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An overview of renal replacement therapy and health care personnel deficiencies in sub-Saharan Africa

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Summary

Chronic kidney disease (CKD) is a public health problem in sub-Saharan Africa (SSA) but there is limited data to guide programs or plan interventions. To help set priorities and understand the needs for renal replacement therapy a baseline assessment is required. World Health Organization (WHO) databases and Medline were searched to determine the number of physicians, nephrologists, and dialysis centers and patients in SSA. Data on renal transplant (RTx) programs were collected from the WHO Global Observatory on Donation & Transplantation database for deceased-donor and living-donor RTx. Of the 47 countries in SSA only 15 had recent data with most rates of physicians per 10 000 population under 2.0. Nigeria and South Africa had the greatest absolute numbers of physicians and nephrologists but Mauritius had the greatest proportion to population. South Africa had the most dialysis patients. Kenya, Nigeria and South Africa were the only countries with RTx programs and reported rates per million population of 0.60, 0.23 and 5.12, respectively. Treatment for patients with CKD in SSA is limited by a lack of physicians, nephrologists, and dialysis centers. Few countries are performing RTx. Resources are needed to increase the health workforce and increase RTx programs in SSA.

Introduction

Chronic kidney disease (CKD) is considered Africa's 'forgotten disease' and most patients who develop end-stage renal disease (ESRD) do not have treatment options in their own country or regionally [1]. Estimates from South Africa, one of the most developed countries in SSA, reveal that over 50% of ESRD patients are not offered dialysis or transplantation and elsewhere on the continent even fewer receive necessary treatment [1,2].

In 2004, renal replacement therapy (RRT) was accessed by approximately 1.8 million patients worldwide, 77% of whom underwent dialysis treatment with the remainder living with a renal transplant (RTx) [3]. Globally, fewer than 5% of the patients on dialysis are from SSA [3–5].

In order to begin addressing the massive needs for RRT in SSA, a baseline assessment of the available data is required. The goal of this paper is to highlight the number of physicians and nephrologists in SSA and provide an overview of RRT including hemo-dialysis, continuous ambulatory peritoneal dialysis (CAPD) and RTx. Such data will help to guide improvements in the establishment of RTx programs throughout SSA.

Materials and methods

Data on number of physicians in the 48 SSA countries were obtained from the World Health Organization (WHO) statistics database. Only data from 2000 or later were included. Using World Bank population estimates, a

rate per 10 000 population was calculated for each country.

Secondly, a search of the English literature using Medline was conducted with the terms: ‘dialysis’, ‘centers’, ‘end stage renal disease’, ‘nephrologist’, ‘kidney transplantation’ and paired with the name of each SSA country. Relevant papers were identified and reviewed and data on the number of nephrologists, hemo-dialysis centers and continuous CAPD centers were recorded. Rates per million population (PMP) were calculated for nephrologists, hemo-dialysis centers and number of patients undergoing dialysis.

Data on RTx programs were collected from the WHO Global Observatory on Donation & Transplantation [6] which maintains records of total number of RTx, deceased-donor renal transplants (DRTx) and living-donor renal transplants (LRTx). Data on transplant programs in the US was obtained from the US Department of Health and Human Services Organ Procurement and Transplant Network [7]. Only data reported as being from 2000 or later was included in this study.

Results

Of the 47 countries considered to be in SSA, only 15 (33.3%) had data on numbers of physicians that was from 2000 or later. These countries included: Benin, Burkina Faso, Cameroon, Cote d’Ivoire, Democratic Republic of Congo, Ethiopia, Ghana, Kenya, Mali, Mauritius, Nigeria, Rwanda, Senegal, South Africa and Togo.

Nigeria, Ethiopia and the Democratic Republic of Congo (DRC) are the most populous countries with pop-

ulations of 158.3, 85.0, and 67.8 million respectively. Nigeria and South Africa have the greatest number of physicians with 55 376 and 34 829 but the rates per 10 000 population are below 10.0. Mauritius had the high proportion of physicians to population with 10.6. Except for Mauritius, Nigeria, and South Africa all the countries have rates below 2.0. Numbers of nephrologists are even less with only Kenya (*n* = 15), Mauritius (*n* = 10), Nigeria (*n* = 70) and South Africa (*n* = 50) having 10 or greater, and only Mauritius and South Africa having a PMP greater than one at 8.3 and 1.1, respectively (Table 1).

Data for number of hemodialysis units, hemodialysis patients and CAPD patients is presented in Table 2. South Africa, had the largest number of hemodialysis patients (2070) and the highest rate PMP (41.43) and the largest number of CAPD patients (1058) with the highest PMP at 21.2 (Table 2).

Table 3 shows that only 6.3% of SSA countries had a functioning RTx program, or registered data concerning them. These countries were Kenya, Nigeria and South Africa. In Kenya, and Nigeria only LRTx were performed with 71 and 69 transplants performed between 2005 and 2008. In contrast, the United States registered 4310 LRTx in 2011 [7].

South Africa reported the greatest numbers of RTx in the SSA region with a total of 682 RTx for the same time period. It was also the only SSA country to register transplants performed with deceased-donors, which represented more than 50% of the country’s RTx efforts.

Figure 1 highlights the differing numbers of RTx performed and LRTx versus DRTx for the six WHO regions

Table 1. Number and rate per 10 000 population of physicians and nephrologists in sub-Saharan Africa.

Country	Year	Population (in millions) [32]	Number of physicians (per/10 000 population) [33–36]	Number of nephrologists (per/million population) [1,5,37]
Benin	2008	9.2	542 (0.6)	3 (0.5)
Burkina Faso	2008	16.3	921 (0.6)	7 (0.4)
Cameroon	2004	20.0	3124 (1.9)	6 (0.3)
Côte d’Ivoire	2008	21.6	2746 (1.4)	–
Democratic Republic of the Congo	2004	67.8	5827 (1.1)	7 (0.1)
Ethiopia	2007	85.0	1806 (<0.5)	2 (0.02)
Ghana	2009	24.3	2033 (0.9)	2 (0.1)
Kenya	2002	40.9	4506 (1.4)	15 (0.5)
Mali	2008	15.4	729 (0.5)	–
Mauritius	2004	1.3	1303 (10.6)	10 (8.3)
Nigeria	2008	158.3	55 376 (3.9)	70 (0.3)
Rwanda	2005	10.3	221 (<0.5)	1.0
Senegal	2008	12.9	741 (0.6)	2 (0.2)
South Africa	2004	50.0	34 829 (7.7)	50 (1.1)
Togo	2008	6.8	349 (0.5)	2 (0.4)

Country	Year	Number hemodialysis centers [1,36,38,39],	Number of hemodialysis patients (per million population)	Number of CAPD patients (per million population) [35]
Benin	2008	1	–	–
Burkina Faso	2008	1	18 (1.1)	–
Cameroon	2004	–	71 (3.6)	–
Côte d'Ivoire	2008	6	130 (6.0)	–
Democratic Republic of the Congo	2004	–	–	11 (0.2)
Ethiopia	2007	2	–	–
Ghana	2009	5	35 (1.4)	0
Kenya	2002	–	260 (6.4)	30 (0.7)
Mali	2008	1	20 (1.3)	–
Mauritius	2004	10	–	–
Nigeria	2006	27	1000 (6.3)	0
Rwanda	2005	0	0	30 (2.9)
Senegal	2008	3	50 (4.0)	26 (2.0)
South Africa	2008	–	2070 (41.4)	1058 (21.2)
Togo	2008	1	–	–

CAPD, continuous ambulatory peritoneal dialysis.

Table 2. Number of hemo-dialysis centers and hemo-dialysis and CAPD patients in sub-Saharan Africa.

Table 3. Total transplants and type for Kenya, Nigeria and South Africa for 2005–2008.

Country	2005	2006	2007	2008
Kenya				
LRTx		22	26	23
Rate PMP		0.63	0.72	0.60
Nigeria				
LRTx	60	20	14	35
Rate PMP	0.48	0.15	0.10	0.23
South Africa				
RTx	232	223	209	250
PMP RTx	4.95	4.68	4.38	5.12
LRTx	84	91	85	90
PMP LRTx	1.79	1.91	1.78	1.84
DRTx	148	132	124	160
PMP DRTx	3.16	2.77	2.60	3.28

PMP, per million population; RTx, renal transplantation; LRTx, living donor renal transplantation; DRTx, deceased donor renal transplantation [6].

in 2010. The Americas has the greatest number (28 393) followed by Europe (22 767), Western Pacific (9486), Southeast Asia (6275), Eastern Mediterranean (5835) with Africa last (423).

Discussion

Sub-Saharan Africa accounts for more than 80% of the landmass of the African continent with an estimated population of 800 million. Sixty five percent of the population lives in rural settings, a significant distance from

cities where most of the organized health care delivery systems exist [5,8].

Data on ESRD from SSA are limited; however, data from the United States suggest that for every patient with ESRD there are more than 200 with overt CKD and almost 5000 with unknown renal disease (stage 1 and 2) [9]. It is likely, that the incidence of CKD and incipient disease is similar, if not greater in SSA.

The overall prevalence of hypertension in SSA, one of the main etiologies for CKD, has been estimated at 16.2%, approximately 75 million people [10]. Other community-based studies have reported hypertension prevalence rates ranging from 6% in rural Tanzania to 68% in Nigeria [11–13]. Elevated blood pressure has been defined as the leading non-communicable disease risk factor globally to which 13% of global deaths are attributed. WHO data estimate that hypertension is the most important risk factor the accounts for 12.8% of annual worldwide deaths [14–16]. Unlike in high-income countries, the incidence of ESRD in SSA is also high in younger patients who are 20–50 years old [17,18].

The data from this study emphasizes the limited number of physicians in SSA. Despite these limitations, health systems in SSA must rely on physicians to initiate preventive treatment of CKD, including the management of hypertension and diabetes mellitus, as well as diagnose and initiate treatment of early renal disease.

This study also highlights the limited number of nephrologists in SSA, which correlates closely to the number of hemo-dialysis centers. Unfortunately the cost of such care is generally not covered by government health

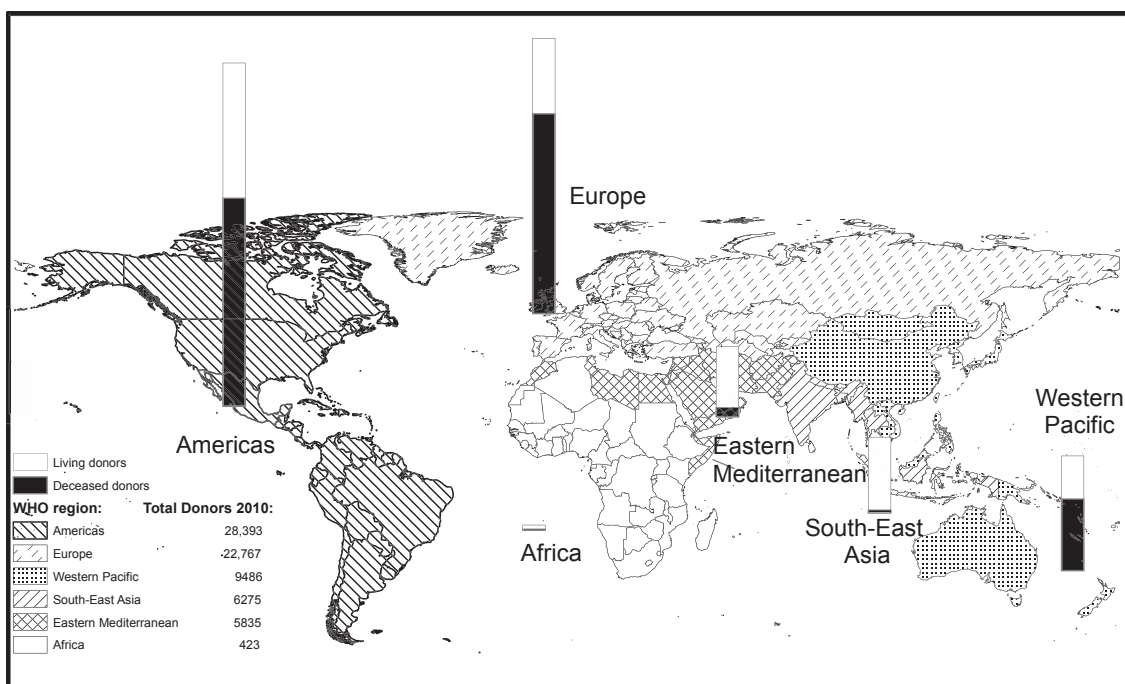


Figure 1 Living- versus deceased-donor renal transplants by WHO region, 2010.

systems and is frequently limited to the wealthy. Countries with the highest number of specialists such as Kenya, Nigeria and South Africa have the RRT programs with the highest number of patients (>200). However, in order to provide access for all needing care, much still needs to be done including: training and retaining specialists, educating the public, constructing local and national infrastructure for the diagnosis and treatment of renal disease, and providing dialysis and RTx.

Recent data show that RTx is the most economical treatment for patients with ESRD [19] and includes the benefit of patients being able to return to full time employment. In this study, only three countries had a documented RTx program – Kenya, Nigeria and South Africa. The latter is the only country reporting DRTx while programs in Kenya and Nigeria depended solely on LRTx. While 30% of patients with ESRD in the United States, Europe and Middle East undergo RTx, due to the excessive costs fewer than 1% of ESRD patients in SSA receive a transplant [8,20,21].

While CKD prevention and screening are vitally important [22], an immediate concern also exists for the acute care of existing ESRD patients. These patients will require an increase in the number of dialysis centers and increased access to RTx. To achieve this goal, SSA countries should initially implement LRTx programs. Multiple studies have shown both related and unrelated living donors have similar results in graft and patient outcomes

as long as an adequate immunosuppressive protocol is followed [23–26]. Where local conditions allow, laparoscopic living-donor nephrectomy could be the preferred method as it is as cost-effective as open procedures [27] even in low to middle-income countries [28,29].

Increasing the rate of LDTx and eventually including DRTx should be goals in countries with a RTx program. Some of the barriers to increasing the rates for LDTx and DRTx include cultural attitudes and cost of immunosuppressive drugs [30,31] and the problems with DRTx also include organization of an infrastructure for the country or for the region to quickly define and identify donors, a lack of brain-death laws, and the financial burden of medications and follow up.

There are multiple limitations to this study. Firstly, recent data is difficult to obtain and sources often vary making comparisons difficult, therefore, only recent data from 2000 or later was included. Secondly, not all SSA countries are represented and possibly not all physicians, nephrologists, dialysis centers and RTx are recorded or reported. Ideally data would be collected from individual Ministries of Health. WHO currently is the best source for much of this data and hopefully more detailed data collecting mechanisms will be established in the future.

Chronic kidney disease and ESRD are a significant problem for millions of patients in SSA and resources are needed to increase the number of trained health care workers and to provide the infrastructure and support for

dialysis centers and RTx. Understanding the magnitude of the problem is an important initial step to help develop plans and increase access for the patients in need.

Authorship

MEP and JLL: collected, analyzed data and drafted paper, critical revision. RG and TBK: analyzed data, critical revision. MAH and ALK: designed research/study, critical revision.

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