

*Original Article*

## Renal Replacement Therapy Resources in Africa

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### Abstract

**Background:** Africa is the world's second-largest and most-populous continent. It is also the world's poorest inhabited continent. Regarding chronic kidney disease (CKD), there are no reliable statistics in most African countries. However, there is a general impression that it is at least three to four times more frequent than in more developed countries

**Methods:** a survey on renal replacement therapy in Africa was conducted in the context of the African Association of Nephrology (AFRAN) Congress 2007. A questionnaire was sent to leading African nephrologists, and data were also collected from the main dialysis supply companies and by personal communication. Data have been obtained from 32 out of 54 countries, representing 89% of the total population.

**Results:** There are no reliable statistics regarding CKD in most African countries. The total number of nephrologists in the continent is 1154 (1-4 pmp). The total number of patients on hemodialysis (HD) is just over 60000 patients (<50 pmp in many countries). Peritoneal dialysis (PD) is only available in 12 African countries, and the total number of PD patients is around 2000. Renal transplantation is performed in 10 of the 53 countries, and only five countries have sustained programs that perform more than 50 cases per year.

**Conclusion:** CKD is an under-recognized health challenge in Africa. Research should be encouraged to gauge the exact incidence and prevalence of CKD in African countries and define its regional risk factors. Efforts are needed to train physicians in this specialty, and strategies for judicious resources allocation should be implemented.

**Key words:** renal replacement therapy, chronic kidney disease, dialysis, transplantation, Africa

### Background

Africa is the world's second-largest and most-populous continent, after Asia. At about 30,221,532 km<sup>2</sup> (11,668,545 mi<sup>2</sup>) including adjacent islands, it covers 6.0% of the Earth's total surface area, and 20.4% of the total land area [1]. With more than 900,000,000 people (as of 2005) in 57 territories, it accounts for about 14% of the world's human population [2]. There are 54 countries including all the island groups. Due largely to the effects of the colonialism, the international trade regime, geopolitics, corrupt governments, despotism, and constant conflict, Africa is the world's poorest inhabited continent. According to the United Nations' Human Development Report in 2003, half of Africans lived in extreme poverty (on under \$1 per day), and the bottom 25 ranked nations (151<sup>st</sup> to 175<sup>th</sup>) were all African nations [3]. The last 40 years have seen a rapid increase in population; hence, this population is relatively young. In some African states half or more of the population is under 25 years old. By most estimates, Africa contains well over a thousand languages.

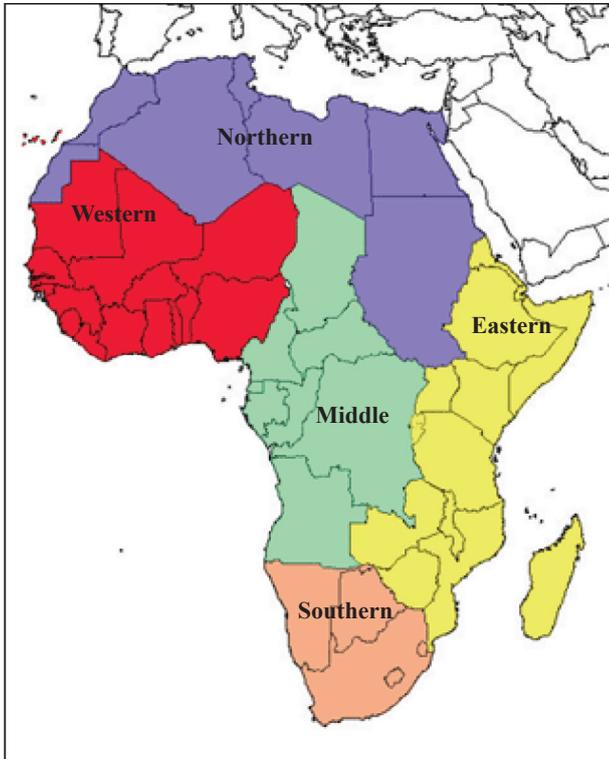
### Economic Indicators

The continent is divided into five major geographic sub-regions according to the WHO statistics division, each region comprising several territories (figure 1). These regions are: Northern, Western, Middle, Eastern, and Southern African [4]. The population and gross domestic product (GDP) per capita vary significantly among these regions (table 1).

The population distribution as well as the per capita healthcare expenditure per year varies significantly among African countries in different territories (table 2). The Commission on Macroeconomics and Health (2001) estimates that \$30-40 per person per year is the minimum required for essential health interventions in low-income countries [5]. The total per capita expenditure on health in Africa averaged 42(US\$) in 2004, in comparison, the

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**Figure 1: Map showing the major geographic African sub-regions [4]**



per capita total health care expenditure in Europe was approximately 1537(US\$) in the same year.[6]

**Health Problems**

Infectious diseases are the world’s leading cause of death, 43% in the developing world compared to 1.2 % in the developed world [7]. The most significant illness in Africa has long been malaria. A new problem of vast magnitude is the rise of HIV/AIDS in Sub-Saharan Africa. AIDS, the spread of which correlates with poverty, has nevertheless hit hardest in some of the wealthiest African countries, including Botswana, Swaziland, and South Africa. AIDS has decimated or is likely to decimate the working-age population of many states. Other major health problems in Africa are tuberculosis, gastroenteritis, other tropical infections, and hypertension. Based upon some estimates, 26.4% of the world’s adult population in the year 2000 had hypertension (26.6% in men and 26.1% in women), and 29.2% are predicted to have hypertension by the year 2025 (29.0% in men and 29.5% in women) [8]. Hypertension increases the risk of stroke, myocardial infarction, congestive heart failure, sudden cardiac death, peripheral vascular disease, and renal insufficiency [9]. Crude rates of hypertension from national surveys in some African countries were 26.3%, 23.9%, 15.4%, and 31.1% for Egypt, South Africa, Cameroon, and

Tanzania respectively [8]. Diabetes mellitus is a major future challenge for Africa. It is currently affecting approximately 171 million individuals worldwide, a number that is projected to rise to 366 million in 2030 [10]. The increase will be most notable in developing countries where > 75% of people with diabetes will reside, compared with 62% in 1995 [11].

Regarding chronic kidney disease (CKD), there are no reliable statistics in most African countries. However, there is a general impression that it is at least three to four times more frequent than in more developed countries [12]. A recent population survey in Khartoum has depicted CKD to affect 5.1% of all adults [13]. Etiology of end stage renal disease (ESRD) in the sub region differs from that seen in the developed world. As opposed to the situation in Europe and the United States, where diabetic nephropathy constitutes close to 50% of patients on ESRD programs, the predominant causes of ESRD in Africa are essential hypertension and chronic glomerulonephritis (CGN) [14]. In 1994, CGN was recorded as the cause of ESRD in 1771 (52.1%) of patients and hypertension in 1549 (45.6%) of patients by the Statistics of the South African Dialysis and Transplant Registry (SADTR) [15].

**Renal Replacement Therapy (RRT)**

At the end of 2004, some 1 783 000 people worldwide were undergoing treatment for ESRD; 1371000 (i.e. 77%) were on dialysis treatment and 412 000 (i.e. 23%) were living with a functioning renal transplant. Of those on dialysis; 89% (i.e. 1 222 000) were treated by HD and 11% (i.e. 149 000) were undergoing PD treatment [16]. The number of patients on dialysis is growing at an annual global average rate of 7%. The main factors contributing to the continued growth are the universal ageing of populations, multi-morbidity, higher life-expectancy of treated ESRD patients and increasing access of a generally younger patient population to treatment in countries in which access had previously been limited [15]. In order to facilitate effective future planning by healthcare authorities, reliable information on ESRD patient numbers, development trends and treatment modalities are essential.

**Methods**

A survey was conducted on nephrology and RTT in the context of the African Association of Nephrology (AFRAN) Congress, February 2007, in order to collect current information. A questionnaire had been sent to the nephrology national societies’ presidents, African Association of Nephrology (AFRAN) board members and to leading nephrologists by regular mail, fax, and

**Table 1: The population in millions and the gross domestic products for the major African geographic sub-regions [3,4]**

Region	Countries	Population*	GDP**
East African	19 territories, 17 countries: Burundi, Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Mayotte (France), Mozambique, Reunion (France), Rwanda, Seychelles, Somalia, Uganda, United Republic of Tanzania, Zambia and Zimbabwe	Lowest: Seychelles (0.1) Highest: Ethiopia (67.3)	Lowest: Ethiopia (95) Highest: Seychelles (6912)
Middle African	9 countries: Angola, Cameroon, Central African Republic, Chad, Congo, Democratic Republic of the Congo, Equatorial Guinea, Gabon, Sao Tome and Principe	Lowest: Sao Tome and Principe (0.2) Highest: D.R. of Congo (49.8)	Lowest: D.R. of Congo (99) Highest: Equatorial Guinea (3935)
Northern Africa	7 countries: Algeria, Egypt, Libyan Arab Jamahiriya, Morocco, Sudan, Tunisia, Western Sahara	Lowest: Libya (5) Highest: Egypt (69.1)	Lowest: Sudan (395) Highest: Libya (6453)
Southern African	5 countries: Botswana, Lesotho, Namibia, South Africa, and Swaziland	Lowest: Swaziland (1.1) Highest: South Africa (44.4)	Lowest: Lesotho (386) Highest: South Africa (11290)
Western Africa	17 territories, 16 countries: Benin, Burkina Faso, Cape Verde, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Saint Helena (UK), Senegal, Sierra Leone, Togo	Highest: Nigeria (117.8) Lowest: Cape Verde (0.4)	Highest: Cape Verde (1317) Lowest: Sierra Leone (146)

\* Population in millions (2001)

\*\*Gross domestic product per Capita in \$US (2001)

e-mail in 2004 and 2006. Data were also requested from the main drug and dialysis supply companies, beside data available in literature and by oral communication. Completed questionnaires have been returned from 11 countries. In total, data have been obtained from 32 out of 53 countries (60%) hosting 762 million people (89% of the total population).

## Results

### Nephrologists and Renal Biopsy Services

The total number of nephrologists in the continent is 1154. Of these, 982 (80%) are based in North Africa (Egypt, Libya, Morocco, Tunisia and Algeria) and 50 (4%) in The Republic of South Africa. Their number per million population (pmp) is less than 1 pmp in 27 countries, up to 4 pmp in 6 countries and more than 4 pmp in 5 North African countries. In Western Europe the average is 20 nephrologists pmp. Renal biopsy is available and

routinely performed in only 8 out of 53 (15.4%) countries (table 3).

### Hemodialysis (HD)

The total number of patients on HD in Africa is 61113. HD is often the only available RRT modality. HD is available in the public sector in 32 countries mainly in North and South Africa. It is also available in the private sector in 10 countries. The prevalence of patients under HD treatment is low, less than 50 patients pmp in many African countries, while it is over 500 patients pmp in European countries. North Africa - Egypt, Morocco, Libya, Algeria and Tunisia - comprise 54625 (89.4%) of HD patients whereas several countries have <100 patients pmp on regular HD, e.g. Burkina Faso, Ghana, Guinea, Mali, Niger and Togo (table 3).

### Peritoneal Dialysis (PD)

Among the 53 African countries, PD is only available in 12 (23%), 5 in Northern Africa, 7 in the rest of Africa,

**Table 2: The per capita gross national income and total health expenditure for some African countries [6]**

Country	Gross national income (GNI)* per capita (PPP international \$) (2005)	Per capita total expenditure on health at average exchange rate (US\$) (2004)
South Africa	12,120.00	390.00
Tunisia	7,900.00	175.00
Egypt	4,440.00	66.00
Morocco	4,360.00	82.00
Ghana	2,370.00	27.00
Cameroon	2,150.00	51.00
Sudan	2,000.00	25.00
Senegal	1,770.00	39.00
Nigeria	1,040.00	23.00
Ethiopia	1,000.00	6.00
Congo	810.00	28.00

\*The Gross National Income (GNI), formerly referred to as gross national product (GNP), measures the total domestic and foreign value added claimed by residents at a given period in time, usually a year, expressed in international dollars using purchasing power parity (PPP) rates. GNI comprises GDP plus net receipts of primary income (compensation of employees and property income) from nonresident sources. GNI provides an aggregate measure of income. An international dollar is defined as the currency unit that has the same purchasing power over GNI as the US dollar in the United States.

**Table 3: The distribution of nephrologists and renal replacement therapy in some African countries**

Country	Number of nephrologists (pmp)	Total patients on HD (pmp)	Total patients on PD (pmp)	Number of transplants per year
Algeria	6	252	15	60
Burkina Faso	0.4	2	0	0
D.R. of Congo	0.1	0	0.16	0
Egypt	6.5	421	0.3	500
Libya	5	370	1.4	50
Senegal	0.2	4.2	0.5	0
South Africa	1.1	46	24.4	240
Sudan	0.7	46	2.8	56
Tunisia	7	650	20	70

pmp: per million of population, HD: Hemodialysis, PD: Peritoneal Dialysis

most patients being in South Africa, and it is only being delivered in the public sector. Many of these units offer acute manual intermittent PD and only a few of them do regular PD.

The total number of PD patients is around 1960. The prevalence is very low being less than 20 patients pmp in most countries (table 3), while it is more than 100 patients pmp in Western Europe. PD is often more expensive than HD in Africa because all components, including fluids must be imported.

South Africa has the largest PD patient population comprising 34.7% of its ESRD patients, with a total of 1050 patients (53.6% of all African ESRD patients on PD) mostly on CAPD. Other countries patients' numbers range from 13 to 490 on regular PD. PD has been recently

introduced in the Sudan; the program has served about 150 patients so far and its performance parameters are encouraging for other African countries [17].

### Renal Transplantation

Renal transplantation is performed in 6 countries in North Africa (Algeria, Egypt, Libya, Morocco, Tunisia and Sudan) and 4 in sub-Saharan Africa (Cameroon, Kenya, Mauritius and South Africa), mainly in the public sector, with the donor pool being primarily live related donors (LRD). It is also available in private hospitals in Egypt, South Africa, and Sudan. Only 5 countries have a sustained program and perform more than 50 cases per year (table 3). Even in these countries many patients have to travel abroad for a kidney transplant when they can afford it.

**Table 4: Cost of renal transplantation in some African countries**

Country	First transplant year (\$US)	Subsequent years (\$US)
Sudan	12,000	8,000
Tunisia	15,000	7,000
South Africa	20,000	15,000

### Cost of Renal Replacement Therapy

Cost of RRT, in all countries, is out of the reach of individuals and represents a burden for the states. The cost of a single HD session is \$ 65, 120, and 140 in Tunisia, Nigeria, and South Africa respectively. Regarding PD, the total annual cost per patient differs significantly in African countries. It varies between (in \$US) 7,000 (Egypt), 24,000 (Democratic Republic of Congo) and 30,000 (South Africa).

Renal transplantation cost differs by the year, being most expensive in the first year and dropping down on the subsequent years (table 4).

### Discussion

CKD is a major health challenge which is under-recognized in Africa. Risk factors are on the rise with diabetes, hypertension, and obesity slowly reaching pandemic scales in many African countries. A three pronged approach towards confronting the disease includes raising awareness, focusing on prevention and judiciously allocating resources for different types of RRT.

Research should be encouraged in different African countries to gauge the exact incidence and prevalence CKD and define its regional risk factors. Programs to prevent CKD and to treat it in the earliest stages must be designed and integrated into the existing health care infrastructure.

The World Health Organization's Innovative Care for Chronic Conditions Framework provides a model for redesigning health care systems in accordance with local resources. The framework emphasizes a well-defined care plan, self-care, scheduled follow-up appointments, monitoring of outcomes, adherence, and stepwise treatment protocols delivered mainly by primary care practitioners. However, increased referrals from such programs, even if limited to patients with advanced disease, may place excessive demands on existing nephrology services. As shown in this survey, there are only about 1154 nephrologists for a population of about 900 million (the United States has more than 5000 nephrologists for a population of about 300 million).

Efforts are therefore needed to train physicians in this specialty. For the time being, primary care practitioners will continue to be the frontline caregivers. These physicians should be required to participate in continuing medical education programs regarding the management of hypertension, diabetes, and CKD.

Because RRT is quite expensive, strategies for judicious resources allocation should be implemented. Dialysis should be provided for short periods of time as a bridge to more definitive transplantation whether from live or cadaveric donors. PD is probably the more cost-effective dialysis modality; it is mostly self-administered, it secures the ability to work and study, and it excludes hospital charges and therefore is more realistic for patients living remotely from dialysis centers. Its cost should potentially drop further if fluids are locally produced.

It is hoped to see a sustained improvement in the future with a greater emphasis on education, prevention, and development of renal services in the continent resulting in better patient outcomes.

### Conclusion

CKD is an under-recognized health challenge in Africa. Research should be encouraged to gauge the exact incidence and prevalence of CKD in African countries and define its regional risk factors.

Efforts are needed to train physicians in this specialty, and strategies for judicious resources allocation should be implemented.

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