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Socio-Demographic and Clinical Profiles of End-Stage Renal Disease Patients Undergoing Haemodialysis in Gaborone, Botswana

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Abstract

Background

Chronic kidney disease has been on the rise worldwide as well as in sub- Saharan Africa. End-stage renal disease (ESRD) is a major public health problem worldwide and is associated with significant morbidity and mortality. There is a dearth of data on the epidemiology of ESRD patients on renal replacement therapy in sub-Saharan Africa including Botswana.

Aim

To describe the socio-demographic and clinical profiles of ESRD participants on haemodialysis by gender and HIV status in Botswana.

Methods

A cross sectional study involving participants undergoing maintenance haemodialysis in three centers was conducted between February and June 2019. Data was analysed using Stata 14 statistical software. Chi-square test, Fisher's exact test and t-test were used to determine association between socio-demographic/clinical characteristics and gender/HIV status.

Results

Overall, 107 participants were enrolled and 65.4% were males. Their mean age± standard deviation at the time of initiation of haemodialysis was 47.5±13.0 years. The prevalence of HIV-infection, diabetes mellitus and hypertension were 24.3%, 26.2% and 90.7%, respectively. The regular use of traditional medicine was ascertained in 43.9% of participants. HIV-infection was significantly associated with hypertension (p=0.04) and low body mass index (p<0.01). Reported use of traditional herbal medicine was a significant associated factor among males (p= 0.01). Unemployment rate among participants was 41.1%, with 54.5% of these participants attributing their unemployment to ill health, with women significantly more affected than men (p=0.04).

Conclusion

Hypertension was the most common associated factor among our study participants. Participants on maintenance haemodialysis in our study were mostly males. Traditional herbal medicine use was significantly more common in men whereas female participants appeared to have higher prevalence of obesity compared to male counterparts. HIV-infected participants were significantly more likely to have low body mass index and be hypertensive. Women were significantly more likely to be unemployed due to ill health as compared to men. Prospective studies with large sample sizes are recommended to help understanding the role of individual associated factors in causing ESRD in Botswana and similar settings in sub-Saharan Africa.

Keywords: *End stage renal disease, Haemodialysis, Gender, Human Immune Deficiency Virus, Botswana.*

Introduction

Chronic kidney disease (CKD) has been on the rise worldwide as well as in sub- Saharan Africa (SSA) (1). The global prevalence of CKD was estimated to be 9.1% in 2017, an increase of 29.3% since 1990 (2). In SSA a systematic review and meta-analysis on the epidemiology of CKD found an overall prevalence of 13.9%. End-stage renal disease (ESRD), a common final pathway of CKD is a major public health problem worldwide and is associated with significant morbidity and mortality (3). The rise of the prevalence of ESRD expected over the next decades is driven by population aging, increasing prevalence of diabetes mellitus and hypertension (4, 5), poverty (6) and communicable diseases such as HIV and viral hepatitis which are more prevalent in Africa (7-9). The rise of ESRD is expected to be more marked in developing countries including SSA, as most of the communicable and non-communicable diseases are disproportionally on the rise (10). Botswana has one of the highest prevalence of HIV-infection in the world at 20.3%; this being the fourth highest only below South Africa, Lesotho and Eswatini (11). On the other hand, the majority of patients with HIV-infection are virologically suppressed (12) and live longer with increased risk of non-communicable diseases like diabetes and hypertension, which lead to CKD and ultimately ESRD. In Botswana, a study on patients admitted in adult medical ward of a tertiary hospital found a CKD prevalence of 16.3% and HIV-infection, hypertension and diabetes were significantly associated with CKD; with HIV-infection remaining significant in multivariate analysis (13). More than three quarters of those admitted with CKD already had ESRD (13).

Although data are increasingly being published characterizing the burden of CKD in SSA (1, 14), the profile of ERSD, has yet to be optimally described in most SSA settings including Botswana. On the other hand, nephrology services are not widely available and are mostly marred by severe shortage of human resources the SSA region. During the period when this study was conducted, Botswana had only three nephrologists who were all based in the capital city, Gaborone. In 2012, there were 34 patients on peritoneal dialysis at Princess Marina Hospital and a total of 21 on haemodialysis at private dialysis centres in Gaborone (15). In 2015, there were more than 300 patients being followed up at Princess Marina Hospital with a third of them on peritoneal dialysis, whereas the rest were on haemodialysis (16). All the patients were receiving haemodialysis services in private dialysis centers with the cost covered by Government of Botswana. Patients undergoing chronic haemodialysis

provide a great opportunity for characterising ESRD in a manner that may provide a profile of the situation in Botswana. The purpose of this study was to describe the epidemiology of ESRD patients on chronic haemodialysis in Botswana by comparing their socio-demographic and clinical profiles based on gender and HIV status.

Methodology

Study design and setting

A cross sectional study was conducted from 1st February 2019 to 30th June 2019 among patients on maintenance haemodialysis in Gaborone, Botswana. We anticipated data collection to be completed within two months, however it took longer because data was collected by the first author who could only spare data collection time to weekend and off days as she had work/employment commitments. Participants for this study were enrolled from three private haemodialysis centers in Gaborone (South East), which is the capital city of Botswana. The haemodialysis centers are Renal Care Institute (RCI) which is located adjacent to Princess Marina Hospital, the main tertiary hospital in the country. Other haemodialysis units are based in the two private hospitals namely Gaborone Private Hospital and Bokamoso Private Hospital.

Study population

The study population was obtained from the three haemodialysis centres mentioned above. It comprised of all ESRD patients on maintenance haemodialysis (≥3 months). All the patients equal or above 21 years of age (consenting age in Botswana at the time the study was conducted) (17) who gave consent to participate were enrolled in the study.

Sample size

Sample size for this study was obtained from a formula for cross-sectional design (18). We used hypertension, being one of the most common clinical characteristics among patients with ESRD on haemodialysis (19, 20) to compute our sample size. The minimum sample size of 94 participants was obtained using margin of error of 4% and prevalence of 95.9% of hypertension among haemodialysis participants in Germany (21) Sampling was not performed as we intended to approach and recruit all eligible participants who would consent to be enrolled in the study.

Data collection

The demographic, clinical and laboratory data were extracted from medical records as well as through interviews by a structured case report form conducted by the first author. The following data were collected; -

Socio-demographic characteristics

Age, gender, ethnicity (Black, White, Asian and Colored (22)). Level of education (none, primary, secondary, college/diploma, university/degree, postgraduate), and Employment status (employed, unemployed, unemployed due to ill health, retired).

History

Medical history such as hypertension, diabetes mellitus, HIV status, hepatitis B and C and use of traditional herbal medicines. For participants who were HIV-infected, most recent CD4 count and viral load performed within three months of the period of data collection was recorded. Medical records (both paper and electronic) were reviewed together with self-reported history to verify the medical history.

Physical examination

Anthropometric measurements [weight (kg), height (m) and body mass index (BMI) were calculated as follows; Weight (kg)/height (m) squared and categorised into underweight (<18.5kg/m^2); normal weight (18.5 – 25 kg/m^2); overweight (25 – 30 kg/m^2); obesity (>30 kg/m^2) according to WHO criteria (23). The anthropometric measurements are routinely performed for participants undergoing haemodialysis.

Ethical considerations

Ethical clearance to conduct the study was obtained from Faculty of Health Sciences Research Ethics Committee at the University of Pretoria as well as Ministry of Health (Republic of Botswana) and Life Healthcare Group (South Africa). Permission to conduct the study was also obtained from heads of respective haemodialysis centers. The principles of the Helsinki Declaration were taken into account and were upheld.

Statistical analysis

Socio-demographic and clinical characteristics were analysed using Stata14 software. For descriptive statistics, continuous data with normal distribution were analysed using mean

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and standard deviation (SD) whereas continuous data with non-normal distribution were analysed using median and interquartile range. Categorical data were analysed using percentages and males compared with females using chi^2 test and Fisher's exact statistics. Comparison between HIV-infected and HIV negative participants were conducted by independent t-test for continuous variables and chi^2 for binary variables respectively. A p-value below 0.05 was considered significant.

Results

Overall, 175 participants were on maintenance haemodialysis and all of them met the eligibility criteria (21 years or older) at the time of data collection. Out of these, 44 participants declined consent, 13 were too sick to take part in the study and six (6) died before being enrolled. Five (5) of the eligible participants were on dialysis holidays; hence the final analysis involved 107 participants (figure 1) who were distributed as follows; Bokamoso Private Hospital (51), Renal Care Institute (42) and Gaborone Private Hospital (14).

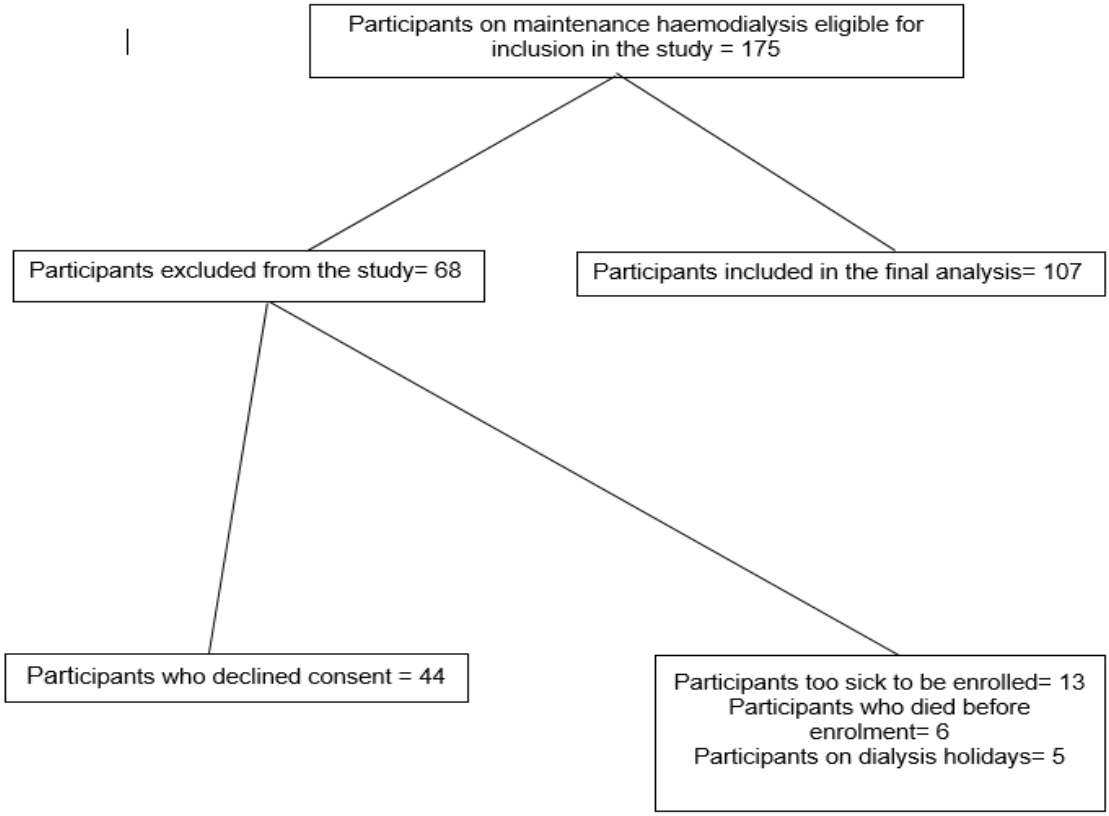

Figure 1. Flowchart of participants with ESRD on haemodialysis recruited in the study

Socio-demographic profile of participants by gender

Male gender comprised 65.4% (70/107) of all participants. Mean age of participants was 51.8 (SD 13.7 years), which was not statistically different across gender (p = 0.33). More than half (52.3 %) of participants were in the age range 35 to 55 years when they started haemodialysis. The majority of the patients were black (97.2%) and literate having attended at least primary school education (92.5%). Unemployment rate among the study participants was 41.1% and among them over half (54.5%, 24/44) attributed their unemployment to ill health. The unemployment was significantly higher in females than in males (54.1% versus 34.3%) (P = 0.04) (Table 1).

Table 1: Distribution of demographic data of study participants by gender

Parameters	Total (N=107)	Male (n=70)	Female (n=37)	P-value
Age in years (mean ±SD)	51.76±13.67	52.91±12.74	49.20±15.09	0.33
Ethnicity				
Black	104 (97.2 %)	68 (97.1%)	36 (97.3%)	0.97
Asian	1 (0.9%)	1 (1.4%)	0 (0.0%)	
Colored	2 (1.9%)	1 (1.4%)	1 (2.7%)	
Level of education				
None	8 (7.5%)	8 (11.4%)	0	0.03
Literate**	99(92.5%)	62 (88.6%)	37 (100%)	
Occupation				
Employed	41 (38.3%)	28 (40%)	13 (35.1%)	0.04
Retired	22(20.6%)	18(25.7%)	4 (10.8%)	
Unemployed	44 (41.1%)	24 (34.3%)	20(54.1%)	

***Literate refers to any sort of formal education whether completed or not*

Clinical profile of participants by gender

Most participants (70.1%) had haemodialysis history spanning 2 to 10 years. Obesity was present in 11.2% of the participants. Prevalence of hypertension and diabetes mellitus was 90.7% (97/107) and 26.2% (28/107), respectively. Prevalence rates of HIV and Hepatitis B were 24.3% (26/107) and 5.6% (6/107), respectively, and no cases of hepatitis C were noted. The use of traditional herbal medicines before initiation of haemodialysis was reported by 43.9% (47/107) of participants with significantly higher prevalence in males (p = 0.01) (table 2).

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Table 2: Clinical profiles of participants by gender

Parameter	Total (N=107)	Males (n=70)	Females (n= 37)	p-value
Age at haemodialysis initiation (years)				
≤34	18 (16.8%)	10 (14.3%)	8 (21.6%)	*0.28*
35 – 55	56 (52.3%)	35 (50%)	21 (56.7%)	
≥ 56	33 (30.8%)	25 (35.7%)	8 (21.6%)	
Time in dialysis (years)				
0.5 – 2	27 (25.2%)	17 (24.3%)	10 (27.2%)	*0.42*
2.1 – 5	38 (35.5%)	24 (34.3%)	14 (37.8%)	
5.1 – 10	37 (34.6%)	24 (34.3%)	13 (35.1%)	
>10	5 (4.7%)	5 (7.14%)	0 (0%)	
Body mass index				
<25	69 (64.5%)	44 (62.8%)	25 (67.6%)	*0.24*
25.0 – 29.9	26 (24.3%)	20 (28.6%)	6 (16.2%)	
30 and above	12 (11.2%)	6 (8.6%)	6 (16.2%)	
History of hypertension	97 (90.7%)	64 (91.4%)	33 (89.2%)	0.71
History of diabetes mellitus	28 (26.2%)	21 (30%)	7 (18.9%)	0.21
HIV-infected	26 (24.3%)	15 (21.4%)	11 (29.7%)	0.34
Hepatitis B infection	6 (5.6%)	6 (8.6%)	0 (0%)	0.09
Traditional herbal medicine use	47 (43.9%)	37 (52.9%)	10 (27.0%)	0.01
CD4 count*(cells/ mm^3) median (IQR)	440 (310-565	336 (242– 461)	538 (440 – 665)	0.48
Viral load* (copies) median (IQR)				
<400	19 (73.1%)	12 (80%)	7 (63.6%)	0.45
>400	1 (3.8%)	0 (0%)	1 (9.1%)	

**Applicable only to HIV-infected participants*

Socio-demographic and clinical profiles of participants by HIV status

Most of the studied socio-demographic and clinical profile variables including gender, ethnicity, employment status, education level and age at haemodialysis initiation were similar between HIV-infected and HIV-negative groups. The overall mean age ± standard deviation at haemodialysis initiation was 47.5±13.0 years (not shown in Table 3). The mean age at haemodialysis initiation was similar between HIV-infected and HIV-negative participants (p=

0.41) (Table 3). HIV-infected participants were significantly more likely to have either normal weight or be underweight as compared to HIV negative counterparts ($p < 0.01$) (Table 3). On the other hand, HIV-infected participants had a significantly higher prevalence of hypertension as compared to HIV-negative counterparts (p=0.04) (Table 3).

Table 3: Socio-demographic and clinical profile of participants by HIV status

Variables	HIV-infected N (%) = 26 (24.3%)	HIV-negative N (%) = 81 (75.7%)	p-value
Ethnicity			
Black	25 (96.2%)	79 (97.5%)	0.59
Asian	0 (0%)	1 (1.2%)	
Colored	1 (3.8%)	1 (1.2%)	
Employment status			
Employed	11 (42.3%)	29 (37.2%)	0.64
Retired	4 (15.4%)	18 (23.1%)	
Never employed	6 (23.1%)	14 (17.9%)	
Not working due to ill health	5 (19.2%)	17 (21.8%)	
Level of education			
None	3 (11.5%)	5 (6.3%)	0.37
Primary	3 (11.5%)	18 (22.5%)	
Secondary	11 (42.3%)	23 (28.8%)	
College/diploma	5 (19.2%)	13 (16.3%)	
University/degree	3 (11.5%)	16 (20.0%)	
Postgraduate	1 (3.8%)	6 (7.5%)	
Body mass index (kg/m^2)			
<25	19 (73.1%)	50 (61.7%)	<0.01
25.0 – 29.9	6 (23.1%)	20 (24.7%)	
30 and above	1 (3.9%)	11 (13.6%)	
Mean age (SD) at dialysis initiation (years)	47±11.1	47.7±13.7	0.41
Mean number (SD) of years on dialysis (years)	4.1±3.8	3.8±2.9	0.68
History of hypertension	24 (92.3%)	71 (87.6%)	0.04
History of diabetes mellitus	3 (11.5%)	25 (30.9%)	0.05
Hepatitis B infection	1 (3.8%)	5 (6.2%)	0.10
Traditional herbal medicine use	12 (46.2%)	35 (43.2%)	0.79

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Discussion

This study provides information on socio-demographic and clinical profiles of participants on hemodialysis in Gaborone, the capital city of Botswana. Participants on hemodialysis in the studied centers are residing in Gaborone and surrounding towns and villages of South, East and parts of Central Botswana. Due to lack of local registry that describe demographics and clinic profile of participants in renal replacement therapy in Botswana, this study is of value as it adds to the knowledge base on ESRD patients and is of paramount importance in terms of providing baseline for future studies as well as estimating resources that can help improve the care of participants on renal replacement in Botswana.

Our study found that male gender and mean age of participants on haemodialysis was similar to those of other African studies (8, 9, 24). The male dominance of participants in our study has also been found in another study in Cameroon (25). This observation has also been reported worldwide and is explained by the fact that male gender is an independent risk for CKD (26, 27). On the other hand, the unemployment rate among participants in our study was higher than the overall unemployment rate in Botswana (28) probably due to their ill health; over half of the participants attributed their unemployment to ill health and the time lost due to dialysis sessions, which is similar in the United States of America (29) and Cameroon (25). The proportion of obesity among males and females were higher than the reported national prevalence of 3.2% and 8.4%, respectively (30) which is expected among patients with CKD (31, 32). Prevalence of diabetes mellitus was much higher than the general population in Botswana (30); and even among dialysis patients in other African countries (19, 33). The prevalence of hypertension was much higher than the general population in Botswana (9; and similar to haemodialysis patients in other countries such as Japan and Germany (20, 21). Several factors explain the higher prevalence of hypertension among patients with ESRD. They include; - increased frequency of sodium and water retention as renal function declines (34, 35) and endothelia dysfunction and arterial stiffness (37, 38). On the other hand, patients with ESRD demonstrate high levels of atrial natriuretic peptide (ANP) which is responsible for regulating salt and water balance in response to arterial wall stretch resulting to increased blood pressure levels (36, 37).

The prevalence of HIV-infection among our participants was understandably higher compared to the data from South African renal registry that documented HIV-infection prevalence of 12.7% among haemodialysis patients (38). The observed difference is most

likely a factor of sample size. The prevalence of hypertension was significantly higher among HIV-infected as compared HIV-negative participants. Our findings are similar to those of a worldwide systematic review and meta-analysis for estimation of the effects of antiretroviral therapy (ART) on blood pressure levels and hypertension risk among HIV-infected populations which demonstrated that exposure to ART was significantly associated with increased systolic and diastolic blood pressure levels, as well as increased risk of hypertension, regardless of study-level socio-demographic differences (39).

The relatively higher prevalence of hepatitis B in this study as compared to the previous study in Botswana (40) might be due to higher risk of nosocomial transmission and impaired host defence mechanisms (41) among haemodialysis patients. Our prevalence appears to be higher than those of another study of participants in haemodialysis in Botswana (42). The possible reasons for this discrepancy are time period difference for the two studies as well as differences in the sample sizes. Absence of Hepatitis C infection might be due to low yield of hepatitis C serology and low prevalence of hepatitis C in Botswana (43).
On the other hand, over 40% of study participants reported to have used traditional herbal medicine, which is similar to findings in South Africa (44). Male predominance of traditional herbal medicine use was similar to the findings of the study in South Africa (45). The major challenge in herbal medicine induced renal dysfunction is that reporting of herbal medicine use is voluntary and in most cases, patients often do not admit to using herbal medicines prior to haemodialysis initiation for fear of negative response from healthcare workers. This has resulted in paucity of data on herbal medicine nephrotoxicity (45).

Limitations of the study

The cross sectional study design employed cannot determine causal relationship, as the temporal sequence is not known. Secondly, reliance on limited and incomplete medical records made it difficult to determine factors associated with ESRD in our study. On the other hand, our eligibility criteria excluded participants below the age of 21 years. At the time of data collection, there was no participant below the age of 21 years on maintenance haemodialysis in our study sites. We are aware that several young participants were on peritoneal dialysis at the time this study was conducted. We have described the socio-demographic and clinical profiles of ESRD patients receiving maintenance haemodialysis but there are no data regarding patients with ESRD who defaulted dialysis and those who cannot be dialysed because of their geographical location. Hence, the findings of our study

may not be generalizable among ESRD patients in Botswana. However, it should be noted that this is the first documented study in Botswana to describe the socio-demographic and clinical profiles of ESRD participants in haemodialysis; it provides a baseline for future large prospective studies that will cover the entire CKD population regardless of renal replacement therapy status.

Conclusion

This multi-centre study adds critical information on socio-demographic and clinical profiles into of ESRD participants on haemodialysis in Botswana in the absence of renal registry data and representative population studies. Hypertension was the most common associated factor among our study participants. Participants on maintenance haemodialysis in our study were mostly males. Traditional herbal medicine use was significantly more common in men whereas female participants appeared to have higher prevalence of obesity compared to male counterparts. HIV-infected participants were significantly more likely to have low body mass index and be hypertensive. Women were significantly more likely to be unemployed due to ill health as compared to men. Prospective studies with large sample sizes are recommended to help understanding the role of individual associated factors in causing ESRD in Botswana and similar settings in sub-Saharan Africa.

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Authors' contributions

KM designed the study, conceptualized, collected data and drafted manuscript drafting. DB designed the study, supervised and critically revised the manuscript. GMR supervised and critically revised the manuscript. All the authors reviewed and approved the final version of the manuscript to be published.

Availability of data and materials

The datasets generated during the current study are available from the corresponding author on reasonable request.

Competing interests:

The authors declare that they have no competing interests.

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