients from BAME backgrounds where no unrelated adult or cord blood donor exists.

A relatively recent approach to haploidentical stem cell transplantation is demonstrating promising initial results, including acceptable rates of non-relapse mortality and severe graft-versus host disease although there are reports of a higher than anticipated risk of disease relapse. However, randomised trials to compare longer term outcomes with alternative donor sources have yet to report.

Reflecting on these recent developments, the Oversight Committee concluded¹² that the need for a high quality UK cord blood inventory and adult donor registry was unchanged for the foreseeable future and that, in accordance with BSBMT consensus guidance, haploidentical donors should only be considered in the absence of a well-matched unrelated adult donor or cord blood donation.

3.3 Health Economics

The UK Stem Cell Strategy Oversight Committee estimated that the expansion of the UK cord blood inventory to 30,000 donations (20,000 at NHSBT and 10,000 at Anthony Nolan) would allow an additional 257 patients to potentially proceed to transplant. The creation of a UK fit panel of 150,000 adult donors would allow an additional 90 patients to be offered a potentially life-saving transplant. In addition, a continued focus on improved service provision and unambiguous HLA typing by NGS would reduce the time taken to provide stem cells, saving the lives of patients who would otherwise deteriorate while waiting for a suitable graft to be provided.

During 2015, the Oversight Committee commissioned a review of the health economics of cord blood banking. This showed a cost of £9,500 per QALY based on a cord blood inventory utilisation rate of 0.85% *per annum*, thereby reflecting a health intervention which is cost-effective. Reflecting on the current inventory utilisation rate of 0.4% to 0.5%, the incremental cost per QALY gained of developing a 30,000 donation inventory can be estimated to be around £13,000, still below the £20,000 threshold used by NICE to evaluate the effectiveness of NHS spending¹³. In comparison, the cost per QALY gained for renal, heart and liver transplantation has been estimated at around £10,000, £30,000 and £50,000 respectively^{14, 15}.

4. Performance Update

4.1 Operational Performance

Development of the Adult Registry and Cord Blood Inventory

Key performance metrics are given at Table 1. Adult donor recruitment was on plan during 2015/16 and is ahead of plan during 2016/17. The proportion of cord blood collections qualifying for banking is a measure of the competence and efficiency of the cord blood collection teams; this remains broadly on plan. Although the growth of the cord blood inventory

¹² Unrelated Donor Stem Cell Transplantation in the UK. Effective, Affordable, Sustainable. UK Stem Cell Strategy Oversight Committee (November 2014).

¹³ Extrapolating from the univariate sensitivity analysis in: Unrelated Donor Stem Cell Transplantation in the UK. Effective, Affordable, Sustainable. UK Stem Cell Strategy Oversight Committee (November 2014)

¹⁴ Longworth L et al. Midterm cost-effectiveness of the liver transplantation programme of England and Wales for three disease groups. *Liver Transplantation* 9:1295 (2003)

¹⁵ Jarl J et al. Economic evaluations of organ transplantation. A systematic literature review. *Nordic Journal Health Economics*. 1:61-82 (2011).

was behind plan during 2015/16 (due to exceptionally high levels of staff turnover among the collection teams), the rate of stem cell collection and banking is broadly on plan during 2016/17. At the end of July 2016, the NHS-CBB held 23,143 donations in cryogenic storage; 14,205 “clinical grade” donations and 8,938 “R&D grade” donations.

Table 1. Summary of Performance versus Strategic Plan and 2016/17 Budget.

Activity	2015/16 strategic plan target	2015/16 actual	2016/17 strategic plan target	2016/17 plan	2016/17 forecast	2016/17 trend
Proportion of cord blood collections qualifying for banking	25%	43%	25%	40%	40%	↔
Cord blood donations added to inventory	2,300	1,947	2,300	2,300	2,300	↑
Young male donors recruited to BBMR	6,000	5,924	7,000	7,000	10,000	↑

Benefits of Allelic-Level Typing by NGS

Allelic-level typing of adult donors and cord blood donations by NGS was introduced in early 2015 with around 11,000 donors typed through 2015/16; the BBMR was the first registry in the world to offer this. During 2015/16, the planned benefits were fully realised with 14 NGS-typed adult donors provided (target = 10) and 6 NGS-typed cord blood donations provided (target = 2). BBMR data with allelic-level typing information was integrated with NMDP’s database through July 2016. Early indications (based on requests for confirmatory HLA typing) are that, as a result, adult donor provisions to the US will increase by *circa* 100% from Q4 2016/17 onwards.

Fit Panel Utilisation and Adult Donor Recruitment

‘Fit panel’ donors are defined as Caucasian male donors under 40 years of age who have been HLA typed at an allelic level. Although these donors comprise around 5% of those listed on the BBMR, they accounted for 26% of stem cell collections provided during 2015/16 validating SCDT’s focus on the recruitment of young male blood donors.

Continuous Improvement

SCDT’s workplan incorporates a systematic continuous improvement programme to reduce errors, eliminate waste, reduce costs and release capacity. During 2015/16, this resulted in:

- Safer procedures for moving donor-related work between the BBMR and Anthony Nolan.
- A new process to triage cord blood collections for processing or discard. This has halved the number of donations sent to Colindale for evaluation without reducing the number of clinical units banked.
- A streamlined cord blood donor consent process, increasing the number of donors consented and releasing staff capacity.
- The automated transfer of microbiology results to Hematos, reducing the possibility transcription errors and releasing staff capacity.
- The removal of cord blood “in process” bottlenecks, reducing the median time (excluding HLA typing) from collection to final validation from around six months to less than three

months. During 2016, further improvements are planned to result in over 80% of donations being made available for search in under two months.

- A revised medical clearance process which allows the scientific staff (after training and assessment) to authorise the clearance for collections without abnormal results (around 70% of collections).
- An improved service for the provision of haemoglobinopathy testing results from Great Ormond Street Hospital. Benefits are a faster and cheaper service, with reports provided in an electronic format.

4.2 Progress against Milestones

As stated above, an effective registry requires a critical mass of young, ethnically diverse donors, genotyped to a high level of accuracy to allow for better matching with recipients. A registry also needs to be accessible to overseas organisations searching for a match, thus supporting the export of donations. The initiatives in the plan therefore support these principles as well as addressing an increase in the efficiency of the cord blood banking operation.

Progress by Q2 2016/17 against the key initiatives set out in the 2015 Strategic Plan are summarised below at Table 2.

Table 2. Summary of Progress against Milestones

Initiative by Strategic Goal	Target Date	Progress	R A G
Goal 1.			
To improve the quality of adult donors and cord blood donations listed on the BBMR by recruiting young male adult donors, and by banking cord blood donations containing a high dose of stem cells from BAME women.			
1. Better Meet Customer Requirements			
a. Match service provision to customer requirements, especially Anthony Nolan, through joint rapid improvement and 2P events.	2015 onwards	Joint rapid improvement events held with Anthony Nolan to streamline processes and communication between organisations.	
b. Through leadership of appropriate forums, such as the WMDA, to raise the profile of NHSBT.	2015 onwards	Significance presence at WMDA ¹⁶ conference. Working with NMDP ¹⁷ to promote BBMR's profile to US transplant centres during 2016	
2. Recruitment of Adult Donors			
a. Agree recruitment targets with Blood Supply and review quarterly.	Annually	Targets agreed and cascaded to teams; donor recruitment above plan	
b. Blood Supply to implement systems and processes to ensure recruitment of male	Ongoing	Achieved – recruitment on plan	

¹⁶ World Marrow Donor Association

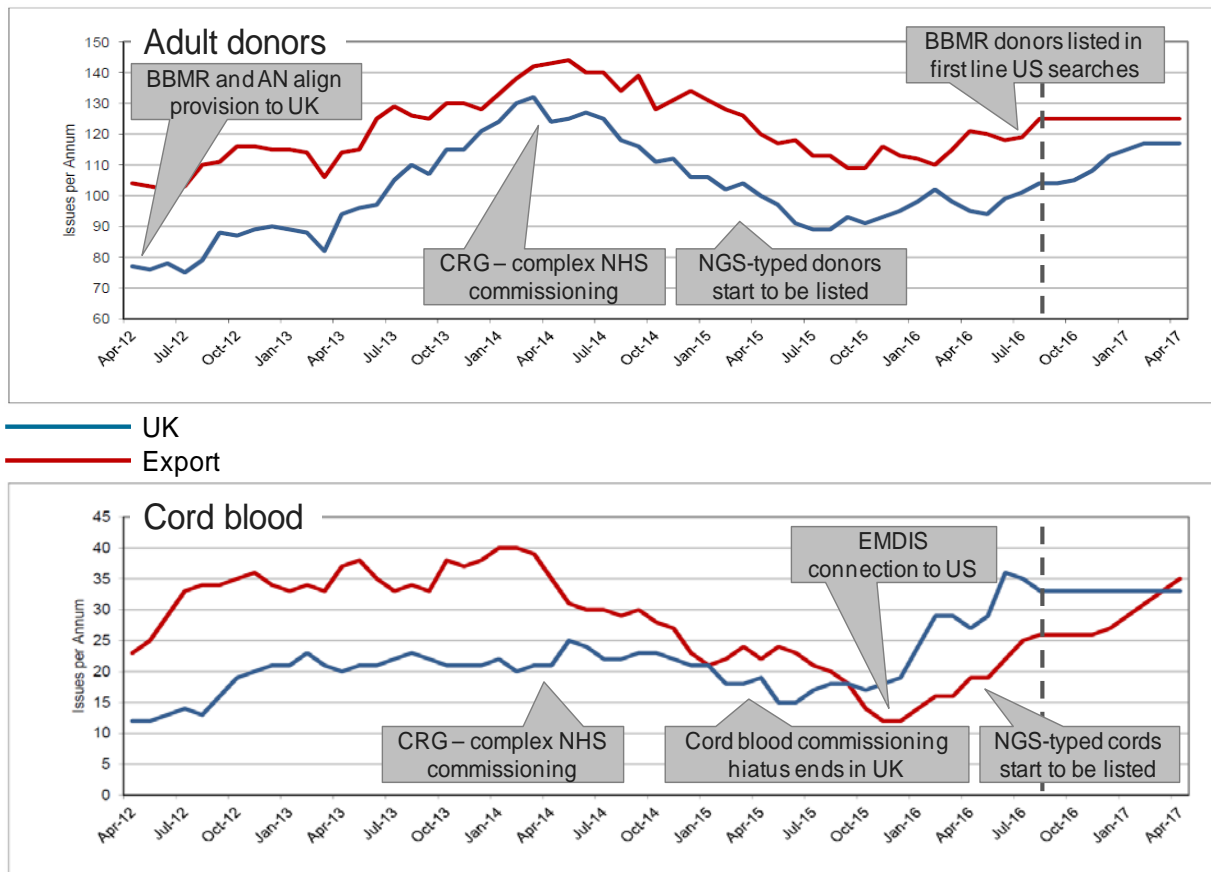
¹⁷ National Marrow Donor Programme

Caucasian donors and BAME donors under 40 years.			
c. Create a BBMR donor portal linked to blood donor portal.	Q4 2015/16	Not a currently prioritised project.	
3. Cord Blood Banking			
a. Improve initial cord collection volumes through process improvement initiatives.	2015 onwards	48% of collections qualify for banking, up from 25%	
b. Improve cord blood processing techniques to increase cell yields through introduction of HES protocol to AXP processing.	Q1 2015/16	Mean processing recovery now 72%, up from 66%	
c. Support improved performance management through introduction of automated reporting tools to monitor collection and banking supply chain.	Q2 2015/16	Achieved – supply chain monitored monthly	
d. Achieve 'biobank status' to expedite the sale of clinically-unsuitable cord blood donations for R&D	Q3 2015/16	Application submitted, approval anticipated Q2 2016/17	
e. Promote sales of cord blood donations for R&D.	Q4 2015/16	Sales via non-clinical issues process established. 2015/16 sales income of £19K, up from £3K in 2014/15	
f. Reduce the stock of R&D grade donations to 5000 donations	Q1 2016/17	Cryogenic storage capacity released for all new clinical donations added to the inventory	
Strategic Goal 2.			
To improve the characterisation of adult donors and cord blood donations by listing unambiguous HLA types obtained by next generation sequencing.			
4. Donor Typing			
a. Implement next generation sequencing for allelic level typing of all fit panel donors recruited and cord blood donations banked.	Q1 2015/16	Commenced Q1 2015/16. Circa 13,800 donors and donations typed as at July 2016.	
Strategic Goal 3.			
To improve the visibility of donors and donations on national and international search reports through implementation of EMDIS functionality.			
5. EMDIS Implementation			
a. Complete roll-out of EMDIS-cord, establishing reciprocal connections with registries in US, France, Italy, Spain and Finland.	2015/16	Connections established with US, France and Finland	
b. Assess the benefits, costs and constraints of EMDIS-adult	Q3 2015/16	Delayed while working via NMDP and WMDA to achieve	

4.3 Impact of Strategic Initiatives and External Influences

Acknowledging the difficulty of demonstrating a direct link between “cause and effect”, Figure 2 seeks to illustrate the likely historic impact of some of the key internal initiatives and external influences since 2012.

Figure 2. Adult Donor and Cord Blood Issues (Moving Annual Total) and Key Initiatives and Influences



4.4 Financial Performance

Demand for BBMR donors for NHS patients during 2015/16 was lower than predicted in the 2015 strategic plan (Table 3). Changes to the commissioning of stem cell transplantation by NHS England contributed to a significant slowing in the historical year on year increases seen until 2014. Table 3 shows that there was also a shortfall in exported donations for both cord blood and adult donors during 2015/16. In part this was likely due to increasing competition from overseas registries (see section 3.2).

The combined impact of this shortfall accounted for a £1.2m adverse income position for SCDT during 2015/16 (£1.1m being attributable to the shortfall in exports).

Table 3. Summary of Performance versus Strategic Plan and 2016/17 Budget.

Activity	2015/16 strategic plan target	2015/16 actual	2016/17 strategic plan target	2016/17 plan	2016/17 forecast	2016/17 trend
Provision of cord blood for UK patients	27	29	33	31	27	↔
Provision of cord blood to overseas registries	33	16	38	21	30	↑
Provision of adult donors for UK patients	137	115	158	127	117	↔
Provision of adult donors to overseas registries	133	98	162	107	117	↑

The financial plan for 2016/17 is predicated on activity levels increasing versus 2015/16 as the interventions and initiatives described above take effect. Through Q4 2015/16 and Q1 2016/17, the provision of cord blood and adult donors increased significantly. Table 3 shows how cord blood provision is now moving ahead of strategic targets, while adult donor provision is moving ahead of 2016/17 budgets (but remains behind the 2015 Strategic Plan target).

5. Strategic Options and Recommendations

5.1 Non-Financial Appraisal of Options

Reflecting on developing trends and on performance to date, four options have been evaluated to assess the merits of accelerating or disinvesting in aspects of SCDT's strategy set out in 2015. These options are summarised at Table 4.

In seeking to accelerate the financial and clinical benefits of SCDT's strategy, option 2 considers the cost and impact of increasing the rate of adult donor recruitment to the BBMR. Accelerating cord blood collection was discounted as an option given the time taken to establish a new collection site (around 18 months for site selection, contracting, refurbishment, staff recruitment and training) by which time NHSBT's inventory should be approaching 20,000 donations (optimal for the UK's needs).

Table 4. High Level Non-Financial Appraisal of Options

Option 1: Existing strategy re-forecast (recommended)
<ul style="list-style-type: none"> Provision of adult donors and cord blood donations extrapolated from last 6 months' activity and adjusted to reflect the expected impact of recent developments. Assumes continuity of grant-in-aid and DH programme funding for 24/7 cord blood collection until 2019. Thereafter cord blood banking rate is reduced five-fold to maintain an inventory of 20,000 donations and funded from sales income. Assumes 10,000 young male donors are recruited and typed each year.

- Delivers NHSBT's contribution to the UK strategy for unrelated donor stem cell transplantation.

Option 2: Accelerate adult donor recruitment

- As option 1, except additional sales income is deployed to fund the typing of 20,000 young male donors each year.
- An additional 190 adult donations would be provided over 5 years at current utilisation rates.

Option 3: Non-renewal of DH programme funding for 24/7 cord blood banking

- A contingency option to cover the non-renewal of DH programme funding for 24/7 cord blood collection from 2017/18 onwards (i.e. following austerity measures at DH).
- As option 1 except cord blood processing costs are reduced by ceasing the banking of grade C donations (those containing less than 18×10^8 nucleated cells).
- The focus on banking only high grade cord blood donations will impact paediatric patients predominantly; 42% of cord blood donations are issued for paediatric patients, 50% of whom receive grade C donations currently.
- The UK strategy of achieving a 20,000 cord blood inventory is not achieved.

Option 4: Full disinvestment

- Assumes that adult donor recruitment ceases and that cord blood banking is sufficient only to replace issued donations, but insufficient to maintain inventory quality. Drives a year on year decline in stem cell provisions.
- Drives a requirement to import an additional 500 donors into the UK over 5 years – cost pressure to NHS system costs in the region of £3m - £5m. Unclear how this would be viewed by international registries who currently promote BBMR donors to their transplant centres.
- Signals a reversal of the government-supported strategy to cost-effectively improve patient outcomes through improved access to unrelated donor stem cell transplantation. Very likely to impact adversely on patient outcomes. Significant negative publicity from patient groups would be expected.

5.2 Financial Appraisal of Options

High level financial analyses, showing the aggregated income and expenditure over five years (2017/18 to 2021/22) are given at Tables 5a (BBMR) and 5b (NHS-CBB).

Table 5a. Aggregated Financial Impact of Options - BBMR

Income and Expenditure 2017-22	Strategic Plan £'000s	Option 1 £'000s	Option 2 £'000s	Option 3 £'000s	Option 4 £'000s
Adult Provisions	2,317	1,554	1,748	1,554	543
Grant-in-aid (1)	£3,443	£342	£342	£342	£0
DH Programme funding (2)	£264	£0	£0	£0	£0
Sales Income	£32,513	£20,944	£23,566	£20,944	£7,303
Expenditure	-£21,719	-£11,160	-£13,917	-£11,160	-£6,241
Gross Margin	£14,500	£10,126	£9,991	£10,126	£1,062
Indirect Costs	-£4,863	-£3,332	-£4,155	-£3,332	-£932
Contribution to Overheads	£9,637	£6,794	£5,835	£6,794	£131
Overheads	-£2,085	-£2,085	-£2,085	-£2,085	-£2,085
Net Surplus/(Deficit)	£7,552	£4,709	£3,750	£4,709	-£1,954

Table 5b. Aggregated Financial Impact of Options – NHS-CBB

Income and Expenditure 2017-22	Strategic Plan £'000s	Option 1 £'000s	Option 2 £'000s	Option 3 £'000s	Option 4 £'000s
Cord Units Issues	566	580	580	464	166
Grant-in-aid (1)	£3,669	£4,169	£4,169	£4,688	£0
DH Programme funding (2)	£1,236	£1,023	£1,023	£0	£0
Sales Income	£11,227	£10,983	£10,983	£8,956	£3,475
Expenditure	-£11,064	-£10,001	-£10,001	-£8,699	-£5,007
Gross Margin	£5,067	£6,175	£6,175	£4,945	-£1,531
Indirect Costs	-£2,534	-£3,053	-£3,053	-£2,640	-£1,529
Contribution to Overheads	£2,534	£3,121	£3,121	£2,305	-£3,060
Overheads	-£2,305	-£2,305	-£2,305	-£2,305	-£2,305
Net Surplus/(Deficit)	£229	£816	£816	-£0	-£5,365

Key.

1, 2. Also termed revenue cash limit

For all options, sales income has been forecast based on exiting levels of registry or inventory utilisation, and assuming that the split between supply for NHS customers and overseas registries remains constant¹⁸.

Table 5a (BBMR) shows that, under option one (existing strategy reforecast), adult donor provision is now expected to be lower than strategic plan targets. As noted above, this is due to increased competition and changes to NHS England commissioning impacting from 2014.

Option one now forecasts the provision of 1,550 adult donors over the next five years compared to around 540 adult donors were NHSBT to cease adult donor recruitment (option four). Under option one, the BBMR is forecast to generate a net surplus over five years of

¹⁸ For the BBMR, it is assumed that annualised fit panel utilisation is 0.3% and the rest of the inventory is 0.05%. It is assumed that 55% of BBMR provisions are for NHS patients and 45% for overseas registries. Cord blood inventory annualised utilisation rates are assumed to be 3.3%, 0.5% and 0.1% for grade A, B and C donations respectively.

£4.7m compared to a deficit of £1.9m under option four. Option two (accelerated donor recruitment) is not recommended at this time as the benefits (190 additional adult provisions over five years) are disproportionate to the additional investment (£2.8m over five years) required to achieve the gain. Nevertheless, the benefits of accelerating donor recruitment should be kept under review as modelling shows that any future increase in the utilisation of fit panel donors (for example as a result of incorporating BBMR data into the NMDP; see section 4.1) would increase the relative benefits of option two.

Table 5b (NHS-CBB) shows that cord blood provision is forecast to be ahead of strategic plan targets. Option one (current strategy) now forecasts the provision of 580 cord blood donations over the next five years compared to around 460 donations were the DH to withdraw programme funding (option three), and 166 donations were NHSBT to disinvest fully (option four). Under option one, the NHS-CBB is forecast to generate a net surplus of £0.8m over five years compared to a deficit of £5.4m under option four.

Option one allows for the incremental re-allocation of grant-in-aid to alternative NHSBT priorities (Table 6).

Table 6. Option One – Grant-in-Aid Funding Released

	2017/18 £m	2018/19 £m	2019/20 £m	2020/21 £m	2021/22 £m
Current Baseline GIA Funding	£4.17	£4.17	£4.17	£4.17	£4.17
GIA Funding Required	£2.08	£2.31	£0.13	£0.00	£0.00
GIA Funding Released	£2.10	£1.87	£4.05	£4.17	£4.17

Table 7 provides further information on the aggregated issues, income and direct costs for option one over five years. This illustrates the relatively large contribution made to SCDT's net surplus from the export of adult donors in particular.

Table 7. Aggregated Issues, Sales Income and Direct Costs for Option One

Income and Expenditure 2017-22 Option 1	Adult Donors £000's	Cord Blood £000's
Issues - UK	854	275
Issues - Export	699	305
Total Issues	1,554	580
Sales Income		
Issues - UK	£3,294	£3,923
Issues - Export	£13,719	£6,710
Total Income	£17,013	£10,633
Direct Costs		
Issues - UK	-£3,294	-£3,923
Issues - Export	-£3,935	-£5,728
Total Direct Costs	-£7,229	-£9,651

Note.

Confirmatory typing and other miscellaneous income streams matched to costs and excluded.

5.3 Recommendation

This review of the strategic plan for SCDT was undertaken in light of mixed performance and challenging market conditions during 2015/16. Some key elements of the strategy such as the recruitment of young male donors and the introduction of NGS delivered the anticipated

benefits in full. NHS patients are clearly benefiting from an improving cord blood inventory. In contrast, the provision of adult donors was behind plan although improving significantly during 2016.

NHSBT remains well placed to meet the NHS requirement for stem cells from donors who reflect the ethnic diversity of the UK. Access to well-motivated blood donors at very low cost is a particular advantage compared to other organisations such as Anthony Nolan. Cessation of adult donor recruitment and/or cord blood banking is therefore not recommended. The resulting deterioration of BBMR donor demographics and cord blood inventory would result in the loss of *circa* £20m sales income over the five year period versus option one. It would result in the UK importing around 500 additional donations over the period, representing a cost pressure to NHS system costs of around £3m to £5m. Politically, this option would signal a reversal of the government-supported strategy to cost-effectively improve patient outcomes through improved access to unrelated donor stem cell transplantation. Reputational damage, both nationally and internationally, would be significant.

It is recommended to continue to pursue the extant strategy - developing a cord blood inventory of 20,000 donations by 2019, and recruiting 10,000 young male donors to the BBMR each year. As noted above, at current inventory and registry utilisation rates, this strategy is forecast to result in the provision of around 580 cord blood donations and 1,550 adult donors and over the next five years compared to around 166 cord blood donations and 540 adult donors were NHSBT to disinvest in cord blood banking and adult donor recruitment. Financially, the recommended option is forecast to generate a net surplus of £5.5m over five years while substantively reducing SCDT's requirement for grant-in-aid funding. In the event that BBMR utilisation rates exceed current levels, then modelling suggests that there may be merit in deploying additional sales income to accelerate the recruitment of young male Caucasian donors; this should be evaluated on an annual basis.

Given the recommended strategic aim is to develop a cord blood inventory of 20,000 clinical grade donations, it is proposed in future to report to the Board the size of the clinical inventory only, rather than the size of the total inventory including R&D donations.

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Non-Executive Director Review

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