Global dialysis perspective: Senegal

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Many countries in sub-Saharan Africa (SSA) face enormous economic and human resource challenges in the management of patients with end-stage renal disease (ESRD) [1]. Dialysis, the most common form of renal replacement therapy in these countries, requires costly equipment [2] and is inaccessible to patients that are poor. This situation is exacerbated by a limited number and busy schedules of dialysis centres. The hemodialysis population rate remains low between 0 and 200 pmh (per million inhabitants) in sub-Saharan Africa, so many patients die without accessing dialysis due to the lack of means. In many countries in SSA, dialysis facilities are unavailable [3,4].

Senegal is a country in West Africa bordered by the Atlantic Ocean to the west, Mauritania to the north, Mali to the east, Guinea and Guinea-Bissau to the south, and the Gambia located within (Figure 1). It covers 196,712 km2 and has 16,209,125 inhabitants [5] with an average density of 82 inhabitants per km2. There is a disparity in the distribution of the population between the 14 administrative regions: Dakar, the capital, constitutes the smallest area and includes 23% of the total population and 75% of the urban population while the south-eastern regions house only 6% of the total population. Young people under 20 represent 55% of the population with an annual growth rate of 3.8%. According to the World Bank, the country has a lower-middle-income classification based on gross national income, which is US$1,410 per capita. Since 1987, patients with End-stage renal disease (ESRD) have been treated with hemodialysis. Only 25 patients were on dialysis in 2004 in the country. There are currently no national data on the incidence of ESRD or these etiologies. However, in the Dakar University Hospital, the causes are dominated by hypertensive nephropathy followed by diabetic nephropathy. There are currently no national mortality data for hemodialysis patients, however infectious and cardiovascular complications are mainly noted as causes of mortality.
**Dialysis: a concern of the authorities**

In Senegal, dialysis is one of the major concerns of the government, due to good awareness and advocacy made by patient associations and health professionals. In recent years with the opening of dialysis centers the care for the patients with ESRD has improved. Dialysis companies compete for government contracts and if they are selected, they deliver machines, manage maintenance, water treatment, and consumables, according to the specifications. Currently there are 26 centers in the country including 22 in the public sector (5 are under construction) and 4 in the private sector. Six public dialysis centres and all 4 private dialysis centres are located in Dakar. There is only one peritoneal dialysis (PD) center that is located in the main university hospital in Dakar. Basic information about dialysis in Senegal was summarized in table1.

**Dialysis: free of charge treatment for the patient in the public sector**

A dialysis session costs US$110 in the private sector. Since 2012, dialysis has been available free of charge in the public sector for all Senegalese patients with ESRD, on the prescription of a nephrologist. This implies the possibility of free hemodialysis or peritoneal dialysis sessions, the possibility of having hemodialysis sessions at a reduced rate in private centres having signed an agreement with the national agency for universal health coverage, and depends on the availability. To benefit from this free treatment, the patient must register on the waiting list in a public dialysis centre. The dialysis session and the hemodialysis kit are free. However, patients pay the costs associated with dialysis, such as antihypertensive drugs, vitamin D, iron and ESA... There are currently 1046 (95.79%) hemodialysis patients and 46 (4.21%) PD patients (Table 1). More than 1000 patients are regularly registered on the different waiting lists in the dialysis centres of the public sector. Over 75% of patients with ESRD die without having access to dialysis due to the lack of available machines. Almost 69.4% of the hemodialysis patients have an arteriovenous fistula [6]. The only vascular surgery department is located in
Dakar. Creation of an arteriovenous fistula and placement of a non-tunneled femoral hemodialysis catheter are done at no cost to the patient. Placement of a tunneled hemodialysis catheter is also free in-hospital, but the catheter must be purchased out-of-pocket by the patient (approximately US$220). The average duration of use of central venous catheters is 7.66 months: for 62.7% of patients, it is a tunneled catheter, for 20.6% a non-tunneled jugular catheter, and for 16.7% it is a non-tunneled femoral catheter [6]. Non-tunneled central catheters were very often complicated by infection (49.09%) due to the lack of financial resources available for the immediate purchase of tunneled catheter. Arteriovenous grafts are infrequently used because of their cost, which is paid by the patient.

**Human resources: a real need**

Senegal currently has 28 nephrologists (including five nephrology professors, three nephrology assistant professors, and two pediatric nephrologists) and 22 Senegalese nephrology trainees. Other than the 3 senior professors of nephrology, the remaining 25 nephrologists have been trained locally with one year of training in western countries mostly in France. The Nephrology Department at the University of Dakar has trained 126 nephrologists from 19 African countries from 2005 to 2019. Each Senegalese public dialysis center is managed by at least one nephrologist. In each center, a head nurse is responsible for administrative organization and care. Head nurses receive specialized education in nephrology and dialysis and graduate after following a two-year curriculum at nursing school. Seventy-three nurses specialized in dialysis have been trained to run dialysis units in Senegal. Hemodialysis units operate 6 days a week for an average of 8 to 12 hours a day. The patients do three weekly sessions of 4 hours in 60% of cases. Incremental dialysis with 2 weekly sessions is applied for 40% of patients. The dialysis adequacy is monitored online during the session by the Kt/V of the dialysis machine, but also by regular biological monitoring of patients every 2 months.
The peritoneal dialysis centre

Senegal is currently the only West African country where PD is available for ESRD treatment. The centre was inaugurated in March 2004 with different modalities (continuous ambulatory peritoneal dialysis (CAPD) and automated peritoneal dialysis (APD)) [7]. Forty-six patients are currently treated with this modality (35 CAPD and 11 APD). The costs associated with PD are borne by the state, but patients pay the associated costs, such as antibiotics, antihypertensive drugs, and erythropoietin. Advocacy efforts have been directed towards the promotion of domestic manufacture which could significantly reduce the cost of dialysis, and translate into substantial financial gain with a larger number of patients receiving treatment [7].

Issues and Challenges

Despite being free, dialysis remains difficult to access because demand far exceeds supply, hence the existence of waiting lists. The government covers the costs of the dialysis sessions. Patient must however pay for their predialysis treatment and their treatment associated with dialysis. Only 20% of patients are covered by insurance (in general, patients working for large companies). The government is making efforts to lower the costs, but these remain astronomical for the local population. Also, hemodialysis centres are mainly located in cities, as in most countries in sub-Saharan Africa, and patients in rural areas have to travel a long distance to access treatment. This imposes an additional financial burden and patients sometimes skip sessions making dialysis inadequate [8]. The average age of dialysis patients is 47 years (range 11 and 85 years). This is a young and productive population, and many of the patients are the main breadwinners [9]. Job losses are also reported upon diagnosis, which makes management difficult.
Patients are generally seen late by a nephrologist, 79% of ESRD patients start unplanned dialysis. Patients do not have free access to other professionals such as dietitians and social workers, that form an integral part of the dialysis service.

Financial challenges remain at the heart of the care of patients with ESRD in Senegal. Even though efforts have been made, there is still important work to be done to improve the life expectancy of dialysis patients and develop peritoneal dialysis. This will require better financial management, a strengthening of the means of prevention and early detection of CKD as well as collaboration between Developed and Developing Countries. Transplantation is the most cost-effective way to manage ESRD in developing countries but has not yet begun in Senegal. A national committee for organ donation and transplantation has just been set up. The first renal transplant in Senegal is planned shortly.

Disclosures

Authors have nothing to disclose.

Acknowledgments

Valerie Luyckx for proofreading the manuscript.

Author Contributions

Abdou Niang: Conceptualization; Data curation; Writing - original draft

Ahmed Tall Lemrabott: Validation; Visualization; Writing - original draft; Writing - review and editing
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Table 1: Basic information about dialysis in Senegal

| Main characteristics                                           | Number or percentage |
|---------------------------------------------------------------|----------------------|
| Number of nephrologists in the country (pmh)                  | 28                   | 1.75                  |
| Number of dialysis patient (total number, per million people in the general population) | 1092                 | 63.5                  |
| Number of hemodialysis patients in the public sector (private) | 846                  | 200                   |
| Percent of patients on hemodialysis (PD patients)             | 95.79%               | 4.21%                 |
| Percent of patients on home dialysis in your country          | 4.21%                |                       |
| Number of dialysis machines (public sector)                  | 311                  | 247                   |
| Number of dialysis units in the country (public sector)       | 26                   | 22                    |
| Number of dialysis units hospital-based (freestanding)        | 21                   | 03 (private)          |
| Number of dialysis units for non-profit (for-profit)         | 22                   | 04 (private)          |
| Number of patients covered by insurance (out-of-pocket expenses) in the private sector | 20                   | 80                    |
| Reimbursement per dialysis session in public sector in $US (private) | 20                   | 110                   |
| Percent of staff who deliver dialysis (dialysis nurses, patient care technicians) | 70%                  | 30%                   |
| Typical patient to RN ratio in the dialysis units             | 6/1                  |                       |
| Average length of a dialysis session                          | 4 hours              |                       |
| How many times per month does a nephrologist see patients during dialysis sessions? | 8                    |                       |
| Proportion of HD patients in the country using an AVF, AVG and CVC | AVF = 69%           |                       |
|                                                                | CVC = 30%            |                       |
|                                                                | AVG = 1%             |                       |
Figure 1: Distribution of Dialysis Centres across regions of Senegal, Functional Dialysis Centres (blue), Dialysis Centres under construction (orange).