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Chronic Kidney Disease: Socioeconomic Impact. Findings from a Two Center Study in Southwestern Nigeria

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ABSTRACT

Introduction: Despite the rising prevalence of chronic kidney disease (CKD), access to adequate renal care is still not available to a very large part of the populace, essentially due to inadequate funds and this has further heightened the burden of the disease on patients and the general society. Measures are therefore needed to highlight this health challenge and proffer solutions.
Methods: A comparative study in which 354 consented participants with CKD stage 3-5 gave history, were examined and had blood taken for serum biochemistry and hematocrit to access kidney function.
Results: Two hundred and thirty six males and 118 females participated. The mean age of the participants was 52.11 ± 6.04 yrs. A greater percentage (44.6%) of participants had hypertension as cause of CKD and earned a monthly income less than the national minimum wage (47.7%). A greater proportion of participants had tertiary education (51.4%), were married (64.1%) and travelled less than 50 kilometers (67.5%) to access renal care. The health insured were more likely to be males (P=0.002), aged (P<0.001) have higher hematocrit (P=0.002), albumin (P=0.06), bicarbonate (P=0.04) and GFR (P=0.01).
The health insured had more frequent dialysis (P<0.001) and erythropoietin use (P<0.001. Forty percent of the health insured had renal transplant compared to 1.6% of the uninsured, P<0.001.
The insured were more associated with IDHT as the uninsured were more associated with IDH. The health insured had a mean dialysis dose (Kt/V 1.34 ± 0.9) compared to 1.13 ± 0.5 for the uninsured, P<0.001. The dialysis dose was positively correlated with frequency of dialysis (P<0.001), and erythropoietin (P<0.001) but was negatively correlated with age (P=0.01) and serum creatinine (P=0.004). Predictors of dialysis dose were insurance status, frequency of dialysis, and erythropoietin, hematocrit, serum albumin and bicarbonate.
Conclusion: Only 11.9% of the CKD cohorts had health insurance coverage and they were more likely to be males, aged, highly educated, with higher hematocrit, and albumin. The health insured had a mean dialysis dose of Kt/V 1.34±0.9 as against 1.13±0.5 for the uninsured. The uninsured had more metabolic acidosis, were younger and being the most active working population, their affectation only further worsens the burden associated with CKD.
Keywords: health insured, intradialysis hypotension, intradialysis hypertension, dialysis dose

INTRODUCTION

Chronic kidney disease (CKD) has become a global socioeconomic and health burden, more so in low income nations (LINs) and even more so in sub Sahara Africa (SSA).[1] The prevalence of CKD

worldwide is on the increase and the cost of treating an individual with CKD is expected to increase, with increased burden to patients, care givers and the governments, as the stage of the disease increased.[2] Management in early (stages 1 and 2) CKD essentially involves prompt and effective management of etiologic factor, blood pressure control, prevention and control of proteinuria, as well as an effective counselling on dietary discretion, prevention/halting progression of atherosclerosis, and the prevention of thrombotic episodes and their complications.[3] Treatment at these stages commonly involves measure with little or no cost implication or measures, some of which are affordable to the populace including most of the indigent individuals.

The third, fourth and the non-dialytic phase of stage 5 CKD present with most of the known disease features, involving constitutional symptoms, worsening blood pressure, hyperparathyroidism and CKD mineral bone disease (CKD-BMD), proteinuria, anemia, metabolic acidosis (MA) dyslipidemia and left ventricular hypertrophy (LVH).[4] Treatment at this stages involves stricter control of BP and proteinuria, treatment, and control of hyperparathyroidism and bone disease and, anemia, dyslipidemia, reduction in protein intake amongst others. These stages of CKD are associated with a reduced quality of life (QOL) and increase risk of several complications, some of which could be fatal particularly cardiovascular events.[5]

The dialytic phase of stage 5 CKD (uremic phase) in most LINs, is unfortunately, the part in which patients commonly present for treatment. This is the phase of the disease where patients QOL are lowest, burden to care givers, governments and society are worse, cost of treatment highest and compliance levels are least.[6] In addition to regimen used in managing earlier stages of CKD, the dialytic phase of stage 5 CKD commonly involves blood transfusions (less common in developed nations), use of intravenous erythropoiesis stimulating agents (ESAs), dialysis and renal transplant.[1]

In most LINs there is delayed referral of pre CKD conditions (hypertension, diabetes, sickle cell anemia and others) from the primary health care centers to physicians and nephrologists, and from physicians to nephrologists.[7] Delay is also common in the preparation of many of these patients for renal replacement therapy (RRT) by the nephrologists in these settings due to socioeconomic, educational and cultural limitations. The kidney disease improving global outcome (KDIGO) recommended referral to nephrologist before stage 3 disease, even in LINs.[8]

Arije et al[9] reported from Ibadan that not more than 30% of patients are able to continue dialysis treatment beyond 3 months. Likewise Akinsola et al[10] had found that some patients had to travel for up to one hundred and forty kilometers to access dialysis treatment. Though many dialysis centers have been established in the last decade, they are still mostly concentrated in the urban centers.[11]

In Nigeria, apart from a very few wealthy, or privileged workers (or relatives) of a few multinational organizations, maintenance hemodialysis (MHD) and erythropoietin treatment is routinely given twice or less, even this is unaffordable to majority of the populace.[12] Under-dialysis is expected to lead to inadequate dialysis, poor treatment outcome and quality of life (QOL), and premature death.[13]

In most LINs, like Nigeria, the rate of unemployment is very high and for many employed, under payment, delayed payment for services provided are very common. The national health insurance schemes (NHIS) of the Federal, and those of regional governments and the multinational corporations has about 3% of the population enrolled into the various schemes leaving more than 95% of the populace at the mercy of funds from self, families, religious bodies, philanthropists and friends. In Nigeria, the national minimum monthly wage is $60. The cost of a session of

hemodialysis (arguably the only RRT modality available to Nigerian adults with kidney disease) ranges from $60 to $150, the monthly (twelve sessions) cost range from $720 to $1800 while the monthly cost of erythropoietin (4000IU x 12 doses) is about $250. This is in addition to the cost of antihypertensives, diuretics, antibiotics, hematinic, many other drugs and routine investigations. The socioeconomic outcome of CKD in LINs is further worsened by the demographics of CKD, where infective causes such as chronic glomerulonephritis (CGN) and chronic pyelonephritis (which are commoner in the actively working population) are among the leading causes of the disease.[15]

Studies highlighting poor treatment outcome in LINs like Nigeria have majorly dealt with specific causes of poor treatment outcome, but literature detailing the contribution of the various implicated factors, particularly socioeconomic, cultural and educational is however scares. This study assesses the contribution of socioeconomic, cultural and educational factors to the poor treatment outcome in Nigeria, a LIN, and ascertains their correlates with intradialysis events and dialysis dose.

MATERIALS AND METHODS

This was 30 months comparative study carried out at the nephrology and hypertension clinics, and dialysis suites of Federal Medical Centre, Abeokuta (January-December 2017) and Babcock University Teaching Hospital, Ilishan-Remo, Nigeria, from August 2019 to January 2021. Recruitment into the study was by consecutive sampling in which three hundred and fifty four participants with CKD according to the KDOQI 2012 criteria[16] from stage 3-5, that is, with glomerular filtration rate (GFR) <60 ml/min/1.73m^2 participated. Participants who had full health coverage (insurance), and those without full health insurance were grouped into two.

Exclusion criteria were: age less than 16 years, and participants with renal graft, pelvic tumors, infections or sessions less than 2 hours.

Variables taken from history, patients' case notes and dialysis notes included age, sex, level of educational attainment, sponsorship of treatment, estimated average monthly income, distance between participant's residence and treatment facility, preceding pharyngitis or skin sepsis, type and cause of CKD, months on MHD and number of antihypertensive drugs. Also entered were dialysis duration, blood flow rate (BFR), ultrafiltration volume (UFV), frequency of dialysis and erythropoietin use, intradialysis events and their timings, and post dialysis weight for preceding session. Also retrieved were doses of erythropoietin (4000 IU), intravenous Iron (200mg) and blood transfusion.

Participants' height and weight were measure according to standardized protocols. The oxygen saturation (SPO_2), pulse rate (PR), blood pressure (BP)] were measured after five minutes rest and documented. All BP readings were taken manually. The interdialytic weight gain (IDWG), the vital signs, the disease condition and participant's peculiarities like age and sex were used to formulate the dialysis prescription. For the non-dialyzing cohorts, blood sample was taken from a peripheral vein but for dialyzing cohorts, blood was taken from the dialysis catheters after withdrawing the sterilizing fluid and heparinized saline. Arterial and venous portals were flushed with heparinized saline and participants were collected through the arterial and then the venous portal. At the end of treatment time, dialysate flow (only) was stopped and the blood flow rate was reduced to 100 ml/min. Five minutes after this, blood was taken from the arterial portal, first, for serum electrolyte (minimizes access recirculation) and then the HCT.[17] The urea reduction ratio (URR) and Kt/V (with Daugirdas second generation logarithmic estimation of single

pool) were calculated[18] Serum albumin was determined using the bromocresol green method. It overestimates albumin in hypoalbuminemia and kidney disease (including dialysis patients) by about 3.5g/dl.[19]

Data analysis was with SPSS 22, continuous variables, presented as means with standard deviation, were compared using student t-test. Categorical variables, presented as proportion and percentages, were compared using Chi square test or Fisher's exact test. P<0.05 was considered statistically significant. Multivariate regression analysis was used to determine predictors of dialysis dose. The Human Ethics Committee of Federal Medical Centre, Abeokuta and Babcock University Teaching Hospital, Ilishan-Remo (FMCA/470/HREC/03/2017, NHREC/08/10-2015 and BUHREC/733/19, NHREC/24/01/2018) approved this study.

Definitions

The diagnosis of the etiology of CKD was not by kidney biopsy.

Hypertension: Blood pressure >140/90 mmHg.[20]

Diabetes: fasting blood sugar (FBS) >126 mg/dl, previous diagnosis or receiving hypoglycemic agents.[21]

Anemia: Hematocrit <33%[22]

Hypoalbuminemia: serum albumin <35mg/dL[23]

eGFR (CKD-EPI)-ml/min/1.73m^2 [24]

Hypertension associated CKD: Hypertension that is complicated by kidney disease seen from late middle age upwards.

Chronic glomerulonephritis: Kidney disease complicated by hypertension seen in the young and early middle age, with or without history of pharyngitis and skin sepsis in the past.

Targeted weight loss (TWL): Predialysis weight plus volume of administered fluid minus UFV.[25]

IDH: Intradialysis fall in SBP of ≥20 mmHg with symptoms but without nursing intervention.[26]

IDHT: Intradialysis rise in SBP >10 mmHg.[27]

Dialysis dose: Normal (Kt/V ≥1.2 and URR ≥65.0%), low (Kt/V <1.2 and URR <65.0%).

RESULTS

Table 1: Socioeconomic, cultural and educational characteristics of participant

Variables	Frequency N=354	Percentage (%)
Sex		
Males	236	66.7
Females	118	33.3
Age, years		
16-39	93	26.3
40-64	208	58.7
>65	53	15.0
Educational attainment		
None	7	2.0
Primary	59	16.7
Secondary	137	38.7
Tertiary	151	42.6
Estimated total monthly income in naira ($)		
<#30000 (<$60)	169	47.7
#30000-99999 (<$60-$199.9)	119	33.6
#100000-499999 ($200-$999.9)	52	14.7
#500000-999999 ($1000-$1999.9)	11	3.1
>#1000000 (>$2000)	3	0.9
Sponsorship		
Self	94	26.6
Family	182	51.4
Institution: Full	42	11.9
: Partial	10	2.8
Religious/Friends/Philanthropists	26	7.3
Distance to dialysis center (km)		
<20	56	15.8
20-49	183	51.7
50-99	67	18.9
>100	48	13.6
Family set up		
Single	78	22.0
Married	227	64.1
Widow/Widower	49	13.9
Etiology of CKD		
Hypertension	128	44.6
Chronic glomerulonephritis	98	34.1
Diabetes	33	11.5
Obstructive uropathy	18	6.3
Others	10	3.5
Stages of CKD		
3a	6	1.7
3b	7	2.0
4	13	3.7
5 (non-dialytic)	41	11.6
5 (dialytic)	287	81.0

CKD-chronic kidney disease

Three hundred and fifty four (236 males and 118 females) participants were studied. The mean age of the participants was 52.11 ± 6.04 years (58.22 ± 16.13 years for non dialytic, and 50.17 ± 11.17 years for the dialytic). Participants in stages 3, 4, non dialytic 5 and dialytic 5 were 12 (3.39%), 14 (3.96%), 41 (11.58%) and 287 (81.07%). A greater percentage (44.6%) of participants had hypertension as cause of CKD and, had

monthly income less than the national minimum wage (47.7%). A greater percentage had tertiary education (51.4%), were married (64.1%) and travelled less than 50 kilometers (67.5%) to access renal care.

The BP, creatinine and anion gap were significantly lower in the health insured compared to the uninsured, P<0.001, P<0.001, P<0.001 respectively (Table 2). The serum bicarbonate, GFR, albumin and hematocrit were significantly higher in the health insured compared to the uninsured, (P=0.001), (P<0.001), (P=0.03) and (P=0.02) respectively.

Table 2: Sociodemographic, clinical and laboratory characteristics of participants

Variables	All participants N=354 (%)	Non-dialyzed CKD N=67 (%)	Dialyzed CKD N=287 (%)	P-value
Sex				
Males	236 (66.7)	44 (65.7)	192 (66.9)	0.7
Females	118 (33.3)	23 (34.3)	95 (33.1)	
Age, years				
16-39	93 (26.3)	19 (28.4)	74 (25.8)	0.5
40-64	208 (58.7)	37 (55.2)	171 (59.6)	
≥65	53 (15.0)	11 (16.4)	42 (14.6)	
Educational attainment				
None	7 (2.0)	3 (4.5)	4 (1.4)	0.04
Primary	59 (16.7)	15 (22.4)	44 (15.3)	
Secondary	137 (38.7)	24 (35.8)	113 (39.4)	
Tertiary	151 (42.6)	25 (37.3)	126 (43.9)	
BMI, kg/m^2	24.8 ± 5.6	25.8 11.4	24.6 ± 9.3	0.06
Systolic BP (mean) mmHg	160.0 ± 16.8	144.2 ± 24.9	163.7 ± 14.7	<0.001
Diastolic BP (mean), mmHg	95.5 ± 9.9	82.4 ± 13.1	98.5 ± 8.9	<0.001
Serum sodium (mean) mmol/L	130.1 ± 7.9	132.8 ± 8.5	129.5 ± 8.2	0.06
Serum potassium (mean) mmol/L	5.7 ± 1.1	5.5 ± 1.3	5.7 ± 1.3	0.8
Serum chloride (mean) mmol/L	97.9 ± 10.4	98.5 ± 6.6	97.8 ± 13.4	0.1
Serum bicarbonate (mean) mmol/L	19.1 ± 4.9	21.5 ± 5.7	18.6 ± 4.3	0.001
Serum calcium (mean) mmol/L	2.1 ± 0.9	2.0 ± 0.4	2.1 ± 1.1	0.05
Serum phosphate (mean) mmol/L	2.2 ± 1.5	2.4 ± 1.4	2.2 ± 1.3	0.1
Serum urea (mean) mmol/L	18.8 ± 9.7	24.5 ± 11.3	17.5 ± 6.3	<0.001
Serum creatinine (mean) umol/L	749.5 ± 33.5	248.8 ±.42.8	866.4 ± 16.2	<0.001
Glomerular filtration rate, ml/min	9.7 ± 3.6	22.5 ± 5.7	6.7 ± 1.4	<0.001
Serum albumin, mg/dL	31.6 ± 7.9	34.8 ± 11.6	30.9 ± 7.4	0.03
Hematocrit, %	24.7 ± 4.9	27.3 ± 5.6	24.1 ± 5.8	0.02
Mean anion gap, mEq	24.6 ± 5.5	15.7 ± 8.4	26.7 ± 8.7	<0.001

CKD-chronic kidney disease, BMI-body mass index, BP- blood pressure

Table 3: Socioeconomic impact on clinical and laboratory profile of the pre dialytic population

Variables	All participants N=67 (%)	Insured N=12 (%)	Uninsured N=55 (%)	P-value
Sex				
Males	44 (65.7)	9 (75.0)	35 (63.6)	0.002
Females	23 (34.3)	3 (25.0)	20 (36.4)	
Age, years				
16-39	19 (28.4)	1 (8.3)	18 (32.7)	<0.001
40-64	37 (55.2)	4 (33.3)	33 (60.0)	
>65	11 (16.4)	7 (58.4)	4 (7.3)	
Erythropoietin use				
No	54 (80.6)	6 (50.0)	48 (87.3)	<0.001
Yes	13 (19.4)	6 (50.0)	7 (12.7)	
Mean BMI, kg/m^2	25.8 ± 11.4	27.4 ± 11.6	25.5 ± 12.4	0.03
Mean systolic BP	144.2 ± 24.9	143.1 ± 16.8	144.4 ± 18.8	0.1
Mean diastolic BP	82.4 ± 13.1	80.9 ± 10.6	82.7 ± 10.7	0.05
Mean hematocrit	27.3 ± 5.6	29.0 ± 6.3	26.9 ± 5.5	0.002
Mean albumin	34.8 ± 11.6	35.8 ± 7.9	34.6 ±.9	0.6
Mean sodium	132.8 ± 8.5	134.6 ± 12.9	132.4 ± 9.3	0.05
Mean potassium	4.6 ± 1.8	4.7 ± 2.0	4.6 ± 1.5	0.07
Mean bicarbonate	21.5 ± 5.7	22.0 ± 7.0	21.4 ± 4.7	0.04
Mean chloride	95.5 ± 6.6	98.6 ± 8.1	94.8 ± 10.2	0.03
Mean anion gap	15.7 ± 8.4	15.0 ± 6.4	15.9 ± 8.7	0.05
Mean calcium	2.0 ± 0.4	2.2 ± 1.6	1.9 ± 0.6	0.001
Mean phosphate	2.4 ± 1.4	2.4 ± 1.5	2.4 ± 1.1	0.5
Mean creatinine	248.8 ±.42.8	195.4 ± 36.9	260.4 ± 39.5	<0.001
Mean GFR	22.6 ± 6.2	25.9 ± 8.6	21.9 ± 9.8	0.01

BMI-body mass index, BP-blood pressure, GFR-glomerular filtration rate

In the predialytic population (Table 3), the health insured were more likely to be males (P=0.002), aged (P<0.001), lower blood pressure, higher hematocrit (P=0.002), albumin (P=0.06), bicarbonate (P=0.04) with lower anion gap (P-0.05) and higher GFR (P=0.01).

In the dialytic population (Table 4), the insured participants were more likely to be males (P=0.04), and associated with aging (P=0.03), frequent dialysis (P<0.001) and erythropoietin use (P<0.001), lower blood pressure, and higher hematocrit (P=0.03), albumin (P=0.04) and GFR (P=0.04). Forty percent of the insured participants went on to have renal transplant compared to 1.6% of the uninsured participants, P<0.001.

Table 4: Socioeconomic impact on the clinical and laboratory profile of the dialytic population

Variables	All participants 287 (%)	Insured N=30 (%)	Uninsured N=257 (%)	P-value
Sex				
Males	192 (66.9)	22 (73.3)	170 (66.1)	0.04
Females	95 (33.1)	8 (26.7)	87 (33.9)	
Age, yrs				
16-39	83 (28.9)	3 (10.0)	80 (31.1)	0.03
40-64	152 (53.0)	19 (63.3)	133 (51.8)	
>65	52 (18.1)	8 (26.7)	44 (17.1)	
Dialysis sessions/week				
1	99 (34.5)	0 (0.0)	99 (38.5)	<0.001
2	143 (49.8)	2 (6.7)	141 (54.9)	
3	45 (15.7)	28 (93.3)	17 (6.6)	
Erythropoietin use				
1	87 (30.3)	1 (3.3)	86 (33.5)	<0.001
2	152 (53.0)	8 (26.7)	144 (56.0)	
3	48 (16.7)	21 (70.0)	27 (10.5)	
Mean BMI, kg/m^2	24.6 ± 9.3	26.1 ± 11.6	24.4 ± 9.7	0.05
Mean systolic BP	164.7 ± 14.7	164.6 ± 10.8	164.8 ± 11.7	0.7
Mean diastolic BP	98.5 ± 8.9	96.7 ± 8.3	98.7 ± 3	0.06
Mean hematocrit	24.1 ± 5.8	27.2 ± 6.6	23.7 ± 9	0.03
Mean albumin	30.9 ± 7.4	33.5 ± 8.4	30.6 ± 4.7	0.04
Mean sodium	129.5 ± 8.2	132.9 ± 9.6	129.1± 12.7	0.07
Mean potassium	5.7 ± 1.3	5.1 ± 0.9	5.7 ± 1.2	0.05
Mean bicarbonate	18.6 ± 4.3	20.7 ±7.1	18.4 ± 5.5	0.04
Mean chloride	97.8 ± 13.4	99.6 ± 10.8	97.6 ± 14.2	0.06
Mean anion gap	26.7 ± 8.7	19.3 ± 4.6	27.6 ± 7.2	0.004
Mean calcium	2.1 ± 1.1	2.2 ± 1.4	2.1 ± 0.6	0.1
Mean phosphate	2.2 ± 1.3	2.3 ± 1.1	2.2 ± 0.8	0.3
Mean creatinine	866.4 ± 16.2	812.3 ±	872.8 ± 21.7	0.002
Mean GFR	6.7 ± 1.4	8.0 ± 1.7	6.5 ± 2,0	0.04
Kidney transplant				
No	271 (94.4)	18 (60.0)	253 (98.4)	<0.001
Yes	16 (5.6)	12 (40.0)	4 (1.6)	

BMI-body mass index, BP-blood pressure, GFR-glomerular filtration rate

Table 5: Intradialysis events in the dialytic population

Variables	All sessions N=1688 (%)	Insured N=180 (%)	Uninsured N=1508 (%)	P-value
IDH	335 (19.8)	6 (3.3)	329 (21.8)	0.001
Insignificant BP change	952 (56.4)	97 (53.9)	855 (56.7)	0.05
IDHT	401 (23.8)	77 (42.8)	324 (21.5)	0.03

IDH-intradialysis hypotension, IDHT-intradialysis hypertension

The episodes of IDH (19.8%) were fewer than IDHT (23.8%). The insured were more likely to experience IDHT than IDH (Table 5). The uninsured participants were more likely to experience IDH than IDHT.

The mean dialysis dose for the study was 1.16 ± 0.4 (insured 1.34 ± 0.9, uninsured 1.13 ± 0.5) (males 1.21 ± 0.3, and females 1.07 ± 0.5). The mean dialysis dose was adequate, low and very low in 15.2%, 48.9% and 35.9% sessions respectively. The dialysis dose was higher in males than females, P=0.04, (Table 6). The dialysis dose was positively correlated with health insurance (P<0.001), frequency of dialysis (P<0.001), and erythropoietin (P<0.001), bicarbonate (P<0.001), hematocrit (P<0.001) and albumin (P<0.001), and was

negatively correlated with age (P=0.01), creatinine (P=0.004), and potassium (P<0.001).

Table 6: Relationship between the dialysis dose and variables of the dialytic population.

Variables	Kt/V <1.2 N=1432 (%)	Kt/V >1.2 N=256 (%)	OR	95% CI	P-value
Sex					
Males	941 (83.7)	183 (16.3)	1.23	1.04-2.57	0.04
Females	491 (87.1)	73 (12.9)			
Age, yrs					
<65	1133 (82.3)	244 (17.7)	2.86	1.15-4.82	0.01
>65	299 (96.1)	12 (3.9)			
Insurance					
No	1375 (96.7)	47 (3.3)	7.33	4.42-10.74	<0.001
Yes	57 (21.4)	209 (78.6)			
Dialysis sessions/week					
<3	1256 (96.5)	45 (3.5)	4.48	4.29-7.36	<0.001
3	176 (45.5)	211 (54.5)			
Erythropoietin use					
<3	1300 (97.5)	34 (2.5)	5.36	3.82-8.26	<0.001
3	132 (37.3)	222 (62.7)			
Etiology of CKD					
Hypertension	623 (82.5)	132 (17.5)	1		
Chronic glomerulonephritis	489 (83.0)	100 (17.0)	1.26	0.62-2.05	0.03
Others	320 (93.0)	24 (7.0)	3.86	0.96-13.59	
Systolic BP, mmHg					
<140	270 (81.3)	62 (18.7)	1.15	0.65-1.82	0.05
>140	1162 (85.7)	194 (14.3)			
Hematocrit, %					
<33	1342 (90.6)	141 (9.4)	4.28	2.9-7.16	<0.001
>33	90 (43.9)	115 (56.1)			
Albumin, mg/dL					
<35	1331 (91.6)	122 (8.4)	5.12	2.96-8.15	<0.001
>35	101 (43.0)	134 (57.0)			
Potassium, mmol/L					
<5.5	185 (53.0)	164 (47.0)	4.89	2.46-6.94	<0.001
>5.5	1247 (93.1)	92 (6.9)			
Bicarbonate, mmolL					
<22	1419 (97.2)	41 (2.8)	8.79	5.11-12.98	<0.001
>22	13 (5.7)	215 (94.3)			
Creatinine, umol/L					
<500	752 (77.0)	224 (23.0)	3.24	2.96-5.03	0.004
>500	680 (95.5)	32 (4.5)			

OR-odds ratio, CI-confidence interval, CKD-chronic kidney disease, BP-blood pressure

From the univariate analysis, variables with P<0.025 were enter into the multivariate model (Table 7) from where health insurance, frequency of dialysis, and erythropoietin, hematocrit, serum albumin, bicarbonate and creatinine predicted dialysis dose.

Table 7: Multivariate regression analysis

Variables	aOR	95% CI	P-value
Age	1.02	0.85-1.92	0.06
Full sponsorship	6.89	5.38-13.54	<0.001
Frequency of dialysis	3.52	1.78-4.45	0.001
Frequency of erythropoietin	3.61	2.55-6.27	0.001
Hematocrit	4.85	3.66-7.93	<0.001
Serum albumin	3.13	1.72-4.06	0.002
Serum potassium	1.25	1.52-2.89	0.05
Serum bicarbonate	6.97	4.82-12.94	<0.001
Serum creatinine	1.78	0.99-2.27	0.03

aOR-adjusted odds ratio, CI-confidence interval

DISCUSSION

We found that only 11.9% of the CKD cohorts (17.9% in the predialytic phase and 10.5% in the dialytic phase) had full access to renal care. This leaves a very large majority (88.1%) without full access. Nearly half (47.7%) of the CKD cohorts were earning less than the monthly national minimum wage of 60 USD. The fully sponsored were more likely to have IDHT than IDH as the non-sponsored were more likely to have IDH than IDHT. This findings only but confirms the 3% population coverage by the Nigeria "Nation Health Insurance Scheme" (NHIS).[14] The health insurance coverage is rather very low compared to other developing nations in South America like Colombia, and India in Asia. In Indian the Federal and States

government with private insurance schemes cover about 25% of the population. Another disheartening truth is the known fact that CKD is more prevalent among the poor and rural dwellers, this disadvantageous position is further compounded by the fact that most of the renal and dialysis centers are located in the urban centers.[11, 28] An addition to these challenges is the reported long distances patients had to travel to access dialysis as was found in this study, considering the functional states of most of the roads, particularly the rural roads.[10]

The insured participants had higher BMI, lower blood pressure, higher hematocrit and albumin than the uninsured, factors that that have been reported to contribute separately, and in synergy, to a higher dialysis dose, better QOL, reduce morbidity and mortality. The benefits of health insurance are further displayed as these patient progresses in the disease to the extent of requiring renal transplant. The insured in this study could be liken to citizens of the developed nations who enjoy better access to the health care provided by their governments, enabling them to access, uninterruptedly, even the most expensive investigations and treatment regimen require for managing CKD.[29]

In this study, the insured were more likely to be aged compared to the uninsured, again, this mimics the older CKD population in developed nations who developed CKD commonly from chronic non communicable, and degenerative diseases unlike in Nigeria and many low income nations where infection related etiological factors are still very common.[15, 30] The higher male participation, and their higher enrolment rate into the treatment program of the insurance schemes in this study is in agreement with earlier studies in Nigeria and many nations in SSA[31-32] The cultural background in Nigeria and many African nations favor males who are therefore more educated, favored to secure employments opportunities and tend to seek health care earlier than females.[33] The higher insurance rate for males in this study further adds credence to the reported socioeconomic and cultural bias against women. The activation of the sympatho-adrenergic system by the use of sympathomimetic agents is reported to be more in males who also show lesser response to sympathetic inhibition with inhibitors of the renin angiotensin aldosterone system (RAAS),[34] and this in addition to the anti-apoptotic properties of testosterone in the renal tubules partly explains the higher prevalence of CKD in males, and also justifies the faster CKD progression rate in them.[35] The higher proportion of males in the dialytic compared to the predialytic phase in this study is in agreement with these earlier findings.[34, 35]

The higher BMI of the insured in this study reflects their better nutritional intake more so considering the fact that they also presented with lower blood pressure, thereby ruling out the possibility of higher BMI that is secondary to fluid retention, a feature that is not uncommon in CKD.[36]

Despite the lower BP of the insured, they were more likely to develop intradialysis hypertension than IDH. Their more frequent dialysis sessions entails lower concentrations of nitrogenous waste and retained fluid compared to the uninsured, as was found in our study. During dialysis, the lower osmotic gradient across the dialyzer membrane is associated with lesser osmotic shift between the blood and dialyzer compartments. The lower fluid shift seen in this case entails lower ultrafiltration volume (UFV) and this is associated with lesser blood pressure reductions hence intradialysis hypotension are less commonly experienced in these sessions compared to IDHT.[37] The better blood pressure control in them may attenuate the cardiovascular damage hence even with larger UFV, they are more likely to mount a compensatory activation of the sympatheto-adrenergic system (in response to ultrafiltration) that may return the BP to predialysis levels or even overshoot it to cause IDHT.[37]

The better biochemical profile of the insured in comparison to the uninsured in

our study, reflects the overall benefits of full access to renal care from the screening through the investigations, treatment and follow up of patients. These benefits cover a wide range of associations relating diseases and clinical outcome. The lower prevalence of metabolic acidosis in them helps in mitigating the occurrence and symptomatology of CKD-mineral bone disease.[38] Chronic metabolic acidosis accelerates the aging process [39] clinically therefore, the insured is more likely to exhibit greater vigor and this, in the working class age group, could mitigate the known features of the disease, improve productivity, lessen the burden on care givers, families and governments. The greater access to erythropoiesis stimulating agents (ESAs) reduces the need for transfusion, and the attendant benefit of improved compatibility and reduced need for desensitization and plasmapheresis prior to transplant.

The higher dialysis dose in the insured is similar to what is obtained in the developed nations and this represents the contribution of the various segments of management and their protocol.[38] While the 15.2% attainment of adequate dialysis in this study is similar to earlier studies, it is worth noting that the insured had a staggering 78.6% dialysis adequacy compared to a dismay 3.3% in the uninsured. Somji et al[40] in Tanzania, a low medium income nation, found that 40% of dialysis sessions were adequate, likewise, El-Sheikh et al in Egypt found that 60% of the dialysis sessions were inadequate. Even higher doses are reported in advanced nations.[41, 42]

Renal transplant is associated with even greater challenges to the uninsured. As kidney disease goes through the stages, the cost of treatment increases but at the transplant phase, in addition to higher financial demand, cultural beliefs and biases have limited availability of both live and cadaveric donors.[43]

Some limitation we encountered included our inability to determine participants' dry weight which would have helped us to access its contribution to the delivered dialysis dose. We were unable to determine residual kidney function (RKF). Timing of dialysis was not very regular in some cases. The inclusion of both the predialysis and peridialysis phases of the disease strengthened the study.

CONCLUSION

Access to renal health care is very low in our clime and expectedly so in many LINs in SSA. Only 11.9% of the CKD cohorts had health insurance, these were more likely to be males, highly educated, and have lower blood pressure, higher hematocrit, and albumin. The mean dialysis dose for the study was 1.16 ± 0.4 with the insured, 1.34 ± 0.9 and the uninsured, 1.13 ± 0.5. (males 1.21 ± 0.3, and females 1.07 ± 0.5). 15.2% of the sessions were adequate (78.6% for the insured and 3.3% for the uninsured). The uninsured had higher anion gap, more metabolic acidosis and were more likely to younger and being the most active working population group, their affectation only further worsens the burden associated with CKD.

Recommendations

1. There is need for more involvement by the various governments, corporate organizations, religious bodies and philanthropists in developing nations in funding renal care and the removal of bottlenecks against the effective funding of renal health care considering its huge cost.
2. The establishment of a revolving fund for the health sector with emphasis on common chronic and funds consuming diseases, particularly kidney disease, should be set up with contributions from the central and regional governments and multinational organizations.
3. The world Health Organization and other Donor agencies should consider and implement further increases in the funding of health care in low and medium income nations.

4. Finally, the international community should help the low income nations in rechanneling their funds stalked in foreign banks and similar institutions, by their privileged few, back to these nations to fund health care.

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