Report of The Global Alliance for Transplantation Workshop

29, 30 July 2013
Durban, KwaZulu-Natal
South Africa

The Southern African Transplantation Society

AN AFFILIATED SOCIETY OF The Transplantation Society

Preamble
Elmi Muller

Africa is the most underdeveloped continent when it comes to transplantation options for patients with end stage organ disease. Renal failure is by far the most common and for this reason exploring options for renal transplantation on the continent makes sense. However, starting a transplant programme is a daunting task and despite previous meetings in Africa (28-30 July 2009, Abuja, Nigeria/ 5-6 December 2008, Bamako, Mali) discussing these issues, little development and progress had been made in this regard over the last few years.

One can look back on these meetings and try and explore why progress on the continent is slow. One reason for this could be that the previous meetings mentioned, did not give enough practical tools to the clinicians who need to drive the process. Another reason could be that driving a process like transplantation requires a much larger group of people than what have been involved in these meetings.

The workshop in South Africa was planned with clinicians in mind. The idea was to give these people the tools and the contacts to be able to apply for some of the different funding opportunities that exist for current transplant programmes. (ISN Sister Renal programmes and TTS/ISN Sister Transplant Centre programmes) Furthermore the faculty members were selected for their keen interest in training and development in Africa. The hope is that this workshop will result in long-term relationships that could help with the training and development of clinicians in a few centres of excellence in Africa.

Elmi Muller

Cape Town, 2013

List of abbreviations

AFRAN	African Association of Nephrology
DBD	Donation after brain death
DCD	Donation after circulatory death
ESKD	End-stage kidney disease
ICU	Intensive Care Unit
ISN	International Society of Nephrology
GAT	Global Alliance for Transplantation
RRT	Renal Replacement Therapy
TTS	The Transplantation Society
WHO	World Health Organization

Table of Contents

1 Introduction: The role of organ transplantation in Africa

1.1 Opening remarks
Francis Delmonico

The Global Alliance for Transplantation (GAT) is a partnership between The Transplantation Society (TTS) and the World Health Organization (WHO), for the worldwide promotion of organ donation and transplantation activities consistent with the principles outlined in the Declaration of Istanbul, the World Health Assembly Resolution on Human Organ and Tissue Transplantation, and the Madrid Resolution on government accountability to achieve self-sufficiency in organ donation and transplantation[1,2] Therefore, at the GAT meeting in Durban, 2013, The Transplantation Society asks: how can the international transplantation community be of assistance to representatives of Africa in identifying needs in the pursuit of transplantation, and in obtaining the commitment of governments to be of support in attaining this goal?

Recent examples from Central and Eastern Europe and South America have demonstrated the impact of local leadership on the development of organ donation and transplantation programs, and illustrate the supportive role that TTS can play in these developments. The South East Europe Initiative on Deceased Organ Donation (Macedonia, May, 2011) and The Croatian Regional Health Development Centre in Organ Donation and Transplantation are two such examples of active and successful partnerships between clinicians, governments and TTS, which might in turn be applied in the African region.[3,4,5] TTS is committed to supporting clinicians to approach governments and to advocate for appropriate legislative frameworks and for the allocation of resources to transplantation, especially in settings where dialysis availability is rapidly outpacing the development of kidney transplantation.

1.2 WHO perspectives on transplantation in Africa
Luc Noël

Prior to this meeting, the last WHO consultation on cell, tissue and organ transplantation occurred in Abuja, Nigeria in 2009. Nearly 5 years on, especially given shifting economic and demographic trends in the region, it is time to reappraise the situation with respect to organ donation and transplantation in Africa. Total health expenditure in sub-Saharan Africa is growing by 7% per annum.[6] Economic growth and corresponding increases in health expenditures in the African region mean that we can confidently anticipate increased demand for organ transplantation within the region over the new few years. The WHO has a role to play in fostering these anticipated developments in accordance with the Guiding Principles on Human Cell, Tissue and Organ Transplantation (see Appendix, Figure 1).

The WHO is interested in every region of the globe, and every level of development, not just those countries with well-established transplantation programs. The goal of the WHO

[1] Chapman JR, Groth CG, Wood KJ. The needs for a Global Alliance for Transplantation. Clin Transpl. 2005:273-9
[2] Vajdic CM, van Leeuwen MT, Turner JJ, McDonald AM, Webster AC, McDonald SP, et al. No excess risk of follicular lymphoma in kidney transplant and HIV-related immunodeficiency. Int J Cancer. 2010;127(11):2732-5
[3] Gopcevic A, Vucic M, Lovrencic-Huzjan A, Vukovic V, Busic M, Vargek-Solter V, et al. Increased donor rate at Sestre milosrdnice University Hospital. Acta Clin Croat. 2009;48(3):319-24
[4] Spasovski G, Busic M, Pipero P, Sarajlic L, Popovic AS, Dzhaleva T, et al. Current status of transplantation and organ donation in the Balkans--could it be improved through the South-eastern Europe Health Network (SEEHN) initiative? Nephrol Dial Transplant. 2012;27(4):1319-23
[5] Zivcic-Cosic S, Busic M, Zupan Z, Pelcic G, Anusic Juricic M, Jurcic Z, et al. Development of the Croatian model of organ donation and transplantation. Croat Med J. 2013;54(1):65-70.
[6] WHO, McKinsey analysis

is to achieve a common global attitude towards transplantation, via a multitude of partnerships with key bodies, including health authorities, scientific and professional societies and experts. With respect to the development of the practice of deceased organ donation, the WHO endorses a 4-step process: (i) adoption of the Critical Pathway for organ donation from deceased persons; (ii) the drafting of a legal framework; (iii) the development of a blue print of a national system for organ donation from deceased donors; (iv) collaboration with government and the private sector for regional, sub-regional and national implementation.

Ultimately it is medical professionals who are at the crossroads between donor, patient and recipient. The practice of transplantation, and especially deceased donor organ transplantation, necessitates a level of trust in the transparency and professionalism of the health system. In addition to the responsibilities of health professionals, there is also a need for public education to generate societal support for transplantation. Finally, there is an important role for governments in terms of commitment to allocation of resources, proper oversight, and the creation of an appropriate normative and legislative environment in which transplantation can operate. Engagement with health authorities is therefore appropriate from the earliest stages of program development. Furthermore, there is no legitimate transplantation activity that cannot be examined and monitored, and therefore registries for the surveillance of practices and outcomes are critical from the outset of the practice of organ transplantation.

In the context of developing health systems it is likely to be necessary to engage the private sector in the development of transplantation services, however such arrangements mandate complete transparency and specific and effective oversight from health authorities. Universal health coverage is a current major objective of the WHO, with an emphasis on access, quality and financial protection for all, based on financing systems designed to deliver cost-effective services that do not expose the user to catastrophic costs. To achieve these goals with respect to the financing of organ transplantation, the engagement and commitment of governments will be essential.

As the practice of tissue, cell and organ transplantation spreads around the world, there is a greater need than ever for global governance in the field of transplantation, upholding societal values of the protection of the donor, safety of the recipient and self-sufficiency. The WHO recognises that there should be cross-cutting principles surrounding medical products of human origin, based on global standards and consensus, and supported by global information standards and surveillance (see Appendix, Table 7). In the proposed WHO budget for 2014-2015 there is scope for surveillance of products of human origin. Such tools will be of particular importance in the context of emerging health systems.

In conclusion, the WHO encourages a national strategy for organ donation and transplantation that: (i) promotes the integrated management of CKD from prevention to renal replacement therapies, (ii) relies on existing guidance and multi-disciplinary collaboration with a more advanced team, through long-term agreement between institutions and health authorities; (iii) is mindful of the need for transparency of activities; (iv) identifies organ donation after death as a long-term objective from the outset; (v) pioneers health system development and universal health coverage; and (vi) uses donation and transplantation as an opportunity to create dynamics in health, and as a interface between the health system and the public.

1.3 The need for kidney transplantation in Africa

Sarah White

Although we know that the availability of renal replacement therapy (RRT) is lower in Africa than in any other region of the world, the true scale of the unmet need for treatment of end-stage kidney disease (ESKD) is unknown. Ideally, population-based studies, death registration data and dialysis and transplant registries would enable quantitative estimation of

the underlying burden of ESKD and its risk factors in the population. Yet, although such data are largely unavailable, many have commented that the underlying burden of ESKD in Africa is likely to exceed that of high-income countries: firstly, because the underlying prevalence of risk factors associated with organ failure is known to be very high given increasing rates of non-communicable diseases in the region, in particular diabetes and hypertension, combined with undiminished rates of infection-related nephropathies (see Appendix, Figure 2 and Figure 3); secondly, the nature of the primary causes of ESKD and the limited capacity for secondary prevention result in more rapid progression to organ failure than experienced high income countries. Glomerular nephropathies and hypertension are the leading causes of treated ESKD in sub-Saharan Africa, accounting for between 18-50%, and 25-75% of all cases respectively.[7] Although diabetes currently only accounts for between only 3 and 24% of treated ESKD in sub-Saharan Africa (compared with 15-60% in high-income countries), this proportion may increase given projections that the number of adults in Africa with diabetes will double by 2030.[8,9]

Estimating the burden of ESKD in Africa is relevant for the reason that in order to effectively advocate for the allocation of resources to organ donation and transplantation it is necessary to demonstrate that there is a need within the population for these services. "Need" may be defined as "the population's ability to benefit from organ transplantation", and has three aspects: (i) the underlying burden of organ failure and its risk factors, irrespective of current treatment availability or eligibility criteria; (ii) the cost and efficacy of treatment (cost will constrain the number of people able to benefit from transplantation, and transplantation outcomes must be acceptable) and; (iii) comparison to the existing provision of services.[10]

The incidence of ESKD in Africa attributable to hypertension and diabetes might be estimated based on the cause-specific incidence of ESKD observed for the African American population. Based on an average adult prevalence of hypertension in the African region of 46%, and an incidence of ESKD with a primary diagnosis of hypertension in the United States African American population of 0.7 per 1000 hypertensive adults, the incidence of ESKD due to hypertension in Africa potentially equals 330 cases per million adults aged >25 years. Similarly, based on an average adult prevalence of diabetes of 9% in Africa, and an incidence of ESKD with a primary diagnosis of diabetes in the African American population of 2.1 per 1000 diabetic adults, the incidence of ESKD due to diabetes in Africa is estimated at 180 cases per million adults. HIV-related CKD is also likely to be responsible for a significant burden of ESKD in the African region – at least 400 cases per million population per year.[11,12,13] If we extrapolate rates of progression to ESKD as reported for the African American population, then, based on the high prevalence of hypertension, diabetes and HIV in the African region, the annual incidence of ESKD potentially exceeds 900 cases per million adults owing to these three risk factors alone (see Appendix, Figure 4).

For the subset of this population that might be considered medically suitable for transplantation, demand for transplantation will be tightly constrained by the availability of specialist physicians and surgeons, pathology facilities, capacity to achieve acceptable graft outcomes, cultural and religious attitudes towards organ donation, trust in the health system, and the extent to which patients are able to meet the costs of surgery and ongoing immunosuppression. Continuing demographic, epidemiological and economic shifts will have implications for the future incidence of organ failure in the African region, and for the level

[7] Bamgboye EL. End-stage renal disease in sub-Saharan Africa. Ethnicity & Disease, 2006; (16, Suppl 2):5-9
[8] Naicker S. End-stage renal disease in sub-Saharan Africa. Ethnicity & Disease, 2009; (19, Suppl 1):13-15
[9] Shaw Sicree and Zimmet. Diabetes Res and Clin Pract 2010
[10] Health Care Needs Assessment. Stevens A and Raftery J, Eds. Radcliffe Medical Press, Oxford, 1994
[11] Naicker S. End-stage renal disease in sub-Saharan and South Africa. Kidney Int Suppl. 2003(83):S119-22
[12] Naicker S, Aboud O, Gharbi MB. Epidemiology of acute kidney injury in Africa. Semin Nephrol. 2008;28(4):348-53.
[13] Naicker S. End-stage renal disease in sub-Saharan Africa. Ethn Dis. 2009;19(1 Suppl 1):S1-13-5.

of demand for high-level health care including transplantation; that is, the capacity of populations in Africa to benefit from transplantation will evolve in coming years. It is therefore timely to evaluate existing capacities to deliver organ transplantation services in the African region, and to identify how local efforts, regional cooperation, and international partnerships can best address current constraints on the delivery of transplantation therapy.

2 Reports from participant countries

2.1 Introduction

Elmi Muller

African countries were selected on the basis that they were English speaking countries that could benefit most from participating in an International Society of Nephrology (ISN)/TTS sister programme. Clinicians who have been involved in previous ISN training were flagged as they already have experience in the field of dialysis and ESKD. In addition, the surgeons who would potentially be performing these transplants were selected to attend. After several discussions at the 12th Congress of the African Association of Nephrology in Accra, Ghana between 20 and 23 February 2013, a list of 31 physicians from 11 countries in Africa was compiled. This was mostly done by Dr Elmi Muller (South Africa/TTS), Prof Dwomoa Adu (Ghana), Dr Luc Noel (WHO) and Prof Saraladevi Naicker (South Africa/ISN).

Initial correspondence with the African delegates was as follows:

A two-day TTS meeting discussing the way forward for transplantation in developing countries (focusing on Africa) is planned to coincide with the World Transplant Games in Durban (South Africa) from 28 July to 4 August, 2013. The aim of this meeting is to discuss transplantation practices in the developing world and to increase organ donation and transplantation in these countries, facilitating better practices around transplantation, including improved use of databases and greater diligence and surveillance. About 30 clinicians will represent the different developing countries in Africa: Ethiopia, Ghana, Kenya, Nigeria, Rwanda, Senegal, Sudan, Tunisia and Zambia, to name a few. Each centre will be partnered with a transplantation centre with well-established transplantation practices. The idea would be to have a mentoring scheme between well-established centres and those that are still in their infancy. The aim is to have this mentoring process to be ongoing between the centres.

One delegate from each country was asked to present according to a template that has been used in previous workshops (26-28 May 2011, Skopje, Macedonia), with slight modification to make this more relevant in Africa (see Appendix). Each presenter had 15 minutes to present on the current status of dialysis and transplantation in their respective countries.

Country	**Presenter**
Cameroon	Gloria Ashuntantang, Fru Angwafo III
Ethiopia	Yewondwossen Tadesse Mengistu
Ghana	Bernard Morton, Charlotte Osafo, Dwomoa Adu
Kenya	M.O.G. Owiti
Malawi	Gavin Dreyer
Nigeria	Ebun Bamgboye
Rwanda	Joseph Ntarindwa
Sudan	Manal Omer, Wafaa Obeid
Tunisia	Taieb Ben Abdallah
Zambia	Aggrey Mweemba

2.2 Country delegate presentations

Table 1: Transplantation and dialysis activities in delegate countries in 2012

		Cameroon	Ethiopia	Ghana	Kenya	Malawi	Nigeria	Rwanda	Sudan	Tunisia	Zambia
Population (millions)		20.5	86.5	24.0	42.0	15.5	160	11.0	31	10.8	13
Transplantation and dialysis activity											
Patients on haemodialysis, 31 Dec 2012 (N)	Public	495	0[a]	300	450	17	1000	55	5967	2575	30
	Private	2	150	0	350	18	500	0	-	6137	10
Patients on peritoneal dialysis, 31 Dec 2012 (N)	Public	0	0	0	1	2	0	9	100	250	10
	Private	0	0	0	2	0	2	0	0	0	0
Living donor kidney transplants performed in 2012 (N)	Public	0	0	3	33	0	6	0	134	122	0
	Private	0	0	0	27	0	8	0	31	0	0
Deceased donor kidney transplants performed in 2012 (N)	Public	0	0	0	0	0	0	0	0	2	0
	Private	0	0	0	0	0	0	0	0	0	0
Centres providing dialysis (N)	Public	-	2	-	-	2	42	-	-	-	4
	Private	-	7	-	-	2	34	-	-	-	4
Centres providing transplantation from living donors (N)	Public	0	0	1	1	0	6	1	5	6	0
	Private	0	0	0	4	0	2	0	1	0	0
Centres providing transplantation from deceased donors (N)	Public	0	0	0	0	0	0	0	0	6	0
	Private	0	0	0	0	0	0	0	0	0	0
No. of kidney transplants performed outside your country in 2012 (total alive and receiving followed up care)		2(6)	25	3(12)	10	6[d]	150(60)	11(38)	90	2	9(17)
Are centres that are providing transplantation officially authorized?		NA	Y/N[b]	Yes	Yes	NA	Yes	Yes	Yes	Yes	NA
Patients on the waiting list, 31 Dec 2010 (N)	Kidney	-	-	15	39	-	1500	36	156	1153	0
	Liver	-	-	0	0	-	-	0	0	-	0
	Heart	-	-	0	0	-	-	0	0	-	0
Patients that travelled abroad for transplantation in 2012 (N)	Kidney	3	25	3	10	-	150	11	90	2	9
	Liver	0	1	0	0	-	-	0	-	1	0
	Heart	0	-	0	0	-	-	0	-	-	0
Potential donor hospitals											
Hospitals with an ICU (N, approximate)		4	8	4	12	5	40	3	-[e]	18	5
Total ICU beds (N, approximate)		50	40	20	100	20	160	16	-[e]	190	30
Total ICU physicians (N, approximate)		10	0[c]	20	-	5	80	4	-[e]	80	10
Total ICU nurses (N, approximate)		-	-	50	-	25	300	22	-[e]	230	<5

[a] no chronic haemodialysis, dialysis for acute kidney injury only.
[b] Government dialysis centres are officially authorised, private centres are not.
[c] Anesthesiologists and internists run ICUs.
[d] follow-up care being received outside of Malawi
[e] This information is currently not available, but will be included in the Sudanese National Centre for Kidney Diseases and Surgeries 2014 survey of related infrastructure.

Table 2: Health systems and legislative/regulatory setting

	Cameroon	Ethiopia	Ghana	Kenya	Malawi	Nigeria	Rwanda	Sudan	Tunisia	Zambia
Do facilities exist for:										
Potential deceased donor identification	No	No	No	Yes	No	No	No	No	Yes	Limited
Donor management	No	No	No	Yes	No	No	No	Yes	Yes	No
Procurement	No	No	No	Yes	Yes	No	No	No	Yes	No
Compatibility testing	Yes	No	No	Yes	No	Yes	No	Yes	Yes	No
Storage and transportation	No	No	No	Potential	No	No	No	No	Yes	No
Allocation, selection of recipients	No	No	No	No	No	No	No	Yes	Yes	Yes[e]
Screening of transmissible diseases	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Limited
Is there a centralized budget dedicated to dialysis?	Yes	No	No	No	Yes	No	No	Yes	Yes	Yes
How are patient costs covered with respect to[a]:										
Deceased donation	NA	OOP	OOP	OOP	NA	OOP[c]	NA	No	Govt[d]	NA
Transplantation	Govt	OOP	OOP	OOP	Govt[b]	OOP[c]	Govt	Govt/PI	Govt[d]	Govt
Post-transplant care	PI	OOP	OOP	OOP	Govt[b]	OOP[c]	PI	Govt/PI	Govt[d]	Govt
Living donation	Govt	OOP	OOP	OOP	Govt[b]	OOP[c]	Govt	Govt/PI	Govt[d]	OOP
Living donor follow-up	OOP	OOP	OOP	OOP	Govt[b]	OOP[c]	PI	No	Govt[d]	Govt
Is transplantation included in the agenda of the government?	Yes	Yes	No	Pending	Potential	Yes	No	No	Yes	Potential
Is organ donation and transplantation a priority in the further development of the health system?	Yes	No	Yes	Pending	Potential	No	Yes	Yes	Yes	Yes
Does any legislation exist pertaining to donation/transplantation?	No	Draft	Draft	Yes	-	Yes	Yes	Yes	Yes	No
Does legislation exist pertaining to the declaration of death?	-	-	No	-	-	-	Yes	Yes	Yes	-
Acceptable for death be certified on the basis of:										
Irreversible cessation of brain/brain stem functions	Yes	-	No	Yes	-	Yes	Yes	No	Yes	Yes
Irreversible cessation of cardio-respiratory functions	Yes	-	Yes	-	-	Yes	No	Yes	No	Yes
Do laws or legal regulations exist concerning:										
Prohibition of giving or receiving payment for organs	-	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes	Yes
If yes, are there penalties for commerce with donated organs?	-	Yes	Yes	-	-	No	Yes	Yes	Yes	-
Prohibition of organ trafficking	Yes	Yes	Pending	Yes	-	No	Yes	Yes	Yes	No
Confidentiality (data protection)	Yes	No	Yes	Yes	-	Yes	No	Yes	Yes	Yes
Import/export of organs	Yes	-	No	No	-	No	No	Yes	Yes	Yes
Agreements to allow patients to be transplanted abroad	No	No	No	No	Ad Hoc	No	Yes	No	No	No
Agreements to allow foreigners to be transplanted in your country	No	No	No	No	No	No	No	No	Yes	No
Cooperative agreements to exchange organs with other countries	No	No	No	No	-	No	No	No	No	No
Are Doctors familiar with the Declaration of Istanbul?	Yes	No	Yes	Some	No	Yes	Some	Yes	Yes	Some

[a] Govt=Government , PI=Private insurance, OOOP=out-of-pocket

Although transplantation is not currently available in Malawi, the government has committed to meeting costs associated with transplantation if it were offered in the future.

[c] In Nigeria, some private companies cover the cost of dialysis and renal transplantation for their staff and dependents. Private health insurance /HMO's also occasionally cover dialysis and/or transplantation. Some state governments (e.g. Lagos, Katsina, Bauchi and Borno) subsidise the cost of dialysis and cover the transplantation costs for some indigenes.

[d] In Tunisia, all ESKD patients have access to treatment; costs of care covered by the government (20%) and the National Insurance Fund (80%) – equal costs in the private and public sector

[e] Facilities currently exist only for recipient selection and the allocation of organs from living donors, no facilities for deceased donor allocation.

2.3 Comments

2.3.1 Overview of transplantation activities in Africa

Of the ten countries represented at the meeting, 5 participant countries were locally performing living related donor transplantation in 2012 (Ghana, Kenya, Nigeria, Sudan and Tunisia). Programs vary between quite well established programs with a relatively large number of transplants (Tunisia, Sudan) to very small programs with a small number of transplants in each centre (Kenya, Ghana, Nigeria). Tunisia currently has the highest rate of organ transplantation relative to its population (122 living-related donor kidney transplants in 2012), followed by Sudan (165 living-related donor kidney transplants in 2012). An issue for Kenya and Nigeria is that there are many centres simultaneously trying to establish transplantation, with each centre performing a limited number of transplants. In Nigeria there are 6 state and 2 private centres, which have performed a total of 14 transplants in the last year; in Kenya there are 4 private and 1 state centres, which have performed a total of 60 transplants in the last year. This creates a problem of dispersal of expertise and facilities. None of the participant countries has yet commenced deceased donor transplantation. Transplant tourism and official arrangements in which governments send donor-recipient pairs abroad to undergo transplantation were relatively common. Destination countries for patients travelling abroad to receive transplants included Tunisia (2 patients from Cameroon), Pakistan (2 patients from Tunisia), and India (patients from Nigeria, Rwanda, Kenya, Zambia, and plans to send patients from Malawi).

The majority of dialysis among participant countries is conducted in state-run facilities, with the exception of Ethiopia and Tunisia. In Tunisia all transplantation activities are in state run facilities, but the majority of dialysis takes place in private facilities. Of the 5 participant countries performing transplantation in 2012, private facilities contributed to this activity in 3 (Kenya, Nigeria and Sudan), indicating a potentially significant role for public-private partnerships in the future development of transplantation in these countries. Cameroon, Malawi, Sudan, Tunisia and Zambia have a central budget dedicated to dialysis; similarly, the costs of transplantation and post-transplant care are met by government or by private insurance in Cameroon, Malawi, Rwanda, Sudan, Tunisia and Zambia. Elsewhere, patient costs are met by out-of-pocket payments. Organ donation and transplantation was said to be a priority in the further development of the health system in 6 out of 10 participant countries. Legislation pertaining to organ donation and transplantation was in existence in 5 out of 10 participant countries, and was in draft form in a further 2. Familiarity of doctors with the Declaration of Istanbul was reported to be variable.

Examples of existing successful outreach programs operating in Africa include the Transplant Links Community, a UK-based charity founded to foster transplantation around the world through linkage with Queen Elizabeth Hospital in Birmingham. Following 5 years of planning, transplantation in Ghana was commenced in 2008 at Korle Bu Hospital in collaboration with Transplant Links Community. Since 2008, 12 living related donor transplants have been performed. Tissue typing is performed at Hammersmith Hospital in London. The importance of regional cooperation for transplantation was highlighted during discussions (i.e. Africa training Africa). For example, in Tunisia 122 living related transplants were performed over the last 12 months – all of these were done in 6 centres in the state sector. This programme certainly has the capacity to train other African clinicians in the future. A similar situation exists in Sudan where 134 living donor transplants were performed in the state sector and 31 in the private sector over the last 12 months. Current examples of regional cooperation for training include government sponsorship of nephrology trainees from Rwanda to travel to South Africa for specialist training. Cape Town has trained 20 nephrologists to date: Dr Mweemba, the first nephrologist in the public systems in Zambia, was trained in South Africa and dialysis commenced in Zambia upon his return in 2009.

Training for Zambian surgeons in South Africa is also planned. South Africa might also in future provide assistance and training for organ procurement with support from TTS. In addition, it was reported that The African Development Bank are establishing an Institute of Nephrology and Urology, intended to train nephrologists and urologists in East Africa A preference was also expressed to send donor-recipient pairs to countries within Africa for transplantation, rather than to India. Currently Tunisia has cooperative agreements with Senegal and Cote d'Ivoire to transplant patients from these countries, and there were discussions of the feasibility of sending more donor-recipient pairs to South Africa for transplantation. The relative costs of immunosuppression in Africa versus India will need to be addressed before current practice shifts.

Paediatric transplantation is relatively rare in the region. Tunisia initiated paediatric transplantation early in the development of its living donor transplant program, constituting a good model for other countries in recognising the importance of paediatric transplantation in the development of a transplantation program.

2.3.2 Involvement of governments

In several countries, health ministries or individual government officials have independently expressed interest in pursuing organ transplantation. In Ethiopia, for example, transplantation is on the government agenda as a result of expressed interest from government ministers in transplantation taking root locally, with the training of local professionals a first priority. In Malawi, the vice president was the first person to receive dialysis in the country and has subsequently become a vocal advocate for transplantation. Kidney transplantation is considered an aspiration of the government of Malawi. Currently the Malawi Ministry of Health has committed to the upgrading of dialysis machines (10 dialysis machines have been donated by Japan, and Fresenius is sending more machines), and is actively involved in programs for screening and prevention of ESKD in partnership with ISN. The government has also committed to publicly fund transplantation in the future. In the interim, the Malawi government is seeking to send patients to India at a cost of 30,000 USD per living donor transplant, with patients returning to Malawi with a personal supply of immunosuppression.

In Cameroon, the Head of State decided in 2007 to decentralize dialysis services and open dialysis centres in every region of the country. Under this plan, 7 centres were created between 2007 and 2012, and the number of public centres will increase to 11 by the end of 2014. Haemodialysis is subsidised; patients pay 10 USD per session. With the rapid expansion of dialysis in Cameroon, the government is now eager to move ahead with transplantation, beginning with a legislative framework. Currently the government of Cameroon pays for patients to undergo transplantation abroad, providing financial aid of 20,000-36,000 USD unless that patient has private insurance. Many patients relocate to France for transplantation. The experience of Cameroon suggests that where government has undertaken to fund dialysis, there may be greater incentive to pursue kidney transplantation if transplantation can be demonstrated to be cost saving.

There is also strong political will to support patients with ESKD in Zambia; there is currently a separate budget allocation for dialysis, new dialysis units are being opened, and the government is developing a health insurance scheme that would cover the costs of dialysis and potentially transplantation. There is also strong political will to enact legislation with respect to organ donation and transplantation. In addition, all 10 regional hospitals will have ICUs by end of 2014, and the University Teaching Hospital has started training 2-4 ICU physicians and 10-15 ICU nurses per year since 2012. The government has requested a roadmap for the provision of cost-effective, sustainable RRT in Zambia and is willing to publicly fund treatment, contingent on costing. Pubic health insurance is currently in the pipeline, which will have implications for the funding of future transplantation programs.

Elsewhere, medical professionals are in the position of lobbying governments in order to advance the transplantation agenda. For example, by the efforts of medical professionals in

Ghana, draft transplantation legislation is currently with the attorney general's office waiting to go before parliament. In addition, in the absence of regulatory oversight and coordinating authorities, the University Hospital has established an independent ethics team. Medical professionals are also leading negotiations on a cost-sharing scheme between governments, private funding sources, and patients to address the fact that transplant recipients in Ghana must currently meet all costs met out-of-pocket. In Nigeria, the Nigerian Nephrology Association has been in recent discussions with government to seek coverage of dialysis under the national health scheme, although currently the agreement is to cover only 6 sessions of dialysis. A National Transplant Act has also been drafted, but not yet signed into legislation.

2.3.3 Requirements for living versus deceased donor transplantation

A topic of debate during the meeting was the relative resource requirements associated with living versus deceased donor transplantation, and at what stage it is appropriate to contemplate deceased donor organ transplantation. Questions included: what is a sufficient level of dialysis availability? Should deceased donor transplantation be contemplated in parallel with the development of living donor transplantation? To what extent is it necessary to consolidate experience with living donor transplantation prior to commencing deceased donor transplantation? What are the minimum requirements in terms of ICU beds and trained personnel?

The experience of Tunisia illustrates the scale of the transition from provision of living donor transplantation to provision deceased donor transplantation. Despite a well-developed living donor transplantation program in Tunisia, established in 1986, deceased donor transplantation is not yet available. Barriers to the initiation of deceased donor transplantation in Tunisia were identified as an absence of legislation on brain death, and the lack of infrastructure, personnel and capacity for coordination required to support deceased donation. Whereas living donor transplantation might be successfully driven by a motivated individual and a single institution, deceased donor transplantation requires dialysis programs, tissue typing and cross-matching facilities, an organ procurement program, an on-call surgical team, capacity to fund this infrastructure and an appropriate legislative framework (see Appendix, Figure 5). Moreover, a significant level of regional/national organization is required: the historical experience of the United States was that deceased donation gained momentum only when it was separated from the hospital and placed under an independent coordinating authority. There is also the need to contend with the public perception of deceased donation - it will be easier to commence deceased donation in the context of an established a living donor program with acceptable and consistent recipient outcomes. Therefore in advocating for deceased donor transplantation, the requirements in terms of resources, infrastructure, track-record, and capacity for coordination needs to be realistically acknowledged.

2.3.4 The high costs of dialysis, transplantation and ongoing immunosuppression

An issue that was identified as a significant and recurring barrier to transplantation in the African region was the high cost of transplantation and follow-up care, and in particular the cost of maintenance immunosuppression. In Africa the costs of both dialysis and transplantation are often higher, as a proportion of personal incomes or of per capita health expenditure, than they are in high-income countries. Firstly, this has implications for dialysis modality utilisation: PD is typically more expensive and less profitable than HD in Africa given the high cost of consumables, and is therefore rare especially where dialysis provision is driven by the private sector (e.g. Ethiopia). Secondly, the high cost of immunosuppression erodes the large cost-benefits associated with transplantation versus dialysis that are typically observed in high-income countries. In Tunisia for example, where dialysis and transplantation are both publicly funded for all patients, kidney transplantation costs 16,000 USD in the first year and 10,000 USD per year in subsequent years, compared to a maintenance dialysis cost of 12,000 USD per year. Thirdly, the high cost associated with ongoing immunosuppression

will result in catastrophic costs to patients where the costs of transplantation are being met out-of-pocket.

Even for countries that are not yet performing transplantation within their own borders, the cost of immunosuppresion was identified as an issue. For example, in Cameroon the government pays for patients to travel abroad to receive transplantation, but when patients return they must contend with the very high cost of immunosuppression, and therefore the government is currently in negotiations to obtain a supply of lower cost generics from India. In response to this issue, it was proposed that international professional bodies might join with African governments and medical professionals to lobby for access to cheaper immunosuppression.

2.3.5 Spatial distribution of dialysis and transplant centres, and issues of access

Unsurprisingly, the majority of dialysis centres, and transplant centres where these exist, tend to be located in major urban centres or capital cities, with implications for access to treatment. Attempts have been made to address this issue in Nigeria, where the size and diversity of the country mean that patients cannot be expected to travel long distances to receive treatment. Although 20 of 76 of dialysis centres are located in Lagos, centres have also been established across a range of geographic areas. There was a plan to fund greater distribution of dialysis centres around the country, however this did not go ahead. A total of 8 centres located in various regions are currently performing living donor kidney transplantation in Nigeria, however individual centre volumes are low. The dispersion of transplantation activities in Nigeria highlights potential trade offs between access and volume for emerging transplant programs (Nigeria commenced transplantation in 2000). On one hand, 8 transplant centres across a wide geographic area reduces disparities in access to transplantation; on the other hand, the small volumes at each of these centres makes it more difficult to build upon experience.

2.3.6 Summary

Some important factors are noted in common among transplantation programmes that are succeeding in Africa. Firstly, most of these programmes experience some positive government involvement. This positive environment results in funding, support, and a willingness from the Ministry of Health to work on a legislative framework. Secondly, these places have champions or individuals driving dialysis and transplantation - a clinician who can see the need for these programs and who is willing to make the effort. This is often much better than a Minister of Health or other official who decides transplantation should be available in a given country.

Issues around training and expertise remain an important concern in Africa. The wide dispersion of expertise by allowing many centres in one country to develop simultaneously might be a problem (for instance in Nigeria and Kenya). Another important issue is how to address the brain drain from Africa. Many physicians and scientists who leave Africa to pursue some training elsewhere never return to their home countries.

Funding for dialysis versus transplantation needs further debate and exploration. Questions raised were for instance: Do you need a dialysis programme to start a transplant programme? How do you evolve a successful dialysis programme into a successful transplantation programme and how do you distribute the funding for these different programmes? Lessons can be learned from the successful dialysis programmes in Africa, and how these have been established. Examples of public private partnerships exists in many places, for instance between Fresenius Healthcare and the South African Government in Polokwane.

For African countries that plan to start living related donation or have already commenced living donation, the transition to a deceased donation programme remains a problem. Deceased donation needs a different set of infrastructure than living donation, for

example a tissue-typing laboratory with trained staff and after hours services as well as an appropriate legislative and regulatory environment. Deceased donation can only develop on the basis of a well-established dialysis programme and requires a significant waiting list of patients to function. Furthermore, many African countries will need a change in public perception around deceased donation for this to succeed. Examples of how to address these problematic multicultural aspects and societal issues might be found in South Africa, the only country performing deceased donation on the continent.

Some clinical and policy issues need further exploration in the future, in particular:

- Does it make sense to have more stringent criteria for living donors in Africa as donor follow up and access to specialists are a problem?
- How can African countries address the need for cost effective immunosuppression?
- Is it possible to lobby for cheaper but effective immunosuppression in Africa?

In the future the agenda should include the establishment of a Pan-African database for transplantation. This would become a major resource should Africa decide to undertake collective negotiation for cheaper immunosuppression. It will also be important to develop centres of excellence on the continent to improve local training and to serve as a magnet for international support. A starting point would be to coordinate all outreach efforts under one umbrella, or to at least document and follow-up all these efforts in order to plan comprehensive programmes for these centres.

3 Minimum requirements to perform transplantation

3.1 Nephrology

Sarala Naicker

From a nephrological perspective, the major problem in Africa is the limited number dialysis slots and the high cost to sustain chronic dialysis programmes. In many countries dialysis is not funded by the state sector and the fact that patients pay for dialysis result in inadequate dialysis for these patients. In many ways transplantation will provide a good quality of life and better clinical outcome for the same or less money. Therefore African countries will be much better off to push transplantation programmes rather than dialysis programmes. However, from a nephrology point of view these countries who start transplantation programmes should have the ability to dialyse these transplant candidates pre- and immediately post-operatively as a minimum requirement.

However, if you do want to have a transplant programme you will probably also need to have other minimal requirements available which are not always available. These services include pathology, radiology and surgery.

From a nephrology point of view one big worry is the cost and sustainability of immunosuppression for these transplanted patients. Of course it will not be a good idea to perform a transplant if the regular and affordable availability of immunosuppression is a problem. For a patient to import immunosuppression for him or herself is not a viable option in the long run and doctors will have to have a system where these drugs are freely available at a reasonable price to the patient before transplantation programmes can be started.

In terms of donation practices there will have to be a lot of work done on public attitude towards especially deceased donation. Living donation seems to be a viable and easier option in many countries where there are cultural barriers towards transplantation. However, one advantage of starting fresh programmes in Africa is that there are probably an opportunity to make people aware right from the start about things like the Declaration of Istanbul and good ethical practices around organ donation.

3.2 Tissue typing and laboratory requirements
Medhat Askar

The laboratory requirements for living donor transplantation are significantly different from the requirements for deceased donor transplantation. In terms of minimal laboratory requirements, the question is whether people are suitable for transplantation if they are ABO matched and have negative donor specific HLA antibodies, or whether they should be HLA matched as well. In living donation, ABO typing and matching are essential. In terms of HLA typing, a combination of crossmatch and solid phase assays are available and probably ideal. A factor that will affect outcomes is the presence of donor specific HLA antibodies - well-matched donors and recipients certainly have better outcomes than completely mismatched patients. In the case of deceased donation these tests needs to be provided on an on-call basis. Typing of all donors for A, B, Bw, C, DR and DQ by molecular method, and the availability of solid phase assays would be ideal in this setting. Furthermore, a strategy should be available to streamline organ allocation and prevent prolonged ischaemic time: something like a calculated PRA combined with unacceptable antigens. This would mean a virtual crossmatch, where the presence of donor specific antibodies would predict a positive crossmatch.

During the discussion it was recognised that tissue-typing laboratories are still not established in Africa and good pathology training programmes do not currently exist. However, for African countries performing living related donation only, it should be an option to establish one or two central high-throughput laboratories on the continent based on regional collaboration, where local expertise gets pooled and shared. This would be a viable option for countries with small transplant numbers as well. Tissues typing could be tailored to the local setting, but it should also be possible to build up expertise and to gradually build up more extensive tissue typing facilities. At the moment desensitisation protocols are unlikely to happen in Africa, so basic tissue typing might be done locally with outsourcing of some of the more complicated tests to other centres. However, because of frequent transfusion, a lot of people might be sensitised and it is for this reason that expertise in desensitization protocols does need to be developed in tissue typing laboratories in Africa. Solid phase assays also need to be tested in the heterogonous African population and more experience needs to be developed in this regard. Our goal here might not be optimal results but rather cost effective and reasonably safe transplantation practices.

3.3 Infectious disease control
Camille Kotton

Infectious disease forms an important part of transplantation and the scope of infectious issues in solid organ transplant is very large. One can think of infectious issues both in terms of screening and vaccination prior to transplantation, and prevention of disease post transplantation. Infections are the most common post transplant complication in the developing world. The rate of graft loss and hospitalization due to infective complications in a country like Pakistan is extremely high. Not only do we need to think about bacterial infections but also about reactivation of diseases like tuberculosis. There is also the issue of donor-derived infections like chagas, strongyloides, schistosoma, malaria and babesia. These will be important in African settings. Standard screening in the USA include the facilities to test for: HIV, Hepatitis B and C, CMV, Syphilis, Varicella, EBV, Measles, mumps and rubella, toxoplasmosis and tuberculosis in all recipients. Donors should probably complete similar screening. It might be argued that you could get away with only screening for HIV, Hepatitis B and C and CMV in Africa. However in highly endemic areas it might be also necessary to screen for tuberculosis. In terms of vaccination a hepatitis B, Pneumovax, Tetanus and Yellow fever vaccination would be strongly recommended pre-operatively.

Post-operative prophylactic therapy should probably include antivirals, TMP/SMX, antifungals, as well as tuberculosis, strongyloides and malaria prophylaxis.

In the discussion of this session it was mentioned that some emerging and reemerging diseases in Africa are not controllable or treatable in the immunosuppressed patient, and that higher rates of parasitic disease might occur in these patients than elsewhere. Tuberculosis is also highly prevalent in Africa, therefore tuberculosis chemoprophylaxis and screening will be important. Optimal duration of prophylactic therapy varies widely and should be tailored made to each individual region. CMV is one of the most common post-transplant infections, and although there is high seropositivity in Africa, it is still important to manage CMV, as the impact post-transplant is severe. Comorbidities also increase risk of infection and these might be more prevalent in Africa (e.g. uncontrolled diabetes).

Infection control will be essential to good transplant outcomes and prevention of the spread of resistant infections. One solution with demonstrated efficacy might be more alcohol based hand sanitizer.

3.4 Surgical requirements
Peter Stock

To perform organ transplantation there are certain basic surgical requirements which are probably equivalent to those for general surgery or orthopaedic surgery. At a bare minimum, a self-retaining retractor is probably essential, but aside from this self-retaining retractor to facilitate the extraperitoneal approach, a routine kidney transplant could be done with a general laparotomy set. Laparoscopic donor nephrectomy has been recommended as a strategy to minimize the overall health and financial cost to the living donor – decreased morbidity, length of hospitalization and faster return to work. However, the cost of staples used in a standard technique is prohibitively expensive, and therefore open donor nephrectomy is probably a better option in Africa.

An anaesthesiologist – dedicated to transplantation – is essential as this person needs to be familiar with transplant "friendly" muscle relaxants, vasoactive drugs, anaesthetic agents. Essential monitoring equipment, airway equipment, intravenous and monitoring catheters (more rigorous for pediatric transplant) should be available at all centres. It is also preferable to have an ultrasound available to look for collections and hydronephrosis and possibly do dopplers to look at inflow of the kidney after transplantation.

In general: the surgical aspects of kidney transplantation are hugely important – but not the rate-limiting step. Multiple programs in resource-limited countries have demonstrated excellent initial results: it is long-term follow-up (and necessary resources) that is a significant problem. Successful programs have started with living donors and only after establishment of a successful program have they slowly transitioned to deceased donation. Most have started with surgeons trained at large transplant centre with continued support from a "sister" institution.

3.5 Is there a role for donation after cardiac death in Africa?
Marti Manyalich

A good option for African countries that want to start deceased donor transplant programs is donation after circulatory death (DCD) transplantation. DCD graft survival in Spain is 80% at 10 years. One definition of death may be either irreversible cessation of brain function, but the most common way in which death is determined is the irreversible circulatory function. Since this is the most well established definition of death, it is more likely to be acceptable and requires less of a cultural/normative/legislative shift. The concept of circulatory death is more easily accepted than brain death, and DCD has fewer resources requirements compared

with donation after brain death (DBD). Family consent tends to be higher for DCD since brain dead donors still have a beating heart, which is harder for the family to understand. In high income countries, DCD is complementary to DBD, as there are plenty of ICU beds – in Africa this might be the opposite given the lower resources requirements.

In the discussion the current experience in South Africa and the UK with DCD was highlighted. In Cape Town there is no machine perfusion and only type III donors are used. If consent from a potential DCD family member is obtained, ventilation is stopped after the team has prepared the theatre. The warm ischaemic time is about 20 minutes. A potential advantage for DCD in the African region is that consent might be easier to obtain as it is more acceptable to give consent to remove organs form a body that looks dead (like in the case of DCD) rather than a body where circulation is still intact. In countries where there is a racial split in willingness to donate after BD, perhaps DCD would be more acceptable across the community. Cultural belief that the donor will be angry if they donate their organs or fear of alienating the ancestor might influence the family's decision to donate their organs. There is a generational divide in these beliefs, so it might be a sensible response form the transplant community to respond to this complicated situation in Africa by developing all three types of donation (DBD, uncontrolled DCD, controlled DCD). In the UK, controlled DCD has been successful in increasing the number of donors. In addition, an uncontrolled DCD program has been established in the UK for which the biggest challenge is managing the family.

4 Partnerships and training options for African clinicians

4.1 Existing transplantation outreach programs in Africa

Paul Morrisey, Paul Harden, Andrew Ready, Jeff Punch

Several partnerships currently exist in Africa - individual institutions or clinicians drive some of these partnerships. An outstanding need is to document and monitor these partnerships to ensure actual needs are being met where limited training has been provided. The ISN has 5 core programs of global outreach – fellows, CMEs, educational ambassadors (e.g. sending a physician to teach vascular access), sister centres, R&P to develop local clinical services. TTS has now partnered with ISN to support at partly fund transplant centre sister programmes.

Examples of existing individual partnership programmes in the African region:

- Brown has an affiliation with Moi Teaching and Referral Hospital in Kenya that has been running for 4 years.
- Transplant Links (Birmingham) had been working in Trinidad, in November will start a program in Jamaica. Has given advice in Kenya, talking with a unit in Zambia. More established links with Ghana and Nigeria.
- University of Michigan has been working with St. Pauls Millennium Medical College in Ethiopia.

One example of a successful model of a partnership programme is the Oxford-Belarus programme. This programme started with joint living donor transplants, then an agreement was signed with the government to continue doing joint transplants with a government commitment to fund these procedures in the future. ICU staff were then brought together for a meeting on brain death and donor identification; subsequently the government committed to appointing local transplant coordinators. Publicity was also part of the partnership - getting transplantation on to national television with positive stories. From 8 transplants performed in Belarus in 2005, there were 201 transplants performed in 2011, nearly all from deceased donors. Since the initial partnership for paediatric transplantation and first paediatric transplants in 2009, there have been 60 transplants. The average waiting time for a paediatric transplant in Belarus is now 6 months (down from 17 years) Another positive outcome is that the transplants surgeons who trained in Belarus are now training surgeons in Krygystan and in Khazakstan – this domino effect within the region is a lessons for Africa.

The Transplant Links programme has been working in Trinidad, and in November they will start a program in Jamaica. They have also given advice in Kenya and are currently talking with a unit in Zambia, and have established links with Ghana and Nigeria. The Transplant Links model is one where financial support for skills transfer will be provided, but part of the model is that the costs of transplantation need to be met through local economic means. The idea is that the long-term sustainability of transplantation relies on a local model of financing emerging.

Challenges noted from existing partnerships with individual centres in Africa include limited availability of necessary surgical instruments for visiting surgeons (e.g. microvascular instruments), poor long-term transplant outcomes due inability to meet the costs of maintenance immunosuppresion, lack of monitoring and surveillance of transplant outcomes ("you can't improve what you don't measure"), the absence of a surgical champion of transplantation, histological capacity. Another issue may be difficulty in establishing tertiary care in settings where travelling to another country to receive high-level medical care is standard practice. On the ground "fact finding" is an important first step in establishing a sister link, to determine whether linkage is likely to be successful, what the major challenges are likely to be, what resources are required as a priority, and what the needs of the population are (e.g. how many patients are on dialysis). It is also important for the success of sister programs that partnership teams become close and establish camaraderie.

During the discussion time the following additional comments were made:

- How can Africa help Africa? Africa understands the problems that Africa has to deal with (e.g. antibiotics running out, dealing with politicians, infrastructure issues). international outreach should act as a complementary, offering depth of surgical experience.
- One of the strengths of training in South Africa is that hands-on training is offered. There was a strong feeling among participants that initial hands-on training is necessary – i.e. to learn the practicalities first before learning the higher level techniques.
- In Mauritius in the 1980's and 1990's there was an established dialysis program, with patients travelling to France and South Africa for transplants. A group from Cape Town went to Mauritius to train local surgeons. They did the first 3, assisted on the next few, and then the local team did the last few on their own. Now Mauritian transplant surgeons are self-reliant.
- It is very important that projects need to be undertaken as long term projects, focused on putting transplantation on the agenda and keeping it there, engaging with politicians, with the view to begin engaged for the long haul, allowing the natural pace of programme development.
- There is a need to engage ministries, not only clinicians: but to do this successfully you need to have a local champion first: a constituent within the country who is the link to government, and sustains government support after the partnership team has left.

4.2 Training options for African clinicians

Abraham Shaked, Jose-Medina Pestana, John Forsythe, Saeed Al-Ghamdi, Sarala Naicker, Jeremy Chapman

Starting a transplant programme in Africa is not just having a local champion – it is having a local champion who is very skilled in transplantation and has been trained very well in a highly experienced centre, not just someone who wants to collaborate with teams from overseas. Training for transplantation is available in many places throughout the world. Different requirements/programs are in place in different countries with respect to observational versus hands-on training. For example, in United States:

	Very Short visit	Short term	One year stay	Formal

		visit		training
Duration	1 month	3 months	1 year	2 years
Type of training	Enhanced clinical experience	Clinical observation	Clinical research fellowship	Clinical fellowship

For potential trainees considering overseas training, the numbers of transplants performed in a given centre is another important consideration in terms of the depth of experience they are likely to receive. In Brazil, surgeons can train in organ procurements, and trainees would deal with 2 potential donors and see about 200-300 patients in the outpatient clinic per day. There is also a busy tissue-typing lab. Surgeons in Brazil don't to laparoscopic donor nephrectomies, but they do short open incision. It is less expensive and patients still leave hospital in two days. South Africa has a similar experience.

Medical training in the UK is divided into the Foundation years; core training, specialist training and post specialist training fellowships. Post specialist training fellowships are best opportunity for African doctors coming to the UK. In Australia there are 6-7 larger transplant programs with almost no vacancies for training posts. Hands on training will be difficult for unregistered foreign doctors - barriers to registration are significant, although observation is possible. Australia's main responsibility is in education and research, and potentially in providing support for aspects other than surgery - e.g. support to establish organ donation and transplantation registries, and other infrastructure building.

In the future, a useful resource would be to list these international opportunities on a central website (for instance TTS/ISN) and make sure people know about opportunities to obtain training in the USA. For example, at any one time 20-30% of training positions in the USA are unfilled.

5 Going forward: needs and strategies

On the second day of the meeting, participants formed breakaway groups to identify local needs that must be met in order for organ donation and transplantation to develop in their respective countries. Participants then identified short-term and long-term strategies through which these needs would most appropriately and effectively be met. Participants were also encouraged to identify other areas of concern, for which no immediate response might be evident or where the scope of the issue is beyond organ donation and transplantation (e.g. health system organization and financing, infectious disease control). The reports from each of the breakaway groups are summarized in the tables below.

To supplement the information delivered in country-specific presentations during the course of the meeting, each sponsored delegate also completed an interviewer-administered questionnaire regarding existing resources to provide organ donation and transplantation services at their current institution. Delegate responses are summarized in Tables 4-6.

5.1 Small group reports

Table 3: Small group reports of needs, strategies and areas of concern with respect to the development of organ transplantation

Kenya	
NEEDS 1. Human capital - surgeons, anaesthetists and paediatric nephrologists; 2. A closer tissue-typing lab (currently out-sourcing tissue typing to South Africa, meaning a two week delay and no recourse is there is a problem with the results); 3. Laws covering deceased donor transplantation (current laws in Kenya cover living donor transplantation only); 4. A registry or means of surveillance and monitoring of practices and transplant outcomes (currently have a template, a challenge will be to harmonise with the private sector); 5. To begin to consider deceased donor transplantation 6. Growing need for matching and greater organization of transplant services. OTHER AREAS OF CONCERN • There is a need to reconcile public and private sector provision of transplantation, so that the two sectors are no longer in competition and so patient access and outcomes are optimised; • Have not started transplanting other organs, but are looking towards paediatric liver transplants.	STRATEGIES 1. Encourage young surgeons to be interested in transplant surgery, and better salaries for those working in transplantation (transplant surgery is not lucrative, especially in the public sector where the costs of transplantation are kept artificially down); 2. Histology training and development of telemedicine; 3. The Kenyan government partially subsidises the cost of transplant for those transplanted in public hospitals (2/3); advocate for government to prioritise funding for transplantation; 4. Educate parents on the benefit of paediatric transplantation; 5. Build up a centre of excellence that performs a large volume of transplants to support emerging centres, rather than a reliance on visiting surgeons; 6. African Development Bank is setting up a nephrology and urology centre in Nairobi, explore potential for leverage; 7. Assign specific responsibilities among Kenyan medical professionals working in transplantation to push forward the agenda; 8. Halt the practice of Indian brokers poaching patients from the transplant waiting list by demonstrating that treatment in Kenya is associated with better outcomes; 9. Develop a 5-year plan for transplantation in Kenya; 10. Explore public/private partnerships; 11. Form a Kenyan Transplant Society.
Ghana	
NEEDS 1. More experience for transplant professionals; 2. More transplant surgeons; 3. Government support; 4. Transplant coordinators; 5. Tissue typing lab; 6. A patient advocate for transplantation in Ghana; 7. Finalise legislation (draft legislation currently before parliament).	STRATEGIES 1. Transplant Links would be prepared to increase their visits to give local surgeons more experience, with ancillary support from Trinidad and Tobago and Nigeria; 2. A surgical trainee has been identified who will undertake training in Birmingham; 3. Support from South Africa to train a coordinator; 4. Financial support from TTS and ISN to fund the training of a surgeon and a transplant coordinator.
Ethiopia	
NEEDS 1. Training of transplant professionals, particularly surgeons; 2. Histopathology and radiology facilities; 3. Better availability of medicines. OTHER AREAS FOR CONCERN • Measuring CNL is also a challenge, although the government has committed to supplying resources for this; • Malaria prophylaxis; • Ensuring a sufficient supply of immunosuppressive medications for	STRATEGIES 1. Legislation relating to organ transplantation will be through parliament shortly; 2. No one with training in pathology is currently available to read transplant biopsies, and therefore will need to outsource to private or university path labs in South Africa or a closer location, with a longer-term strategy to increase local capacity for pathology with the potential support of ISN; 3. University of Michigan will conduct sandwich training of professionals in the short term; in the longer term will be necessary for surgeons to seek longer fellowships, potentially with the support of TTS.

induction will require negotiations.	
Cameroon	
Malawi	
NEEDS 1. Patient management; 2. Availability of drugs; 3. Therapeutic drug monitoring; 4. Operative, anaesthetics and recovery facilities. OTHER AREAS FOR CONCERN • Ethical issues; • Cost: dialysis costs 27,000 GBP per year; a one month supply of generic cyclosporine costs 1000 GBP.	STRATEGIES 1. The first living donor transplant will be timed to coincide with the return of the first trainee who will head this service in the future; 2. Medical professionals consistently report back to government to keep them mindful of transplantation; 3. A possible strategy for cross-matching and tissue typing may be to access pathology services through Wellcome Trust, which is active in Malawi; 4. Learn from neighbours: for example, relevant legislation was developed based on organ donation and transplant legislation previously developed in Namibia.
Nigeria	
NEEDS 1. Training and exposure – need for more cooperation within Nigeria itself and between countries; 2. Government support; 3. Lower cost immunosuppression; 4. Assistance with tissue typing and drug monitoring; 5. Deceased donor organ transplantation.	STRATEGIES 1. Training: level of development, size and diversity of the country would suggest much greater needs than others. Training could be both in the form of reverse fellowships to encourage the growth of local training programs and international fellowships to locations where hands one experience is possible; 2. Advocacy to government for a legal framework, reduction in duty and other taxes on immunosuppression, support for the various transplant programs and patients (via subsidies for drugs and other consumables). Recommendation to identify 3-4 local public programmes for direct government support; 3. Lobby international drug companies to reduce the costs of drugs to developing nations (akin to HIV and malaria); 4. Support the local societies, hold local conferences and subsidized fees to international congresses; 5. Address the fragmentation of the transplantation program across 8 centres: might suggest that government actively supports a smaller number of centres over a wide distribution to build these up as focal centres from which to establish expertise and expand activities.
Rwanda	
NEEDS 1. Funding for dialysis and clinics – currently there is a gap in government support although the government has committed to recommence funding; 2. Work-up of donor – currently cross-matching is performed in the UK; 3. Transplant coordinators; 4. Transplant surgeons.	STRATEGIES 1. Have applied for a sister site arrangement with Yale 2. Regarding living donation: plans to streamline international lab links, seek assistance to set up own lab services, and train a transplant coordinator; 3. With regards to pathology, will establish links to an international pathologist; 4. Surgical training options planned; 5. International links have been made - now need to follow through for transplantation practices to grow.
Sudan	
NEEDS 1. Need for a larger number of trained surgeons (currently only 2 senior, trained in UK, and 4 junior surgeons, trained in Pakistan and Egypt, who move from one centre to another to perform transplant	STRATEGIES 1. Need to consider deceased donor transplantation to address the large pool of dialysis patients.

operations); 2. Experiencing difficulty with retention of medical staff, and need to establish a more cohesive, consistent team; 3. Better quality control of HLA cross-matching; 4. More nephrologists and pathologists; 5. Need to expand on knowledge and exposure for medical professionals.	
Tunisia	
Zambia	
NEEDS 1. Legislature with respect to both living donor and deceased donor transplantation; 2. National transplant coordinator for living donor transplantation – potentially attached to South Africa; 3. Capacity to conduct pre-screening for infections; 4. Capacity for tissue typing and cross-matching; 5. Surgical transplant expertise – urologist for open donor nephrectomy and early post surgical complications, and a transplant surgeon for the recipient; 6. Capacity for post-operative medical management of the recipient, supported by cost-effective protocols; 7. Transplant nurses for patient follow-up; 8. Histopathology/pathologist; 9. Capacity for drug monitoring	STRATEGIES 1. Work on draft legislature with reference to templates from other African countries; 2. In correspondence with university of California, will identify a pathologist for training in histology; 3. Support from TTS/ISN for training and assistance with linkages in, for example, tissue typing.

5.2 Delegate survey responses

Table 4: Existing institutional resources to provide organ donation and transplantation services – infrastructure, personnel and technical capacity

Institution	Country	No. of surgeons	No. of surgeons willing to perform Tx	No. of nephrologists	No. of anaesthetists /anaesthesiologists	How many 24 hr operating rooms?	Do you have transplant coordinators?	Could you ventilate a brain-dead patient for 24 hrs?	Laparoscopic surgery capability?	CT scan available?	Ultrasound capabilities to diagnose obstructed ureter?	Pathology services capable of diagnosing acute rejection?	Pharmacology laboratory offering drug levels (next day results)?	Do you have easy internet access?	The speed of the internet allows effective Skype conversations with video?
Yaounde General Hospital	Cameroon	0-10	2-4	2-4	2-4	1-5	✓	✓	-	-	-	✓	✓	-	-
Black Lion Hospital	Ethiopia	31-50	2-4	2-4	5-9	1-5	✓	-	-	-	-	-	✓	-	-
School of Medicine, Addis Ababa	Ethiopia	31-50	2-4	2-4	2-4	1-5	✓	✓	-	-	-	✓	✓	-	✓
Korle Bu Teaching Hospital	Ghana	50+	<=2	2-4	10+	1-5	✓	-	-	-	-	-	-	-	✓
University of Ghana Medical School	Ghana	-	2-4	2-4	-	-	✓	-	-	✓	-	-	✓	-	-
Kenyatta National Hospital	Kenya	31-50+	2-5+	5+	10+	6-10+	-	-	-	-	-	✓	-	✓*	✓*
Maseno University	Kenya	0-10	2-4	<=2	2-4	6-10	✓	-	✓	-	-	-	✓	-	-
Moi Teaching and Referral Hospital	Kenya	0-10	2-4	2-4	2-4	-	✓	-	-	-	-	-	-	-	-
QE Central Hospital	Malawi	0-10	<=2	<=2	2-4	1-5	✓	-	✓	-	-	-	-	-	-
Aminu Kano Teaching Hospital	Nigeria	11-30	2-4	2-4	2-9	-	-	-	-	-	-	-	-	-	✓*
Obafeni Arolomo University	Nigeria	31-50	5+	2-4	2-4	1-5	-	-	-	-	-	-	✓	-	-
St Nicolas Hospital	Nigeria	0-10	2-4	2-4	2-4	1-5	✓	-	-	-	-	-	-	-	-
University College Hospital Ibadaa	Nigeria	11-50	2-4	5+	10+	1-5	✓*	-	-	-	-	-	✓*	-	-
University of Ilorin Teaching Hospital	Nigeria	11-30	2-4	2-4	2-9	6-10	-	-	✓*	-	-	-	✓	-	✓*
University of Nigeria Teaching Hospital	Nigeria	31-50	5+	5+	5-10+	6-10	✓*	-	✓*	-	-	-	✓*	-	-
Yariman Bakura Specialist Hospital	Nigeria	0-10	<=2	<=2	<=2	1-5	-	-	-	-	-	-	-	-	-
King Faisal Hospital	Rwanda	-	2-4	2-4	2-4	1-5	✓	-	-	-	-	✓	-	-	-
Dr Salma Centre for Kidney Disease	Sudan	0-10	<=2	5+	-	1-5	-	✓	✓	-	-	✓	-	-	-
Charles Nicolle Hospital	Tunisia	31-50	5+	>5	<=2	1-5	-	-	-	-	-	-	-	-	✓
University Teaching Hospital	Zambia	11-30	2-5+	<2-4	2-9	1-5	✓	✓*	✓*	-	-	✓*	✓	-	-

*Non-agreement among multiple respondents

Table 5: Existing institutional resources to provide organ donation and transplantation services – donor/recipient screening and infectious disease control

Institution	Country	Can you get infective blood test screening within 24 hrs?	Lab capabilities: HIV (Elisa)	Lab capabilities: Hep B surface antigen	Lab capabilities: CMV viral load	Can you vaccinate for Hep B?	Can you vaccinate for Yellow Fever?	Can you vaccinate for Pneumovac?	Do you have an infection control committee at your hospital?
Yaounde General Hospital	Cameroon	-	-	-	✓	-	-	-	✓
Black Lion Hospital	Ethiopia	-	-	-	✓	-	-	✓	-
School of Medicine, Addis Ababa	Ethiopia	-	-	-	✓	-	-	✓	-
Korle Bu Teaching Hospital	Ghana	✓	-	-	-	-	-	-	-
University of Ghana Medical School	Ghana	-	-	-	✓	-	-	-	-
Kenyatta National Hospital	Kenya	✓*	-	-	✓*	-	-	-	-
Maseno University	Kenya	✓	-	-	-	-	-	-	-
Moi Teaching and Referral Hospital	Kenya	-	-	-	✓	-	-	-	✓
QE Central Hospital	Malawi	-	✓	-	✓	-	✓	✓	✓
Aminu Kano Teaching Hospital	Nigeria	-	-	-	✓	-	-	✓*	-
Obafeni Arolomo University	Nigeria	-	-	-	-	-	-	✓	-
St Nicolas Hospital	Nigeria	-	-	-	✓	-	-	-	-
University College Hospital Ibadaa	Nigeria	✓*	-	-	✓	-	-	-	-
University of Ilorin Teaching Hospital	Nigeria	-	-	-	✓	-	-	✓*	-
University of Nigeria Teaching Hospital	Nigeria	✓*	-	-	✓*	-	-	✓*	-
Yariman Bakura Specialist Hospital	Nigeria	-	-	-	✓	-	-	-	-
King Faisal Hospital	Rwanda	-	-	-	✓	-	-	-	-
Dr Salma Centre for Kidney Disease	Sudan	-	-	-	✓	-	-	✓*	-
Charles Nicolle Hospital	Tunisia	-	-	-	-	-	✓	-	-
University Teaching Hospital	Zambia	✓*	-	-	✓*	✓*	✓*	✓	✓*

Table 6: Existing institutional resources to provide organ donation and transplantation services – availability of immunosuppressive medications

Institution	Country	Cyclosporin	Azathioprine	Tacrolimus	Anti-T lymphocyte	Myofortic	Plasmaphoresis	Solumedrol	MMF	Thymoglobulin	Rituximab
Yaounde General Hospital	Cameroon	✓	-	✓	✓	✓	✓	-	✓	✓	✓
Black Lion Hospital	Ethiopia	-	✓	-	✓	✓	✓	✓	-	✓	✓
School of Medicine, Addis Ababa	Ethiopia	-	✓	-	✓	✓	✓	-	-	✓	✓
Korle Bu Teaching Hospital	Ghana	-	-	-	✓	✓	✓	-	-	✓	✓
University of Ghana Medical School	Ghana	-	-	-	✓	-	✓	-	-	✓	✓
Kenyatta National Hospital	Kenya	-	-	-	✓	-	✓	-	-	✓	✓
Maseno University	Kenya	-	-	-	-	-	✓	-	-	✓	✓
Moi Teaching and Referral Hospital	Kenya	-	-	-	✓	-	✓	-	-	-	✓
QE Central Hospital	Malawi	✓	✓	✓	✓	✓	✓	-	✓	✓	✓
Aminu Kano Teaching Hospital	Nigeria	-	-	✓*	✓	✓*	✓	-	-	✓	✓
Obafeni Arolomo University	Nigeria	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
St Nicolas Hospital	Nigeria	-	-	-	-	-	✓	-	-	✓	-
University College Hospital Ibadaa	Nigeria	-	-	✓	✓	✓	✓	-	-	✓	✓
University of Ilorin Teaching Hospital	Nigeria	-	-	-	✓*	-*	✓	-	-	✓	✓
University of Nigeria Teaching Hospital	Nigeria	✓*	✓*	✓*	✓	✓	✓	✓*	✓*	✓	✓*
Yariman Bakura Specialist Hospital	Nigeria	-	-	-	✓	✓	✓	-	-	✓	✓
King Faisal Hospital	Rwanda	-	-	-	✓	-	✓	-	-	✓	✓
Dr Salma Centre for Kidney Disease	Sudan	-	-	-	✓	-	✓	-	-	✓	✓
Charles Nicolle Hospital	Tunisia	-	-	-	-	✓	-	-	-	-	-
University Teaching Hospital	Zambia	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

6 Concluding remarks

Francis Delmonico

The objective of this workshop, conducted/and sponsored by TTS through the GAT under the leadership of Dr. Elmi Muller, was to bring stakeholders together to address the needs of Africa in the development of organ donation and transplantation. The likely burden of renal failure in Africa is staggering for any health ministry to contemplate - potentially 900 new cases of ESKD per million population annually when considering disease attributable to diabetes, hypertension and HIV alone. Although the majority of these cases would not be candidates for transplantation – there is currently no program of dialysis for HIV patients, nor are older age patients with diabetes likely to have the opportunity of dialysis let alone transplantation – if this emerging burden of ESKD in Africa unfolds as anticipated, its impact on resources and opportunities for treatment will profound. Another issue to consider is the implication of a high population prevalence of chronic kidney disease and its risk factors for the availability of suitable donors for living related organ transplantation in the region.

There is an unequivocal need for transplantation services throughout Africa. Ten representatives presented an overview of current dialysis and transplantation activities in their country. Reminiscent of my experience with Latin America – where for example in Peru there are 10,000 patients on haemodialysis yet the country is struggling to find enough resources to perform fewer than 100 transplants annually – similarly in Africa we learned of countries with 1000-6000 patients on dialysis, with dialysis financed by government, but transplantation activity of 20-200 kidney transplants in 2012. We learned of countries with waitlists exceeding1500 patients, and of patients departing Africa for India and other countries, financed by governments, because there is no local transplantation service competitive in resource availability. There is virtually no deceased donation in Africa: only Tunisia reported 2 deceased donor transplants in 2012.

These observations require government/national health authority/ministerial attention. It was concluded repeatedly over the course of the meeting that professionals must be aligned to target government and advocate for support for the provision of transplantation services within that country. Efforts to develop transplantation require a legislative mandate: several participating countries reported an absence of satisfactory/comprehensive legislation that would place the accountability for transplantation activities with the national health authority. This issue of legislation and government accountability therefore becomes a clear objective of the WHO in what may be a proposed meeting of Ministerial representatives in 2014. It also became evident that there must be a champion to facilitate engagement of the health ministry, and that the champion must be a credible medical professional with a commitment to organ donation and transplantation. Ministries ultimately addressing the epidemic of renal failure at the local level might be greatly influenced if chronic kidney disease were to be elevated into the realm of the non-communicable disease priorities of WHO, setting aside the notion that kidney transplantation is an esoteric treatment for the rich.

Whether transplantation is delivered in the public or private sector, as described by Luc Noel the “boat” of transplantation creates a ripple effect in its wake that has broader societal value and impacts upon the overall quality of health care, organisation and delivery of health services. The conclusion from the country representatives and faculty was that there is a natural sequence in which transplantation programs are established, with dialysis leading to living donor transplantation to then the emergence of deceased donor transplantation once those two initial modalities are sufficiently developed. The availability and cost of immunosuppressive medications was identified as a critical issue for the further development of transplantation in the African region. The representatives of all the countries in the workshop made a plea for the availability of immunosuppressive medications to be made a priority.

TTS and ISN will undertake collaboration to achieve an awareness of current activities for the development of transplantation in Africa, to prevent duplication or competition with existing relationships, and to be inclusive of current AFRAN efforts. It is evident that certain countries can be more immediately assisted by international collaboration, such as Sudan, Nigeria and Tunisia.

TTS will now have support for that objective through the Haberal Foundation for the Declaration of Istanbul through its leader - Dr Elmi Muller and we close with our thanks to Elmi in conducting this seminal workshop.

7 Appendices

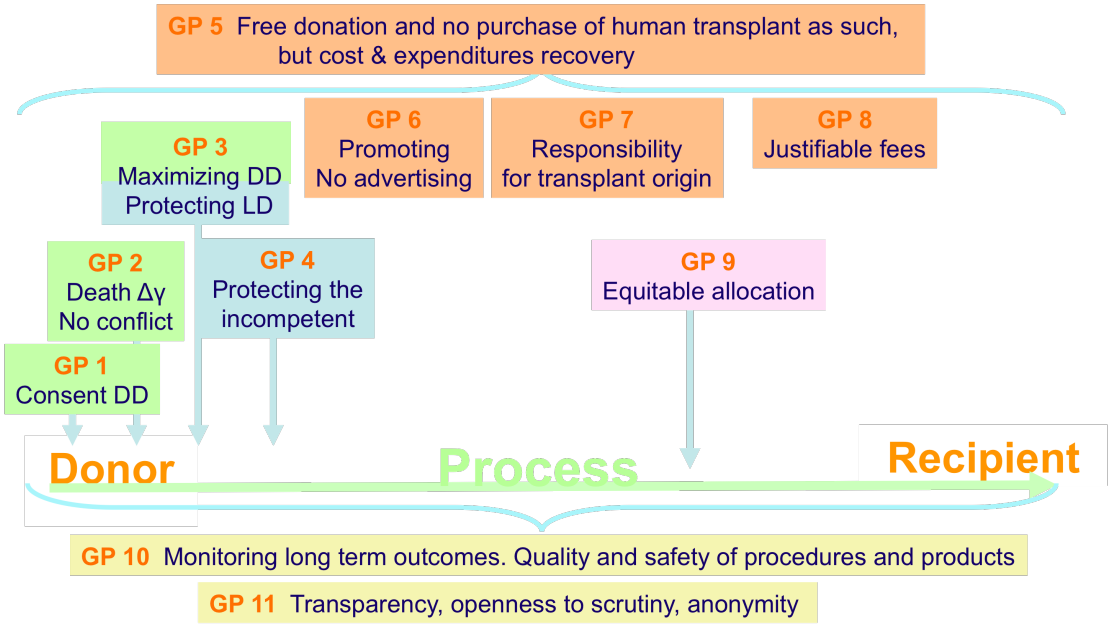


Figure 1: WHO Guiding Principles on Human Cell, Tissue and Organ Transplantation

Table 7: Global Governance Tools for Medical Products of Human Origin

A Global set of Principles	
1. Transparency and openness to scrutiny indispensable while confidentiality and anonymity when required must be preserved; 2. Prohibition of financial gain on the human body and its parts as such and when not forbidden (e.g. plasma and gametes in some countries) mandating full transparency; 3. Responsibility for the provision of MPHO placed with authorities and through them the individual citizen and resident; 4. Genuine consent of donors and recipients; **5.** Protection of the incompetent	6. Equity as a goal, in the burden of donation and in allocation of MPHO 7. Use of MPHO justified by evidence and absence of comparable alternative; 8. Traceability and accountability mandated throughout the process, from donors to recipients, including long term outcomes and vigilance and surveillance under the oversight of national competent authorities; 9. Duty to constantly optimize the safety, quality and efficacy of procurement, process and clinical application of MPHO.
Global use of ISBT 128	
Global governance function with national competent authorities • Global harmonization (Global Terminology→ Global code …etc) • Unique donation identifier Allow: easier information transfer + traceability + interoperability across MPHO, and between countries in routine and emergency + cost containment *Warwick R et al. Globally consistent coding systems for medical products of human origin. Bull World Health Organ 2013;91:314*	
Global vigilance and surveillance	
Notify project for Vigilance and Surveillance of medical products of human origin Global collaboration for V&S of MPHO • To support operation and oversight o Donor selection and management o Recipient management o Quality system - risk assessment and management • To establish transparency for trust **www.notifylibrary.org**	

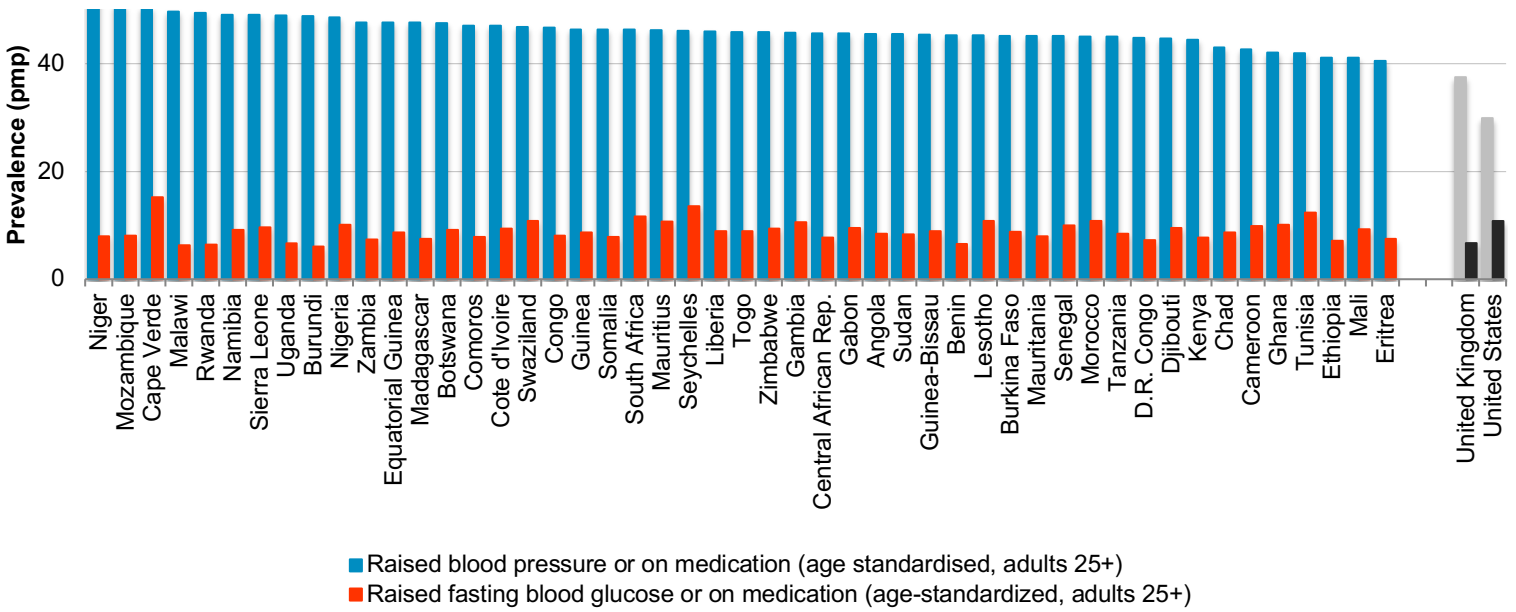


Figure 2: Estimated prevalence (per million population, age-standardised) of hypertension and diabetes in African countries, compared with the United States and United Kingdom (source: WHO Global Health Observatory).

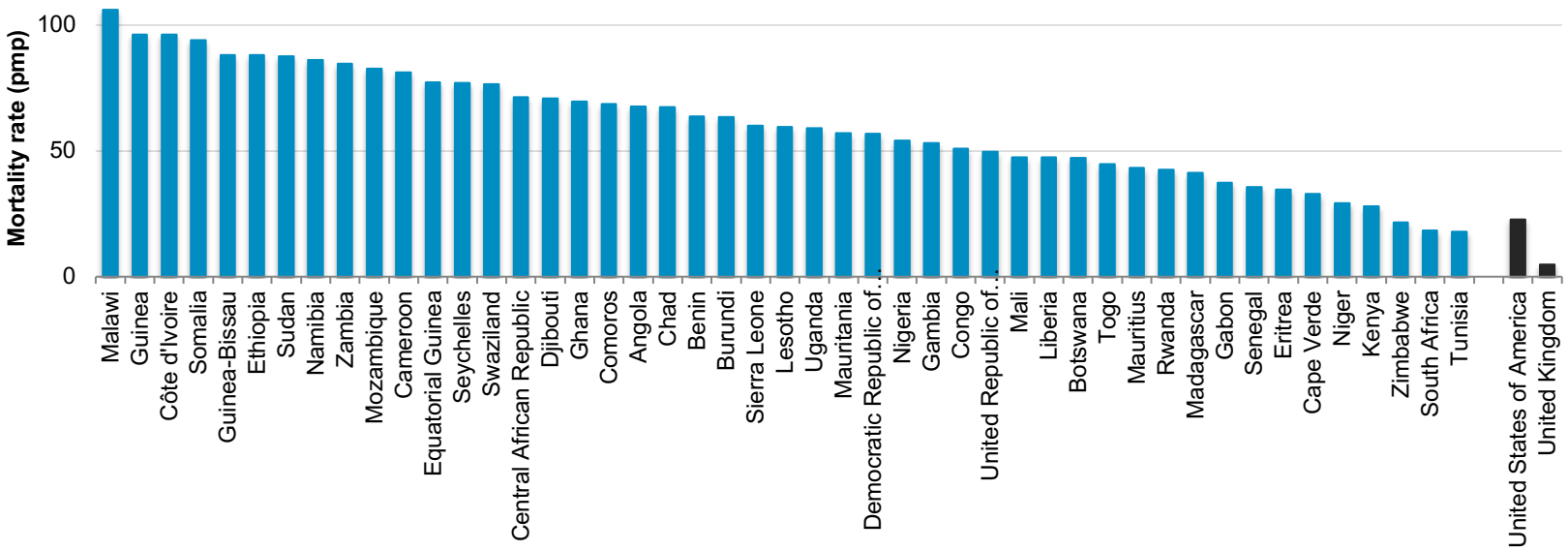


Figure 3: Estimated rate (per million population) of mortality from nephritis and nephrosis in the population younger than 60 years in African countries, compared with the United States and United Kingdom (source: WHO Global Health Observatory, Global Burden of Disease Study).

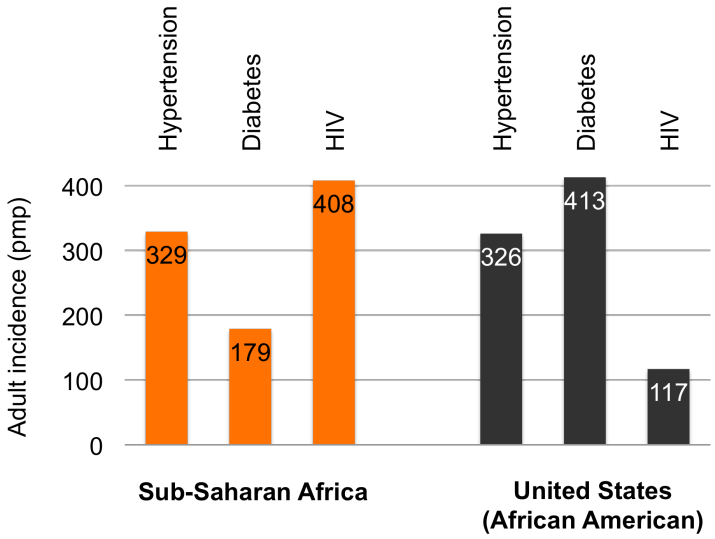


Figure 4: Estimated incidence of end-stage kidney disease in the sub-Saharan African adult (>25 years) population, by primary cause, based on cause-specific disease incidence extrapolated from the African American population.

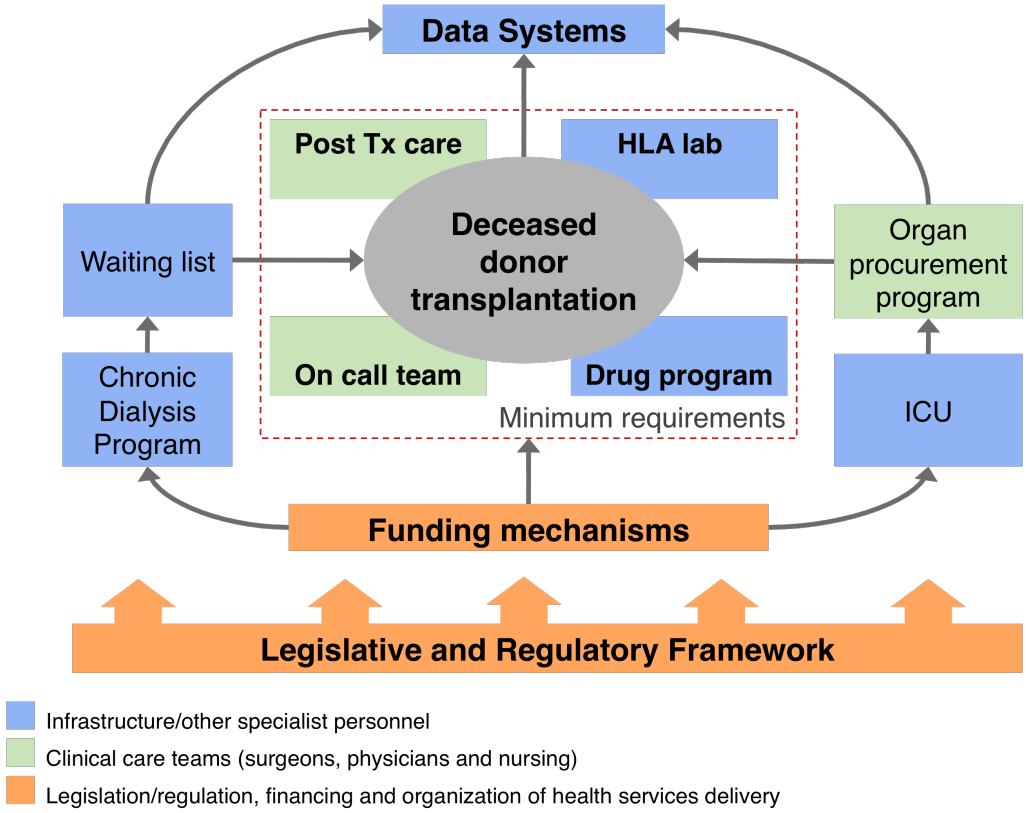
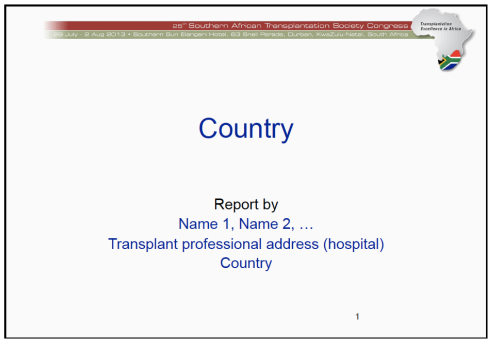
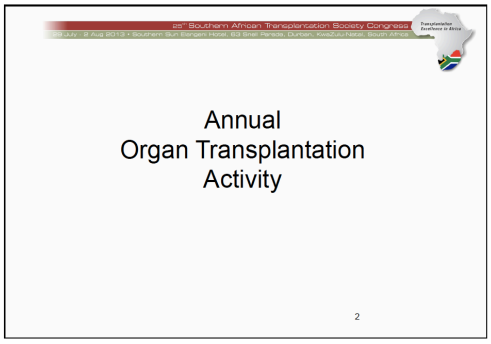
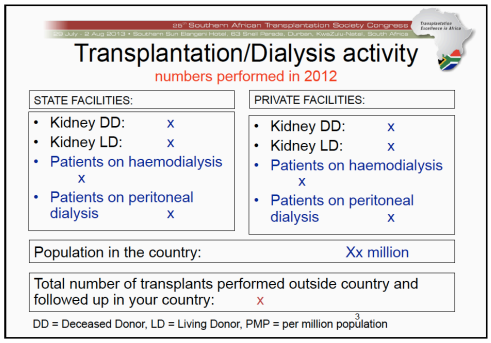


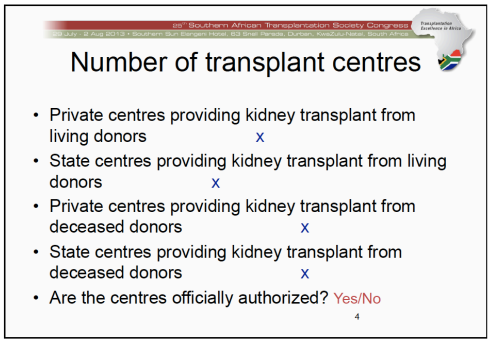
Figure 5: Schematic diagram of the minimum requirements to perform deceased donor organ transplantation, and the interactions between these requirements.

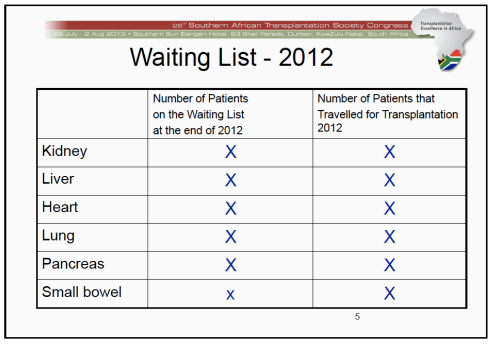
Reporting template for individual country presentations

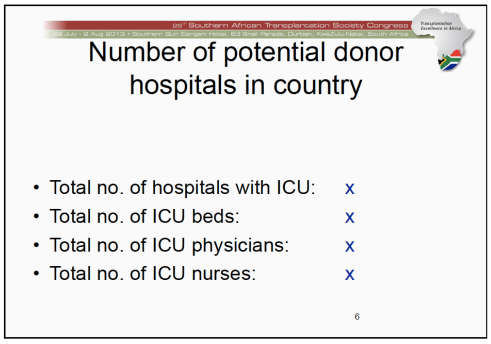












Authority and Mandate

7

Is transplantation/deceased donation included in the health-care agenda of the Government?

X

Is organ donation and transplantation a priority in the further development of health care system?

X

Is there a centralized budget allocated to dialysis?

X

What is the government currently doing to support patients with renal failure in your country?

Verbal response

8

Laws or legal regulations:

- Is there any legislation or are regulations in place for donation/transplantation? X
- Determination of death
- What is acceptable to certify a patient dead in your country?
  - Irreversible cessation of brain/brain stem functions X
  - Irreversible cessation of cardio-respiratory functions X

9

Are there laws or legal regulations concerning:

- Prohibition of giving or receiving payment for organs X
  - If yes, are there penalties in the event of commerce with donated organs?
    X
- Prohibition of organ trafficking? X
- Confidentiality (e.g. data protection law)? X
- Import/export of organs? X
- Are doctors familiar with the Declaration of Istanbul in your country? X

10

Laws or legal regulations:

- Are there cooperation agreements to allow patients to be transplanted abroad? X
- Are there cooperation agreements to perform transplants to foreigners in the country? X
- Are there cooperation agreements to exchange organs with other countries? X

11

National Organization with Coordination Authority

12

Are there facilities for:

- Potential deceased donor identification? X
- Donor management? X
- Procurement? X
- Compatibility testing (HLA, X-match) X
- Storage and transportation? X
- Allocation, selection of recipients? X
- Screening of transmissible disease (cancer, infection)? X
- Comments:

13

Funding

- Are patients' costs covered for
  - Deceased donation X
  - Transplantation X
  - Post-transplant care X
  - Living donation X
  - Living donor follow up X

Response (government, private, insurance?)

14

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