Nephrology in Uganda

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Area[1]	241,550 km^2
Population[2]	44.7 million (2019)
Capital	Kampala
Three most populated cities	1. Wakiso 2. Kampala 3. Kibaale
Official languages	English, Kiswahili, Luganda, Lunyakitala, and many others
Gross domestic product (GDP)[3]	27.48 billion USD (2018)
GDP per capita[3]	710 USD (2018)
Human Development Index (HDI)	0.516 (2017)
Official currency	Ugandan shillings
Total number of nephrologists	10
National society of nephrology	Uganda Kidney Foundation
Incidence of end-stage renal disease	Not available
Prevalence of end-stage renal disease[4](on dialysis)	2018 – 51.8 pmp
Total number of patients on dialysis[5] (all modalities)	2017 – 176 2018 – 186
Number of patients on hemodialysis[5]	2017 – 173 2018 – 184
Number of patients on peritoneal dialysis[5]	2017 – 3 2018 – 2
Number of renal transplantations per year	2017 – 0 2018 – 0

Table references:
1. Uganda surface available https://www.indexmundi.com/facts/uganda/surface-area
2. WHO, 2017
3. Uganda GDP per capita, available https://tradingeconomics.com
4. Kalyesubula R, Nankabirwa et al, BMC Nephrology, 2017
5. Uganda Kidney Foundation, unpublished data

Introduction

Uganda is one of the countries found in East Africa. It is bordered by the Democratic Republic of Congo, Kenya, Rwanda, South Sudan, and Tanzania. Uganda achieved independence from the United Kingdom in 1962. The country is located on the East African Plateau, lying mostly between latitudes 4°N and 2°S (a small area is north of 4°) and longitudes 29° and 35°E. It averages about 1100 meters (3609 ft) above sea level, sloping very steadily downward to the Sudanese plain to the north. It has 134 districts and Kampala, its capital city, sits close to Lake Victoria. The population of Uganda is currently estimated at 44,700,000 people. Uganda is called the pearl of Africa due to its evergreen nature and the lively nature of the people who live in it [1, 2].

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J. A. Moura-Neto et al. (eds.), *Nephrology Worldwide*, https://doi.org/10.1007/978-3-030-56890-0_7

Uganda has allegiance along ethnic, religious, and political lines. With more than 56 tribes, diversity is at the heart of Uganda. However, it is easy to navigate through the country if you speak either English, Swahili, or Luganda. The official currency of Uganda is Ugandan shillings (UGSH) with a symbol of /=. One US dollar is equivalent to 3700 Ugandan shillings. One of the most attractive sites includes the Bwindi forest which is home to the world's most beautiful gorillas. We have several game parks where wild animals can be found in their natural homes. Uganda is at the equator and therefore receives sunshine throughout the year.

Uganda has had several presidents and a turbulent past. However, in 1986, President Yoweri Museveni came into power and his presidency has remained until present day (2019). The Ugandan parliament is one of the largest in the world with 426 members in the 10th parliament. It is currently headed by Hon Rebecca Kadaga.

Healthcare in Uganda is generally free across the country organized into different levels of care. We do not have health insurance in the country, and the health facilities are often ill equipped to provide adequate resources to care for the growing population. This is more pronounced when it comes to chronic diseases [3].

Brief History of Nephrology in Uganda

Uganda has a great heritage and history in the field of nephrology with key research performed in malaria-associated nephropathy and glomerulonephritis by Kibukamusoke in the late 1960s and early 1970s [4]. Acute peritoneal dialysis (PD) using normal saline fortified with dextrose 50% was introduced by Dr Edward Kigonya in the 1970s who also introduced the concept of enteric dialysis using sorbitol in 2000 (unpublished data). Dr Amos Odiit started pediatric nephrology care services in Mulago Hospital in 2000. Since then, we have had slow progress in both research and clinical nephrology until recent years. Renal replacement therapy (RRT) in the form of hemodialysis (HD) is still new in Uganda, having been introduced to the capital, Kampala, in 2001. Dr Emmanuel Ssekasanvu working alongside Mr Moses Odongo started HD at a private center and 2 years later, in 2003, at the intensive care unit of Mulago National Referral and Teaching Hospital. Since then, dialysis has improved as explained in the different sections. As of 2019, Uganda has unfortunately not yet started kidney transplant program, and most Ugandan patients are referred to outside countries for this service.

There is a lot of enthusiasm for the field of nephrology since 2012 when the Uganda Kidney Foundation (UKF) was established by Dr Emmanuel Ssekasanvu, Dr Simon Peter Eyoku, Dr Rose Muhindo, Dr Peace Bagasha, Dr Prossy Ingabire, Dr Joseph Lunyera, and Mr Tomson Masereka under the leadership of Dr Robert Kalyesubula. In 2013, the UKF team organized the first international kidney conference in Uganda. Since then the UKF holds regular scientific meetings and celebrates the World Kidney Day together with other team players like the Uganda Kidney Psychosocial Support Organization (UKPSSO) and the Uganda Ministry of Health. Since its foundation, the UKF has screened 2160 community members for hypertension, diabetes, obesity, and kidney disease and referred them for further care [5, 6].

Renal Diseases in Uganda

Kidney disease is a common problem worldwide with one in ten people estimated to have kidney disease. Developing countries like Uganda have the largest burden of disease due to lack of well-established infrastructure for prevention, diagnosis, and care for patients with kidney disease. The current prevalence of chronic kidney disease (CKD) in Uganda ranges from 2.5% in the general population to 14.4% among high-risk groups [7, 8]. The major risk factors driving kidney disease in adults include hypertension, diabetes mellitus, and infections, particularly HIV-AIDS. In children, the major contributors to renal disease are sickle cell disease, malaria, and other infections [9–11]. However, a large proportion of the general population with CKD (49%) is not explained by the known risk factors [12]. We do not know the prevalence of acute kidney injury (AKI) in the general population. However, one study done in a hospital care setting in Mulago National Referral Hospital, the largest hospital in Uganda, provides some information. Among the 387 patients attending an emergency unit with sepsis, 16.3% had AKI and had an inhospital mortality of 21% largely due to lack of access to dialysis and intensive care services [13].

Uganda has a large population with 55% of the people below 18 years of age and only 4% of the people above 60 years [1]. We have no national health insurance policy, and there is limited health insurance for a few employed individuals. Most of these policies exclude renal care beyond renal function tests, urinalysis, antihypertensive therapy, and diabetes treatment. Individuals pay out of pocket for renal care (biopsy, dialysis, transplant, and posttransplant care). We do not have a renal registry, and most of the data is from individual community or hospital-based studies. About 1000 patients are diagnosed with renal disease every year in Mulago National Referral Hospital. Up to 56.2% of patients who attended for the first time at the renal clinic present with CKD stage 5, and most of these are under 38 years of age [14, 15]. The leading associations with CKD are hypertension, diabetes mellitus, infections (HIV in particular), and tuberculosis [15, 16]. Diseases such as malaria and schistosomiasis are some of the endemic diseases associated with kidney disease [4, 7]. Hemorrhagic fevers like Marburg and Ebola viral infections have been associated with kidney diseases. Other causes include locally available herbal remedies often used for treatment of various ailments and among pregnant women [17].

AKI accounts for 4% of hospital admissions and is a major cause of mortality among adults, and most of the cases arise from infections and trauma [13]. Pregnancy and its related complications are a major cause of AKI among women of childbearing age. Uganda has a young population and a high fertility rate with poor health systems [3, 18].

Renal Diseases in Pediatric Population

Glomerulopathies are among the leading causes of CKD among children. Unfortunately the lack of immunofluorescence limits our ability to confirm the exact causes of the glomerulopathies. Past studies among children attributed these glomerulopathies particularly nephrotic range proteinuria to quartan malaria [4]. Recent studies describe sickle cell disease as a cause of proteinuria among children in Uganda. About 15,000 babies are born with sickle cell disease in the country annually [19]. A cross-sectional study, among children with sickle cell anemia in a steady state attending Mulago National Referral Hospital in the years 2007 and 2008, reported the prevalence of microalbuminuria to be 28% [9]. This highlights the importance of sickle cell disease as a cause of glomerulopathies in children in Uganda. The role of *Plasmodium falciparum* malaria in causing CKD has not been well documented; however, in the past 2 years, two children have received renal transplant following *P. falciparum* infection, and a study published in 2019 has indicated an increased risk of CKD in children with severe *P. falciparum* [10].

Concerning AKI among children in Uganda, *P. falciparum* is a leading cause of AKI in these children. A recent study at the Mulago National Referral Hospital showed an AKI prevalence of 35.1% among children admitted with severe malaria [10]. The study further indicated that the risk of these children progressing to CKD is three times more than those without AKI [10]. Unfortunately, AKI is associated with an increased risk of mortality in these children with malaria [10]. Other causes of AKI in children in Uganda include gastroenteritis, malnutrition, pneumonia, and HIV [11]. Even though we have limited literature in the country concerning the epidemiology of other causes of renal diseases in children, based on observations during clinical care, idiopathic nephrotic syndrome contributes to almost 50% of our outpatient reviews. In addition, post-streptococcal glomerulonephritis, urinary tract infections, and obstructive uropathies are also prevalent causes of pediatric renal diseases in Uganda [20].

Renal Replacement Therapy in Uganda

Renal replacement therapy (RRT) in Uganda is largely restricted to HD as initial results for PD were not optimal. We are in the early stages of setting up a national kidney transplant program. Only about 9% of the people who need RRT have access to it in Uganda, and their options are currently limited to hemodialysis [5].

Hemodialysis

RRT in the form of HD is still new in Uganda and was initiated in early 2001 at the Mulago National Referral and Teaching Hospital located in the capital, Kampala. This is a 1500-bed teaching hospital serving a population of about 30 million Ugandans. Patients therefore had to travel several kilometers from out of Kampala city to access the service at a costly fee. With a fast-growing population, at close to 45 million currently and an increased prevalence of CKD, the number of patients needing RRT has markedly increased. In response, the number of dialysis centers has also increased from one dialysis center in early 2001 to 11 centers by 2019. Regrettably, the majority of these dialysis centers are all concentrated in the central region, the capital city, Kampala. Two dialysis centers are government owned, while the remaining nine are privately run. Only two centers are located out of the capital city (Table 7.1).

Table 7.1 Dialysis centers in Uganda (2019)

	Dialysis unit	Ownership	No. of HD machines	No. of pts	Male	Female	Head of the unit
1.	Kiruddu Teaching Hospital	Government	19	110	74	36	2 nephrologists 1 specialist physician
2.	Nakasero Hospital	Private	5	7	6	1	1 nephrologist
3.	Norvik Hospital	Private	6	22	13	9	1 nephrologist
4.	Panorama Medical Center	Private	4	8	4	4	1 nephrologist
5.	UMC Victoria Hospital	Private	6	11	8	3	1 nephrologist
6.	Case Hospital	Private	3	5	4	1	1 nephrologist
7.	Nsambya Hospital	Private	4	12	8	4	1 nephrologist
8.	Mbarara University Teaching Hospital	Government	2	2	2	0	1 nephrologist 1 specialist physician
9.	DMA diagnostics and laboratory	Private	2	1	1	0	1 nephrologist 1 specialist physician
10.	Home dialysis	Private	1	1	1	0	1 nephrologist

HD hemodialysis, *Pts* patients

There are 52 hemodialysis machines in the country, 21 of which belong to the public sector, providing both acute and chronic HD. A total of 179 patients are undergoing chronic HD, with the largest in-center number dialyzing in a government hospital due to a government subsidized cost of about 20 US dollars. The private centers and the other government center currently provide HD at an average cost of 80 US dollars per dialysis session. Other drugs used alongside dialysis like erythropoietin, iron, calcium, vitamin D, phosphate binders, and drugs for treating comorbidity disorders are paid for by the patients in both private and government dialysis centers. There is a general male predominance in dialysis accessibility in most centers; women and children are underrepresented like in many other low-income countries [21, 22].

We neither have a national health insurance scheme nor do we have a national dialysis policy for dialysis allocation in Uganda. This means that all patients access dialysis through out-of-pocket costs. The private health insurance schemes for nongovernmental organizations (NGOs) do not cover dialysis. In comparison, neighboring countries, like Kenya, Tanzania, and Rwanda, offer short-term dialysis for AKI under their existent national health insurance schemes [21, 23]. In Uganda, dialysis is only subsidized at the main national and referral hospital (Mulago); however, the majority of the patients are dialyzed once or twice weekly due to the prohibitive long-term unsustainable costs for dialysis, medications, tests, and transport to the dialysis center. The minimal internationally recommended hemodialysis dose is 4 hours, thrice weekly. Clinicians are always faced with the dilemma of dialysis adequacy. At the government center, patients are entitled to a maximum of two sessions per week. This is because the numbers are quite overwhelming. Dialysis teams often begin work at 1:00 am in the morning, and the shifts go up to 10:00 pm in the night. Patients who can afford often get a third dialysis session from private units, while the majority (about 90%) of them gets less than two sessions a week. It is therefore a challenging situation, and some patients end up using drugs, herbal remedies, and other conservative methods of treatment, like probiotics and strict diet, in between the dialysis session. It is not uncommon for patients to present with creatinine of over 2000 umol/l (22.6 mg/dl) and hemoglobin levels of less than 5 g/dl to dialysis units. Only 9 out of 184 patients (5%) have been on dialysis for more than 5 years in the country. We also do not have any national guidelines for dialysis, and this sector is not yet regulated. As a result of this, practices vary widely across centers. For example, dialyzer reuse is only done inconsistently by one private center. Even then less than six patients overall are using this method. The dialyzer is used for a maximum of eight sessions.

With a population of 44.7 million, Uganda has only 10 nephrologists, 2 pediatric, and 8 adult nephrologists, providing a nephrologist to population ratio of 0.15 per million population (pmp). The average ratio in Europe, for example, is approximately 20 pmp [24]. This very low number of nephrologists in Uganda directly affects patient access to quality care and hence dialysis access. Additionally, dialysis access is provided only in the two major cities, Kampala and Mbarara, leaving the rest of the country out of reach for dialysis services. Some patients travel more than 300 kilometers to access dialysis, while others have had to migrate to the big cities in order to access these services.

The lack of a transplant program in the country leaves some potential transplant candidates on chronic HD. This imposes an excessive financial burden on the families of the affected patients. In many instances, it has resulted in catastrophic health expenditures, leading to the sale of family property and depletion of life savings, leaving the entire family impoverished. At the government center where costs are subsidized, a number of other major challenges include overwhelming patient numbers, inadequate dialysis, and very low fistula rates. The majority of patients use temporary catheters for long periods of time, hence presenting patients with recurrent catheter-associated infections and sepsis leading to poor dialysis outcomes. Patients suffer with high rates of anemia, while staff get fatigue and burnouts. There are occasional consumable stockouts, absence of timely machine maintenance, hence frequent machine breakdowns with limited technological support, and irregular water analysis. Similar challenges have also been observed in other low- and middle-income countries [25].

Peritoneal Dialysis

We currently have no active PD services in Uganda. Efforts to set up PD through the Sustainable Kidney Care Foundation were hampered by lack of commitment from stakeholders and the fact that peritoneal fluid for dialysis was hard to transport across the borders. There is no champion to lead this effort of dialysis development in the country. Occasionally, some children are able to get PD through insertion of temporary catheters. The dialysis equipment and fluids have to be procured from nearby Kenya by the relatives of the children. In 2018, three adult patients were on continuous ambulatory peritoneal dialysis (CAPD); two of them passed away due to peritonitis in 2019.

We are currently looking for ways to revise this program particularly for children. The international community is welcome to support us in this effort because many children are dying from AKI, a condition which also increases their risk of developing CKD [9–11].

Renal Transplantation

As the burden of CKD increases in sub-Saharan Africa, so does the need for renal transplantation. As of 2019, we have no transplant program in Uganda, and all our patients have

undergone renal transplant outside Uganda, mostly from hospitals in India. Renal transplant in conjunction with Indian Hospitals began in 2004, and over 100 recipients from Uganda have been transplanted and are monitored in continuing consultation with the mother transplant hospitals that include Trivedi in Mumbai, Apollo Hospital in New Delhi, Yashoda in Hyderabad, and Fortis in Bangalore. A few more patients have had their transplant done in South Africa (Groote Schuur), Kenya (Nairobi), and other countries.

There is an undocumented, but worrying, rise in the number of chronic allograft loss among Ugandan renal transplant recipients noted over the past decade, but the factors associated with chronic allograft injury have not been conclusively identified. Several studies have shown different factors (both donor and recipient) to be associated with poor allograft outcome/survival rate, including underlying cause of CKD stage 5, longer time on dialysis prior to renal transplantation, creatinine level at the time of discharge, and donor age, among others [26, 27].

Though there is an increasing number of patients diagnosed with CKD stage 5 and in need of kidney transplant in Uganda, very few patients (less than 1%) can get a transplant because of the prohibitive cost. In addition, because we only rely on living-related donors, there is a problem of finding suitable donors, and this is further complicated by lack of capacity among medical institutions and lack of policies to regulate the transplantation process. These factors are not different from those encountered in most African countries [26]. However, compared to the developed world, where the biggest challenge is shortage of donated kidneys, the biggest challenge in Uganda is the cost since the patients and relatives have to pay for medical care, in addition to travel and living expenses for the donor and caretaker. Thus many patients never consider transplant an option for care once diagnosed with CKD stage 5.

All our patients who have undergone kidney transplantation have had living-related donors. The nephrologists in Uganda often collaborate with the centers abroad where the patients are transplanted and only take over care once the patients return to their home country.

Uganda is currently discussing an organ transplant bill that is under review by the parliament. We are hopeful that this will be passed and transplant resources availed to patients at a local level. This may reduce the cost of medical care and set up a system for nonliving organ donation and improve local human resources and institutions' capacity building, among others.

As we await the organ transplant bill to be passed, Mulago National Referral Hospital is currently under renovation and getting ready to start kidney transplantation. This transplant program has been spearheaded by the executive director, Dr Byarugaba Baterana, and a transplant team comprising surgeons, nephrologists, pathologists, and intensivist nurses who have been trained in anticipation of the same.

We believe when the program starts more patients will be able to undergo kidney transplant.

Nephrology Practice in Uganda

Amid the rising tide of CKD, the global nephrology workforce has shrunk and is failing to meet the growing healthcare needs of this vulnerable patient population. Africa has the lowest number of nephrologists per million population (pmp) in the world, with no nephrologists in many parts of the continent [28]. Uganda is estimated correctly to have less than 0.15 nephrologist pmp [28] (Fig. 7.1). As a matter of fact, this global shortage of nephrologists is seen in many parts of the world [29, 30].

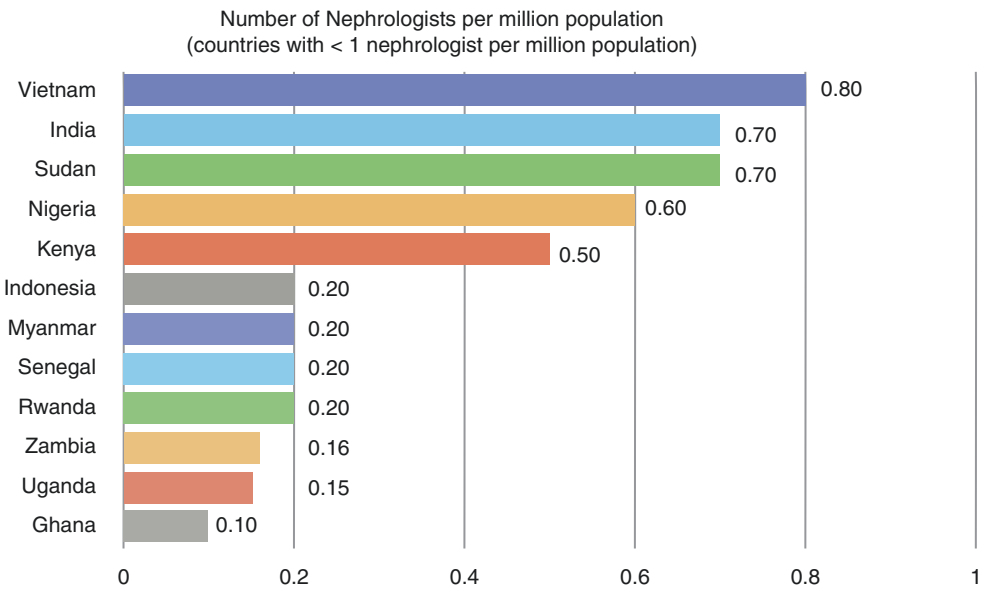

Fig. 7.1 Number of nephrologists per million population by countries with <1 nephrologist per million population [28]

As of April 2019, Uganda had only ten nephrologists for a population of 44.71 million [1] leaving each nephrologist to take care of over four million people. The nursing arm of nephrology follows a similar trend marred by low numbers and lack of training within the nursing schools about kidney disease and its management [31]. This is mainly contributed to by the absence of in-country training opportunities for specialist nephrology practice. All specialist nephrology providers trained abroad in South Africa, the United States of America (USA), Canada, Tanzania, and India for the doctors and mostly India for the nurses. Training abroad has cost implications which must be incurred by the individual either through personal funds or through looking out for scholarship opportunities mainly offered by the International Society of Nephrology (ISN) and the host universities-hospitals.

Advanced nephrology services are distributed between two major cities; Mbarara and Kampala. Mbarara, the smaller of the two, with a projected population of 216,800 [2], only has one nephrologist who covers all the private facilities and the one public government-owned hospital. This hospital is a regional referral hospital attending most of the western region of the country and also serves as the teaching hospital for Mbarara University of Science and Technology (MUST).

Kampala, the capital city of Uganda, with a projected population of over 1.65 million people [2] hosts the 9 other nephrologists. These are also distributed between one public hospital, two private not for profit hospitals, and six private for profit hospitals. Only three of these nephrologists cover the public hospital (Mulago National Referral Hospital) which doubles as a national referral hospital and a teaching hospital for Makerere University College of Health Sciences (MakCHS). This hospital receives medical referrals from all over the country and neighboring countries like the Democratic Republic of Congo and South Sudan.

Opportunities in the private hospitals include either full coverage, as a resident nephrologist, or partial coverage, i.e., as a part-time consulting nephrologist. The most common reason for consultation is AKI for inpatient reviews, but regular outpatient clinics are also often carried out at the primary medical facilities of practice. The nephrologist is expected to be involved in inpatient consults, outpatient clinics, HD unit rounds, and ICU coverage. The nephrologist is expected to be conversant with the management of a wide range of systemic disorders, which may be responsible for malfunctioning of the kidneys, which include high blood pressure, cancers, or diabetes.

Most frequent procedures include HD catheter insertion and performing kidney biopsies, but occasionally other procedures like paracentesis for massive ascites or pleurocentesis for pleural effusions may be required. There may be an interventional radiologist to do some of these procedures, especially in the private facilities. It is most common for the nephrologist to report to the medical director or chief of specialists, depending on the institution.

Patient load has seasonal variations with each of the private facilities admitting regularly five to ten patients per week, with five to ten patients on chronic HD. Private not for profit facilities may have fewer patients due to the elevated financial costs for a population that is seen to be less economically advantaged. The public government facility has 20–30 patients in the inpatient wards, with 10–15 new patients in the inpatient clinic weekly and 100–120 HD patients on chronic hemodialysis.

Nephrologists tend to cover each other in case one is away on leave or travelling and do frequently discuss complicated cases, with the older more experienced group members giving advice and mentorship to younger members. The annual World Kidney Day celebrations mark a time for the meeting of nephrologists; the group works together to organize national celebrations often involving a community screening activity and a scientific conference. In 2019, community screening activities were organized at the parliamentary grounds, and a motion to increase funding for sustainable kidney disease care was debated by members of parliament and passed. This momentous event is aimed to be the launch pad for a proposal by the nephrology community in Uganda to increase dialysis units in the country. This proposal seeks to include hemodialysis services at all 13 regional referral hospitals in the country. There are few trained pathologists in Uganda, so most of the biopsies done are processed abroad by partnering laboratories with turnaround time of about 1–2 weeks.

Currently, there are only five intensive care units (ICUs) that offer hemodialysis, with only one offering both hemodialysis and continuous renal replacement therapy (CRRT). In places without CRRT, hemodynamically unstable patients are offered sustained low-efficiency dialysis (SLED). Intensivists often work closely with nephrologists and will usually not start dialysis without nephrology review.

Salary scales in the government/public facilities are fixed at a starting annual scale of 7500 US dollars and increase as higher-level posting is announced by the public service. In the private sector, this could range between 19,000 and 65,000 US dollars per annum.

Nurses are expected to be the coordinators between the physician and the patient. A nephrology nurse has key tasks in the dialysis room, during ward rounds, in outpatient clinics, and in non-doctor-related reviews. A dialysis nurse may work in the dialysis department of a hospital, a dialysis clinic, or a physician's office. The nurse typically operates an

HD machine, monitors patient vital signs, communicates procedure details with patients, and assesses the effectiveness of procedures, as well as being responsible for cleaning the work area. It is also the responsibility of the dialysis nurse to be sympathetic, caring, patient, positive, and responsible when caring for patients. The terms dialysis nurse and nephrology nurse are often interchangeable; however, a nephrology nurse is involved in all aspects of treatment of patients with kidney problems, including dialysis. The nursing numbers are low for the patients, ranging from three in private hospitals to 18 in the public hospitals. Nurses often work 12-hour shifts, one shift per day and up to five shifts per week with Sunday being an off day for most dialysis units. Only emergency sessions are usually scheduled on Sundays. Most chronic dialysis sessions on average last 4 hours. Exceptions lie within initiation sessions both for chronic and acute HD undertaking 2 hour sessions and very few, especially the hemodynamically unstable, lasting beyond 5 hours. The earliest nonemergency dialysis starts at 1:00 am in the public hospital. The nurse would earn between 3500 and 7000 US dollars per year. Due to a nonexistent transplant program in the country, positions such as transplant coordinator have not been started, but this would be a nephrology nurse with a transplant qualification.

The nephrology social work is usually done by the nephrologist and nurse, but we appreciate that such a position would help in activities such as evaluating for vocational rehabilitation services. This often includes employment, going to school, volunteering within the community, or returning to previously enjoyed activities, providing education and referrals to appropriate resources. Other activities include assisting with keeping or obtaining insurance coverage, assisting patients with understanding their rights and responsibilities, providing supportive counseling, and assisting in informing patients of the importance of treatment participation and advanced directive education, among others. All in all, the workforce is limited in numbers, and this creates a huge case for training, deploying, and capacity building in other areas. Collaborations with partners would go a long way in making this happen.

The Uganda Kidney Foundation – a team of doctors, health scientists, social scientists, and public health experts serving in both public and private facilities – is spearheading the advocacy arm of nephrology services in the country. We have a work plan to ensure at least one nephrologist and one nurse are trained each year to achieve numbers and continue battling the scourge of kidney disease in the country. It is also bringing multidisciplinary professionals, such as social workers, psychologists, dietitians, and physiotherapists, together with NGOs, offering psychosocial support to increase access to holistic care for kidney disease patients.

Highlights of Nephrology in Uganda

Uganda was the first country to demonstrate that quartan malaria causes nephrotic syndrome in a landmark study by Kibukamusoke in 1967 [4]. Since 1996, in our medical school, Dr Edward Kigonya has been promoting the concept of intestinal dialysis. He believed that using laxatives and antibiotics would help in ensuring that the body got rid of some of the uremic toxins when patients could not afford dialysis (unpublished data). Probiotics have now become of great interest in delaying progression of CKD [32].

In March 2019, under the leadership of Dr Joseph Ogavu Gyagenda, the Uganda Kidney Foundation conducted screening for kidney disease at the Uganda parliament, and the healthcare bill for kidney disease was discussed by the parliamentary health committee.

Future Perspectives of Nephrology in Uganda

The future of nephrology in Uganda very much lies in going back to the basics of prevention; screening; training; health financing; improved diagnostics; safe, affordable, and accessible dialysis; an active transplant program; and solid research.

The current annual cost of renal replacement services in Uganda ranges from 3125 to 18,720 US dollars against the average annual salary income range of 1380 to 2400 US dollars rendering renal care inaccessible for the vast majority of the Ugandan population. Worldwide, the establishment of health insurance schemes has translated into better healthcare and growth of healthcare systems. Because health financing is such a bottleneck in healthcare in Uganda, there is a more than urgent need for expedition of all measures to ensure that the country gets a health insurance scheme running in the shortest time possible. Other countries in the region are running national health insurance schemes with big benefits to tertiary care and hence kidney care. This scheme, while being applied to the entire healthcare system, would mobilize enough financial resources to fund preventive, investigative, curative, as well as rehabilitative services related to kidney health. Currently, all the nephrologists and dialysis nurses have had to pursue their specialized training outside the country. This directly translates into higher costs of training, while limiting the number of nephrology caregivers that can be trained at any one time. With the country presently only having a total of ten nephrologists, there is clearly a big need for more training among all care providers in nephrology to address the globally increasing number of patients with CKD stage 5 and those needing dialysis. This

training also needs to address the big need for transplant which the country is beginning to prepare itself for.

As a country, Uganda needs to resurrect its PD services to address care for the pediatric patients as well as those that are unable to afford or take on HD as their preferred mode of RRT [33]. Whereas some locations, such as Hong Kong, have a high prevalence of PD (up to 70%) as a modality of RRT [33], Uganda presently runs absolutely no PD service due to many factors, especially unavailability of supplies and lack of training.

Summarily, the country needs to train nephrologists, transplant surgeons, transplant medical officers and nurses, dialysis nurses and technicians, renal dietitians, social workers, dialysis technical staff, transplant coordinators, clinical research leaders, as well as kidney health advocates. Developing local capacity to train these care providers is certainly the most cost-effective approach, and setting up a kidney institute is perhaps the single way of meeting all these training needs.

Globally, the established risk factors for kidney disease include diarrheal diseases, HIV infection, low birth weight, malaria, and preterm birth and also encompass life course and environmental-, infection-, and lifestyle-related risks [34]. It is also common knowledge that if these risk factors are identified early, AKI and CKD can be prevented. In addition, if CKD is diagnosed early, worsening of kidney function can be slowed or averted by inexpensive interventions, many of which are in the reach of low- and middle-income countries like Uganda. Such interventions include counseling for cardiovascular disease, diabetes, and hypertension, drug therapy, tobacco control, promotion of physical activity, and the reduction of salt intake through legislation and food labeling. The timely identification and management of AKI and CKD represent the most effective strategy to address the growing global burden sustainably [35].

The nephrology fraternity therefore needs to offer guidance to the policy-makers, Ministry of Health, medical education system, and health workers on how to effectively prevent, screen for, and manage kidney disease. We must ensure that adequate resources are allocated to the public health aspect of kidney care so as to reduce the progression to end-stage disease. The Uganda Kidney Foundation has already engaged the Parliament of Uganda in considering improved budgetary support specifically earmarked for renal care, screening being one of the primary objectives.

Our health system needs to deliver quality, safe, accessible, affordable, and sustainable dialysis as a means of managing AKI and CKD and offering an effective dialysis bridge to those being prepared to transplant. Government-led efforts should foster the establishment of more dialysis centers around the country, at least at all regional referral hospitals. This very proposal has been adapted by the Parliament of Uganda starting with the financial year 2019/2020. More dialysis centers will translate into more affordable dialysis as favored by the economies of scale. With the country only meeting a mere 0.04% of its dialysis need, it is very crucial that dialysis becomes more available in the country. An effective dialysis service will feed well-rehabilitated candidates into the transplant program and eventually cut down the cost of long-term renal care.

Despite the absence of a running PD program in the country, the barriers to policy implementation are broadly associated with government policy, economics, provider or healthcare professional education, modality-related factors, and patient-related factors; similar factors are responsible for the low HD prevalence in the country [36]. The country therefore needs to equally invest in a PD program given its comparable health outcomes and relatively cheaper cost.

Presently, the bigger part of the population is unable to access screening and diagnostic services as part of the routine healthcare checkup due to the government stratification of healthcare that puts serum creatinine and urine dipstick at health center IV level, which is at county or municipal level. At the higher level, laboratory and imaging services are sparse only best found at the tertiary facilities within the capital, Kampala. And with only two pathologists with specialized training in nephropathology, whose service provision is moreover presently only limited to light microscopy as immunofluorescence and electron microscopy are unavailable and samples cannot be shipped out due to transportation challenges, our diagnostic capability for glomerular disease is at best limited. Increasing availability and knowledge about screening at the lower-level centers while strengthening the capacity of higher-level centers will boost diagnostics related to kidney disease. The kidney institute would then serve as a one-stop superspecialized center for provision of diagnostic services receiving samples and patients referred from lower units.

With the advance of technology, the future provides more options where the advanced services of a nephrologist, nephropathologist, or other care provider, physically remote from a certain site, may provide the same service by live or recorded means in what has come to be termed telenephrology [37]. Such an approach is not new to medicine, already being employed in several disciplines like radiology, and many nephrologists worldwide are pursuing their ISN Certificate in Nephropathology via live and recorded webinars as well as shared sources.

Conclusion

Uganda is a beautiful country with a growing burden of CKD. The lack of availability of both PD and kidney transplantation is an injustice that needs to be urgently addressed. Emphasis should be placed on disease prevention, and efforts to determine the major risk factors for CKD in this country should be prioritized.

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