Global Dialysis Perspective: South Africa

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Introduction

South Africa is an upper-middle-income country with a population of 59.6 million people (1). Gauteng is the most densely populated province, and houses 26% of the population, followed by KwaZulu-Natal (19%), and the Western Cape (12%). About 29% of the population are <15 years old and 9% are ≥60 years. Approximately 13% of the population are seropositive for HIV. Life expectancy is estimated at 68.5 years for females and 62.5 years for males, whereas the infant mortality rate is 23.6 per 1000 live births. In 2019, the gross national income per capita was approximately $6040 (Atlas method, current US$), with 8% of the country’s gross domestic product spent on health care (2). Despite the transition to democracy in 1994, a high level of inequality remains, reflected in a Gini coefficient of 0.63 and an unemployment rate of 30% (2,3).

This inequality is also reflected in a two-tiered health system. Access to a well-resourced private health care sector depends on the ability to pay for services, usually via medical insurance. Treatment for CKD is included in the set of “prescribed minimum benefits” that all registered medical insurance schemes in South Africa are obliged to provide for their members. The majority of South Africans (84%), however, are dependent on an under-resourced, government-funded, public health care sector. Public health care facilities use a sliding scale, where the fees charged are dependent on income. Indigent patients are able to access services free of charge (4).

Epidemiology

South Africa is faced with a high burden of infectious diseases (such as tuberculosis and HIV infection), non-communicable diseases, maternal and childhood diseases, and injury-related diseases (5). These factors drive an epidemic of AKI and CKD. Two studies have estimated the population prevalence of CKD in South Africa. Adeniyi et al. (6) reported the prevalence among schoolteachers at 6%, and Matsha et al. (7) found CKD in 17% of a geographic cohort in Cape Town.

Although there are no reliable data on the incidence of kidney failure in South Africa, the South African Renal Registry (8) collects data on those patients who are treated with dialysis or kidney transplantation. The registry also provides the data-collection platform for the African Renal Registry (9).

Despite a growing demand for KRT, there are major barriers to its equitable provision, ranging from financial constraints to a lack of infrastructure and human resources. KRT in the public health care sector is strictly rationed, with transplantability a prerequisite for access to treatment. Given the resource limitations and focus on transplantation, patients with serious comorbidities and those over the age of 60 years are seldom admitted to public-sector KRT programs. Some provinces have developed guidelines for the allocation of this scarce resource through a formal process involving patients, ethicists, and other stakeholders (10). Local guidelines on kidney supportive and palliative care have recently been developed (11); these are of particular importance for the many patients who are not able to access KRT.

Hemodialysis

Table 1 summarizes dialysis services in South Africa. The first chronic hemodialysis (HD) clinics were set up in Cape Town and Johannesburg in the 1960s (12). By 1994, 31 KRT centers had been established, with 26 in the public sector, and five in the private sector. Most patients on KRT (56%) had a functioning transplant, 30% were treated with HD, and 15% were on peritoneal dialysis (PD). The overall prevalence in 1994 was 70 per million population (pmp) (13).

Recent trends in KRT provision are illustrated in Figure 1. Currently, the overall KRT prevalence is 183 pmp (8). The prevalence in the public sector has been stagnant and stands at 66 pmp; in contrast, the prevalence in the private sector is more than ten-fold higher at 855 pmp. There are also large disparities in KRT access among provinces (Figure 2), with Mpumalanga and Limpopo the most underserved, and among ethnic groups, with Black South Africans having the lowest prevalence (126 pmp) (8).

HD is the predominant KRT modality for prevalent patients in both public and private sectors (41% and 84%, respectively), with 87% of all patients on chronic dialysis receiving HD. The demographic and clinical characteristics of South African patients on KRT are summarized in Table 2. As a result of the criteria applied in the public sector, patients on KRT in this sector are much younger than those in the private sector.
There are now 278 centers offering KRT in South Africa, of which 248 (89%) are in the private sector. Dialysis units in the public sector are hospital based, whereas there is a mix of hospital-based and freestanding units in the private sector. Several public-private initiatives have been established, which involve private HD units treating public-sector patients, improving their access to KRT. Home HD is not widely used.

The South African Renal Society has published guidelines on chronic dialysis (16), which cover the staffing and supervision of dialysis units, dialysis dosing and prescription, laboratory tests, infection control, and water-quality standards. Most patients receive thrice-weekly dialysis sessions of 4 hours duration, using high-flux membranes and bicarbonate as a buffer. Dialyzer reuse is no longer practiced. Erythropoiesis-stimulating agents and intravenous iron are readily accessible, but access to noncalcium-containing phosphate binders, calcimimetics, and convective dialysis therapies remains limited. Approximately half of the patients are dialyzed via an arteriovenous fistula, one third via a tunneled catheter, and the remainder via either an arteriovenous graft or a temporary catheter (12,14).

### Table 1. Dialysis services in South Africa

| Characteristic                                      | Value                                                                 |
|----------------------------------------------------|-----------------------------------------------------------------------|
| Number of dialysis patients in South Africa (December 2017 data) | Total, 8881 (157 per million population)                               |
|                                                    | HD, 7682                                                              |
|                                                    | PD, 1199                                                              |
| Percentage of patients on home dialysis            | PD in 14% of patients on dialysis; very few on home HD                |
| Are all dialysis sessions covered by insurance, or do patients have out-of-pocket expenses? | Public: costs fully covered by government for indigent patients, income-based sliding scale for other patients |
|                                                    | Private: fully covered by medical insurance schemes as part of the “prescribed minimum benefits” |
| Number of treatment centers                        | Total, 278; public, 29; private, 249                                  |
| Hospital-based or freestanding dialysis units      | Hospital based in the public health care sector; both types in the private sector |
| Are the dialysis units for profit or nonprofit?    | Public sector is nonprofit; private sector is for profit              |
| Approximate cost per dialysis session in US$?      | Public, US$100; private, US$150                                       |
| Are all of the staff who deliver dialysis nurses, or do you also use patient care technicians? | Mainly dialysis nurses but also technologists                          |
| Typical patient/nurse ratio in the dialysis units  | 4:1                                                                  |
| Average length of a dialysis session               | 4 h (thrice weekly)                                                   |
| Vascular access for patients on HD                 | AV fistula, 51%; tunneled catheter, 33%; AV graft, 7%; temporary HD catheter, 6% |

Source: South African Renal Registry (8,14). HD, hemodialysis; PD, peritoneal dialysis; AV, arteriovenous.

**Figure 1.** Incident and prevalent patients on KRT in South Africa from 2012 to 2017, by health care sector. Data supplied by the South African Renal Registry.
PD

In South Africa, PD features prominently as a treatment modality for kidney failure. The dialysate is manufactured locally and delivered via country-wide distribution networks. It has been estimated that South Africa accounts for 85% of patients on PD in Africa (17). PD is the treatment modality for 11% of patients on KRT, and for 14% of those on dialysis. It is more commonly used in the public sector, where PD is used in 26% of patients on KRT and in 39% of those on dialysis. A “PD-first” approach is often used in public-sector units due to limited numbers of HD slots, and the inability of many rural patients to access HD facilities. The use of PD as the first KRT modality in the public sector has been reported at 57% (18). PD catheters are often inserted at the bedside and around half of South African nephrologists report competence at this skill (15).

Continuous ambulatory PD is the predominant form of PD, with most patients performing four 2-L exchanges per day. The proportion of patients on PD who use continuous ambulatory PD is around 90% in the public sector (19) and 70% in the private sector. Automated PD is more often used in the private sector (30%) and in approximately 65% of pediatric patients in both public and private sectors (personal communication with senior pediatric nephrologists).

Peritonitis is the leading cause of technique failure in patients on PD (19–21). Peritonitis rates (0.82–0.87 events per patient-year), although still higher than the International Society for Peritoneal Dialysis recommendation of no more than 0.5 events per patient-year, have been declining steadily over the past 15 years (12).

Transplantation

South Africa has a long history of organ transplantation, with our first kidney transplant performed in Johannesburg in 1966 and the world’s first human heart transplant performed in Cape Town in 1967. The bulk of the country’s kidney transplants are performed in the provinces of Gauteng and the Western Cape, and approximately half of organs are from deceased donors. There has been a steady increase in the number of kidney transplants performed in the private sector but, disappointingly, there is a declining trend in the public sector. The current annual rate of kidney transplantation is low (4.6 pmp), with barriers including a lack of human and other resources, inadequate policies, and attitudes of the public and some health care workers to organ donation (12,22).

Outcomes

The survival of South African patients on KRT is comparable with that in better-resourced countries. Jardine et al.
Regarding quality of life (QOL), Tannor et al. (23) reported that patients on PD experience a heavier burden of symptoms and psychosocial difficulties when compared with those on HD. Mbeje and Mtshali (24) highlighted the loss of financial independence, anxiety, and geographic remoteness as major contributors to poor QOL among patients on dialysis. Okaka et al. (25,26) found that patients on PD in Johannesburg had better QOL scores if they were <30 years of age, had a duration on PD of <4 years, and reported higher incomes.

(18) recently analyzed South African Renal Registry data and reported 1-year survival of 90% in incident patients. There was no difference in survival between patients treated in the private and public health care sectors, even after using multivariable analysis to adjust for differences in case mix. Higher mortality was associated with older age, province of residence, and the primary kidney disease diagnosis. Neither first KRT modality, health care sector, diabetes, nor ethnicity were independently associated with survival; the effect of HIV infection was unclear.

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Human Resources

Nephrology teams in South Africa typically comprise nephrologists, nurses, technologists, surgeons, dietitians, and social workers. Dialysis units are generally supervised by nephrologists or specialist physicians/pediatricians with experience in nephrology. The South African Renal Society recommends a nurse/patient ratio of 1:4 and having an experienced registered nurse present in the HD unit at all times (16). The study by Hassen et al. (15) revealed a dearth of nephrologists, with a density of 2.5 pmp, much lower than the median for upper middle-income countries of 10.8 pmp. Their distribution is inequitable, with 90% working in three of the nine provinces, and 60% of the adult nephrologists based in the private sector. South African nephrologists are generally positive about their chosen profession, but challenges include excessive workloads and unsatisfactory remuneration, which contribute to the threat of a “brain drain” (15).

Current and Future Challenges

Our limited nephrology resources have been put to the test during the ongoing coronavirus disease 2019 pandemic. An early and strict nationwide lockdown allowed us time to prepare, and our medical and nephrology services have largely proved to be resilient. The peak of the pandemic has now passed, and most lockdown restrictions have eased.

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Table 2. Characteristics of South African prevalent patients on KRT (data from 2017, n=10,744)

| Characteristic                               | N and/or %          |
|----------------------------------------------|---------------------|
| Health care sector, n (%)                    |                     |
| Private                                       | 7562 (71)           |
| Public                                        | 3162 (29)           |
| Age in yr, median (IQR)                      |                     |
| All patients                                  | 52.6 (41.8–62.3)    |
| Public sector                                 | 44.3 (34.2–53.2)    |
| Private sector                                | 55.9 (46.2–65.2)    |
| Male (%)                                      | 60                  |
| Ethnicity, % (prevalence per million population) |                     |
| Black                                         | 52 (126)            |
| White                                         | 18 (442)            |
| Mixed ancestry                                | 16 (354)            |
| Indian/Asian                                  | 12 (897)            |
| KRT modality, n (%)                           |                     |
| HD                                            | 7682 (72)           |
| PD                                            | 1199 (11)           |
| Transplant                                    | 1863 (17)           |
| Primary kidney disease diagnosis (%)          |                     |
| Hypertensive kidney disease                   | 35                  |
| Etiology unknown                              | 32                  |
| Diabetic nephropathy                          | 15                  |
| Glomerular disease                            | 10                  |
| Cystic kidney disease                         | 3                   |
| Province, n (%)                               |                     |
| Gauteng                                       | 3608 (34)           |
| Western Cape                                  | 2283 (21)           |
| KwaZulu-Natal                                 | 2064 (19)           |
| Eastern Cape                                  | 1013 (9)            |
| Free State                                    | 578 (5)             |
| North West                                    | 424 (4)             |
| Limpopo                                       | 391 (4)             |
| Mpumalanga                                    | 254 (2)             |
| Northern Cape                                 | 129 (1)             |
| Viral seropositive rate (%)                   |                     |
| HIV                                           | 10                  |
| Hepatitis B                                   | 2                   |
| Hepatitis C                                   | 0.8                 |

Source: South African Renal Registry (8). IQR, interquartile range; HD, hemodialysis; PD, peritoneal dialysis.

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