The Ghana Renal Registry – a first annual report

Vincent Boima1,2, Elliot K Tannor3,4, Charlotte Osafo1, Yaw Asante Awuku5, Michael Mate-Kole1, M Razeen Davids6, Dwomoa Adu1

1University of Ghana Medical School, University of Ghana, Accra, Ghana; 2Korle-Bu Teaching Hospital, Accra, Ghana; 3School of Medical Sciences, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana; 4Komfo Anokye Teaching Hospital, Kumasi, Ghana; 5Cape Coast Teaching Hospital, Cape Coast, Ghana; 6Division of Nephrology, Stellenbosch University and Tygerberg Hospital, Cape Town, South Africa.

ABSTRACT

There are few data on the treatment of kidney disease in sub-Saharan Africa and no formal reports of kidney replacement therapy (KRT) in Ghana. We report data from the newly established Ghana Renal Registry on the prevalence, causes, and modality of treatment of kidney disease in Ghana. Using the web-based data capture system of the African Renal Registry, data were obtained for patients who had KRT in Ghana between January and December 2017. A total of 201 patients started KRT, giving an incidence rate of 6.9 per million population (pmp). There were 687 patients on KRT, a prevalence rate of 23.6 pmp. The median age of prevalent patients was 45.5 years and 63.6% were male. Hypertensive kidney disease was the most common primary kidney disease, reported in 39.9%. The overwhelming majority of patients (96.2%) were treated with haemodialysis, 3.5% had a kidney transplant, and only two were on continuous ambulatory peritoneal dialysis. The incidence and prevalence of KRT-treated kidney failure in Ghana is low, and the patients are younger than those on KRT in high- and upper-middle-income countries. The major cause of kidney failure is hypertensive kidney disease and the vast majority of the patients are treated with haemodialysis.

Keywords: end-stage kidney disease; kidney failure; renal registry; kidney replacement therapy; Ghana.

INTRODUCTION

The increasing prevalence of non-communicable diseases combined with a high prevalence of communicable diseases threatens the lives of many people in sub-Saharan Africa (SSA) and is likely to overwhelm the already inadequate health budgets of most African countries. Chronic kidney disease (CKD) is common in SSA, with systematic reviews estimating the prevalence in adults to be between 13.9% and 15.8% [1,2]. In Ghana, the CKD prevalence is comparable at 13.3% [3]. Patients with CKD are at increased risk of developing kidney failure as well as cardiovascular disease, which is associated with increased morbidity and mortality.

There are few data on the incidence of kidney failure in SSA, but one study estimates this to be 239 per million population (pmp) in patients with diabetes mellitus and hypertension [4]. Most Africans who develop kidney failure are not able to access chronic dialysis and transplantation services. According to a recent systematic review, approximately half of the patients so affected had at least one dialysis session, but only 10% were able to continue dialysis beyond three months and only 1% continued dialysis for one year [5].

The major causes of kidney failure in Africa include hypertensive kidney disease, glomerulonephritis, diabetes, and HIV infection [6-10]. Renal registries that provide data on the burden of kidney failure, its treatment modalities and outcomes are critical to the planning and delivery of effective services for KRT. With the exception of

Received 19 February 2021; accepted 6 June 2021; published 01 July 2021.
Correspondence: Vincent Boima; vboima@ug.edu.gh.
© The Author(s) 2021. Published under a Creative Commons Attribution 4.0 International License.
South Africa [11], there are few active renal registries in Africa. To address this deficiency, the African Association of Nephrology (AFRAN), at its 2013 Congress in Accra, Ghana, took the decision to establish a renal registry for Africa. The African Renal Registry was formally established at a workshop held just before the World Congress of Nephrology in Cape Town, in 2015 [12]. Arising from this initiative, the Ghana Renal Registry was established in 2016 and here we report its first set of data, from 2017.

METHODS

This was a prospective survey of all patients on KRT in Ghana between 1 January and 31 December 2017. We used the web-based data capture platform of the African Renal Registry, developed by the South African Renal Registry [12], which resides on a Windows 10 server, runs Windows Internet Information Services (IIS) and uses HyperFileSQL as its relational database engine. Data capturers interface with the database via user-friendly web pages. Password protection ensures that treatment centres have access to their own data only. Data files are backed up daily and the full registry application is backed up weekly. Quality control is built into the system through logical checks, form field validation, and the use of controls such as checkboxes, radio buttons and drop-down lists, and limiting the number of fields which allow the entry of free text.

The following core data were collected on each patient: region, dialysis centre, unique identification number and name, date of birth, sex, ethnicity (tribe), primary kidney disease, date KRT started, first modality of treatment, current modality, sector (private or public), diabetes mellitus status (non-diabetic, type 1 or 2 diabetes mellitus, post-transplant diabetes mellitus), hepatitis B, hepatitis C, and HIV status. The African Renal Registry uses the latest set of diagnostic codes of the ERA–EDTA Registry [13]. Data were extracted from patient records and entered directly into the registry.

Numerical data have been summarised using means and standard deviations if normally distributed, and medians and interquartile ranges (IQR) if not. Counts and percentages have been used for categorical data. In keeping with the descriptive nature of this report, statistical tests for differences between groups have not been performed.

Ethics approval, including a waiver of individual informed consent, was obtained from the Ghana Health Service Research Ethics Committee.

RESULTS

Ghana in 2017

Ghana is a lower-middle-income country and had a gross national income per capita for 2017 by the Atlas method (current US$) of $1 890 and by the purchasing power parity (PPP) method (current international US$) of $4 860 [14]. The Ghanaian health system includes public institutions under the Ghana Health Service, teaching hospitals which are controlled by the Ministry of Health, and several private health centres mostly situated in the urban areas. The population in 2017 was estimated at 29.1 million [15]. Of the 16 regions in Ghana, most of these hospitals and health centres are located in two main regions (greater Accra and Ashanti), where most patients with kidney disease receive their care.

Treatment centres

Only five of the 16 regions in Ghana have dialysis centres, namely Greater Accra, Ashanti, Northern, Central and the Volta Region (Figure 1). Seven treatment centres out of a total of nine which were operating in 2017 contributed data for this report; four in the public healthcare sector and three in the private sector. These centres reported on all patients under their care in 2017. The two centres that did not submit data had a total of fewer than 50 patients on dialysis. The omission of data from these units gives at most a 7.3% variation in the incidence and prevalence data presented in this report. Most patients (83.4%) were treated in public sector centres. All trained nephrologists are in two teaching hospitals and have oversight responsibility for some of the dialysis centres.

Incidence and prevalence of kidney replacement treatment

There were 201 patients who started KRT for the first time in 2017, an incidence rate of 6.9 pmp. The total number of patients on KRT in 2017 was 687, a prevalence of 23.6 pmp.

Treatment modality

Of the patients on KRT, 661 (96.2%) were on haemodialysis, and only two patients were being treated with peritoneal dialysis (0.3%). There were 24 patients (3.5%) with a functioning kidney transplant.

Demographics

The sex distribution of the patients on KRT reflected a male predominance (63.6%). The prevalence was 30.6 pmp in males and 16.4 pmp in females. Patients were
generally young, with a median age of 45.5 years (IQR 33.6–55.6 years). The age distribution is shown in Figure 2. Female patients were younger than their male counterparts, with median ages of 41.6 years (IQR 29.1–54.6 years) and 46.8 years (IQR 37.2–56.4 years), respectively. The median age of patients treated in private sector units (51.5 years, IQR 39.8–61.0 years) was higher than in patients in the public sector units (43.8 years, IQR 32.9–54.6). The median duration of time on dialysis was 25.4 months with an interquartile range of 10.5–44.5 months.
causes of kidney failure

The most common cause of kidney failure (Table 1) was hypertensive kidney disease, reported in 37.8%, followed by kidney failure of uncertain cause in 28.5%, diabetic nephropathy in 9.2%, and glomerulonephritis in 7.7%. HIV infection was present in 3.8% of the patients, 3.9% were hepatitis B surface antigen positive, and 0.8% were hepatitis C antibody positive.

**Table 1. Causes of kidney failure in patients receiving kidney replacement therapy in Ghana.**

| Cause                           | Male No. (%) | Female No. (%) | All No. (%) |
|---------------------------------|--------------|----------------|-------------|
| Hypertensive kidney disease     | 187 (42)     | 73 (31)        | 260 (38)    |
| Diabetic nephropathy            | 34 (8)       | 29 (12)        | 63 (9)      |
| Glomerulonephritis              | 29 (6)       | 24 (10)        | 53 (8)      |
| Uncertain or not stated         | 133 (30)     | 63 (27)        | 196 (29)    |
| Cystic kidney disease           | 3 (1)        | 2 (1)          | 5 (1)       |
| Obstruction or reflux disease   | 4 (1)        | 3 (1)          | 7 (1)       |
| Sickle cell disease             | 0            | 2 (1)          | 2 (0)       |
| SLE*                            | 0            | 3 (1)          | 3 (0)       |
| HIV                             | 20 (4)       | 6 (3)          | 26 (4)      |
| All others                      | 41 (9)       | 31 (13)        | 72 (11)     |
| Total                           | 451          | 236            | 687         |

*Abbreviations: SLE, systemic lupus erythematosus; HIV, human immunodeficiency virus.

**DISCUSSION**

In 2017, the incidence rate of patients starting KRT in Ghana was 7 pmp, which was much lower than the rate of 26 pmp reported in South Africa [8] and 127 pmp in Europe [16]. The prevalence of KRT in Ghana was 24 pmp and again this was much lower than the 183 pmp reported from South Africa [8] and the 854 pmp reported from Europe [17]. The low rates of KRT in Ghana are likely to reflect the situation in many African countries where
inadequate resources for health care limit the provision of KRT. Most Ghanaian patients with kidney failure pay out of pocket for dialysis, putting KRT out of reach for most patients. Using data on the prevalence of diabetes and hypertension, Anand and colleagues have modelled the incidence of kidney failure in SSA, estimating it at 239 pmp [4]. In Ghana, this would translate into a substantial shortfall, with only 2.9% of patients needing KRT being treated.

It is not clear why many more males than females received KRT. We speculate that this may be because women are disadvantaged in terms of accessing KRT in Ghana, although we have no evidence to support this. Alternatively, fewer women may develop kidney failure in Ghana. Future studies will examine these possibilities. Similarly, more males than females started KRT in the United Kingdom in 2016 (males 62.9%) [18], South Africa (59.2 %) [8] and Europe (62%) [17]. A review by Carrero et al. in 2018 speculated that the protective effect of oestrogen on kidney function in women and the damaging role of testosterone in men might account for the higher proportion of men starting dialysis [19]. Further reasons are an unhealthy lifestyle in men and also that elderly women tended to choose conservative treatment more readily than men [19].

The patients on KRT in Ghana are young individuals, and even younger than reported from South Africa (median age of 45.5 versus 51.5 years) [8]. They are much younger than the average age of patients in the United Kingdom (64.3 years) [18] and Europe (63.1 years) [17]. Kidney failure in Ghana is thus a disease of young, economically active people. Females on KRT were significantly younger than males; the reasons for this are unclear.

The principal reported cause of kidney failure was hypertensive kidney disease, followed by diabetes and glomerulonephritis. In Ghana, the prevalence of hypertension has risen from 4% in rural areas and 13% in urban areas in the 1970s, to 24–27% and 33% in the 2000s, respectively [20]. Osafo et al. reported an overall CKD prevalence in Ghanaian patients with hypertension of 47% [21]. The high prevalence of hypertensive kidney disease we are reporting in patients on KRT is comparable to that of South Africa (35%) [8] and other African regions (17–35%) [6, 7, 22, 23] but much higher than the 6% reported by the UK Renal Registry [18]. The ERA–EDTA Registry reported that 12% of prevalent patients had hypertensive kidney disease [16]. In 1993, we reported an autopsy study in which hypertensive kidney disease was the cause of kidney failure in 49% of cases [24]. We now know that two apolipoprotein L1 (APOL1) susceptibility gene variants (G1 and G2) are associated with hypertension-attributed CKD, focal segmental glomerulosclerosis and HIV-associated nephropathy in individuals of African ancestry [25–28]. The currently available evidence suggests that many patients with “hypertensive kidney disease” may have undiagnosed glomerular disease with secondary hypertension, rather than kidney disease resulting from primary hypertension [29].

Our report identifies diabetes mellitus as another major cause of kidney failure in Ghana. Interestingly, there were no cases of diabetic nephropathy reported in the autopsy series from 1993 [24]. Other studies from SSA also report diabetic nephropathy as an important cause of kidney failure in 4% to 15% of cases [6-8,10,22]. The prevalence of diabetes in Ghana has increased from less than 1% in the 1960s [30] to 6% in the 2000s [31]. The same pattern is seen in other African countries [32].

Glomerulonephritis was reported as the cause of kidney failure in 8% of our cases, lower than expected. We previously demonstrated histologically proven glomerulonephritis, mostly focal segmental glomerulosclerosis, in 42% of patients in the 1993 autopsy study [24]. The low prevalence of glomerulonephritis in the present study is probably because most patients presented late, with advanced CKD, and did not have a kidney biopsy. A high proportion of our patients therefore have kidney failure of uncertain aetiology. Future registry reports will analyse these patients in more detail. HIV infection was found in 4% of our patients; in contrast, in 1993, there were no cases of HIV recorded in our autopsy study. The national prevalence of HIV infection in Ghana in 2017 was 2% [33].

Limitations and challenges

For this first round of data collection, data were available from only seven of the nine dialysis units. Almost all patients presented late and required dialysis treatment on admission. This made it difficult to ascertain the cause of kidney failure reliably. The cause of the kidney failure was based on the clinical assessment of the attending physician as there were very few biopsies done. We did not analyse laboratory data for this report and do not yet have sufficient follow-up data to comment on survival and prognosis.

CONCLUSIONS

This first report of the Ghana Renal Registry provides much-needed data on the treatment of kidney failure in Ghana. Subsequent reports will include coverage of a greater number of regions and will report on important outcomes such as patient survival.
Acknowledgements

The funding of the registry was supported by the Ghana Kidney Association. We thank the South African Renal Registry and the African Renal Registry for providing access to the data capture platform and we thank Portia Antwi of the Ghana Renal Registry for assistance with data collection.

We gratefully acknowledge the contribution of our colleague and collaborator on this project, Jacob-Plange Rule, who sadly passed away in April 2020.

REFERENCES

1. Stanifer JW, Jing B, Tolan S, Helmkie N, Mukerjee R, Naicker S, Patel U. The epidemiology of chronic kidney disease in sub-Saharan Africa: a systematic review and meta-analysis. Lancet Glob Health. 2014; 2(3):e174-e181.

2. Kaze AD, Iliam T, Jaar BG, Echouffo-Tcheugui JB. Burden of chronic kidney disease on the African continent: a systematic review and meta-analysis. BMC Nephrol. 2018; 19(1):125.

3. Adjei DN, Stronks K, Adu D, Beune E, Meeks K, Smeeth L, et al. Chronic kidney disease burden among African migrants in three European countries and in urban and rural Ghana: the RODAM cross-sectional study. Nephrol Dial Transplant. 2018; 10:1812-1822.

4. Anand S, Bitton A, Gaziano T. The gap between estimated incidence of end-stage renal disease and use of therapy. PLOS ONE. 2013; 8(8):e72860.

5. Ashuntantang G, Osofo C, Olowu WA, Arogundade F, Niaam N, Porter J, et al. Outcomes in adults and children with end-stage kidney disease requiring dialysis in sub-Saharan Africa: a systematic review. Lancet Glob Health. 2017; 5(4):e408-e417.

6. Ulasi I, Iomu CK. The enormity of chronic kidney disease in Nigeria: the situation in a teaching hospital in South-East Nigeria. J Trop Med. 2010; 501957.

7. Arogundade FA, Sanusi AA, Hassan MO, Akinsola A. The pattern, clinical characteristics and outcome of ESRD in ille- Nigeria: is there a change in trend? Afr Health Sci. 2011; 11(4):594-601.

8. Davids MR, Jardine T, Marais N, Jacobs C. South African Renal Registry 2016. Afr J Nephrol. 2018; 21(1):61-72.

9. Ekrinpo UE, Kengne AP, Bello AK, Effa EE, Noubiap JJ, Salako BL, et al. Chronic kidney disease in the global adult HIV-infected population: a systematic review and meta-analysis. PLOS ONE. 2018; 13(4):e0195443.

10. Davids MR, Benghamn Gharbi M. Global considerations in kidney disease: Africa. In Brenner & Rector’s The Kidney, 11th edition. Philadelphia, PA: Elsevier; 2019. pp 2493-2516.

11. Davids MR, Jardine T, Marais N, Jacobs J, Mathews H. South African Renal Registry Annual Report 2018. Afr J Nephrol. 2020; 23:185-196.

12. Davids MR, Eastwood JB, Selwood NH, Arogundade FA, Benghanem Gharbi M, et al. Renal registry for adults and children: a key step in Africa. Clin Kidney J. 2016; 9:162-167.

13. Venkat-Raman G, Tomson CR, Gao Y, Comel R, Stengel B, Gronhagen-Riska C, et al. New primary renal diagnosis codes for the ERA-EDTA Nephrol Dial Transplant. 2012; 27:441-444.

14. Ghana. The World Bank. Available from: https://data.worldbank.org/indicator/NY.GNP.PCAP.CD?locations=GH and https://data.worldbank.org/indicator/NY.GNP.PCAP.PP.CD?locations=GH. Accessed 17 June 2021.

15. World Population Prospects 2017. United Nations. Available from: https://population.un.org/wpp/Download/Standard/Population/. Accessed 17 June 2021.

16. Kramer A, Boenink R, Noordzij M, Bosdriess J, Ster VL, Beltrán P, et al. The ERA-EDTA Registry Annual Report 2017: a summary. Clin Kidney J. 2020; 13:693-709.

17. Kramer A, Pippins M, Noordzij M, Ster V, Aventakis N, Ambuhi PM, et al. The European Renal Association – European Dialysis and Transplant Association (ERA-EDTA) Registry Annual Report 2015: a summary. Clin Kidney J. 2018; 11:108-122.

18. Hole B, Gilg J, Casula A, Methven S, Castledine C. Chapter 1 UK renal replacement therapy adult incidence in 2016: national and centre-specific analyses. Nephron. 2018; 139(Suppl1):13-46.

19. Carrero JJ, Hecking M, Chnesaye NC, Jager KJ. Sex and gender disparities in the epidemiology and outcomes of chronic kidney disease. Nat Rev Nephrol. 2018; 14:151-164.

20. Addo J, Ayegyem C, Smeeth L, de-Graft Aikins A, Edusei AK, Ogedegbe O. A review of population-based studies on hypertension in Ghana. Ghana Med J. 2012; 46(2 Suppl):4-11.

21. Osofo C, Mate-Kole M, Affram K, Adu D. Prevalence of chronic kidney disease in hypertensive patients in Ghana. Ren Fail. 2011; 33:388-392.

22. El Minshawy O. End-stage renal disease in the El-Minia Governorate, upper Egypt: an epidemiological study. Saudi J Kidney Dis Transpl. 2011; 22:1048-1054.

23. Banaga AS, Mohammed EB, Siddiq RM, Salama DE, Elbashir SB, Khojali MO. et al. Causes of end-stage renal failure among haemodialysis patients in Khartoum State/Sudan. BMC Res Notes. 2015; 8:502.

24. Matekole M, Affram K, Lee SJ, Honig AJ, Michael J, Adu D. Hypertension and end-stage renal failure in tropical Africa. J Hum Hypertens. 1993; 7:443-446.

25. Tzur S, Shemer R, Yudkovsky G, Selig S, Tarekken A, Bekele E, et al. Misense mutations in the APOL1 gene are highly associated with end-stage kidney disease risk previously attributed to the MYH9 gene. Hum Genet. 2010; 128:345-350.

26. Genovese G, Friedman DJ, Ross MD, Lecondor L, Uzuerue P, Freedman BL, et al. Association of trypanolytic APOL1 variants with kidney disease in African-Americans. Science. 2010; 329:841-845.

27. Ulasi I, Tzur S, Wasser WG, Shemer R, Kruzel E, Feiglin E, et al. High population frequencies of APOL1 I risk variants are associated with increased prevalence of non-diabetic chronic kidney disease in the Igbo people from South-Eastern Nigeria. Nephron Clin Pract. 2013; 123:123-128.

28. Kasembeli AN, Duarte R, Ramsay M, Mosiane P, Dickens C, Dix-Beer T, et al. APOL1 risk variants are strongly associated with HIV-associated nephropathy in Black South Africans. J Am Soc Nephrol. 2015; 26:2882-2890.

29. Freedman BL, Limou S, Ma L, Kopp JB. APOL1-associated nephropathy: a key contributor to racial disparities in CKD. Am J Kid Dis. 2018; 72(5 Suppl 1):58-16.

30. Dodu SR. Diabetes in the tropics. Br Med J. 1967; 2(5554):747-750.

31. Asamoah-Boaheng M, Sarfo-Kantanka O, Tuffour AB, Eghan B, Mbanya JC. Prevalence and risk factors for diabetes mellitus among adults in Ghana: a systematic review and meta-analysis. Int Health. 2019; 11:83-92.

32. Atun R, Davies JI, Gale EAM, Barnighausen T, Beran D, Kengne AP, et al. Diabetes in sub-Saharan Africa: from clinical care to health policy. Lancet Diabetes Endocrinol. 2017; 5:622-667.

33. Ghana AIDS Commission. National and sub-national HIV and AIDS estimates and projections. Available from: www.ghanaids.gov. Accessed 17 June 2021.