Prevalence of Chronic Kidney Disease in Anambra State, Nigeria: Results of a Community Survey

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ABSTRACT

Background: Chronic kidney disease (CKD) is a global epidemic but its burden is more pronounced in sub-Saharan Africa (SSA). Within regions of SSA, there is paucity of data on the epidemiologic characteristics of CKD in these communities. These population-based studies are required to better describe the epidemiologic characteristics of the disease and also to aid in designing holistic prevention and treatment programs within the community. **Objective**: To determine the prevalence of CKD among adults residing in a rural setting in Anambra State, Nigeria. **Methodology**: This was a descriptive cross-sectional study of 391 adult residents of Ukpor, Anambra State, Nigeria who were selected using multi-stage sampling technique. Albuminuria and estimated glomerular filtration rate used to estimate CKD prevalence. Data analysis (Kruskal-Wallis H test and Chi square test) were done using *Epi Info*™ version 7.2.2.16 software. **Results**: The prevalence of CKD was 10.7% (95% CI: 8.0-14.2%). The prevalence of decreased kidney function and albuminuria were 6.6% (95% CI: 4.6-9.6%) and 7.9% (95% CI: 5.6-11.0%) respectively. Although there was a significant decline in eGFR with increasing age ($p<0.001$), the association between increasing age and reduced kidney function, albuminuria and CKD was not significant ($p>0.05$). **Conclusion:** The prevalence of CKD in rural Anambra State is high. There is need to institute regular screening programs for CKD in order to detect people at earlier stages of CKD when appropriate measures can be taken to prevent or retard their progression to kidney failure.

Keywords: Prevalence, Chronic kidney disease, Nigeria, Albuminuria, Anambra

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INTRODUCTION

Globally, the prevalence of chronic kidney disease (CKD) has increased to epidemic proportions, however its burden appears to be particularly pronounced in sub-Saharan Africa (SSA).[1,2] Worldwide, the mortality attributable to CKD has increased by more than 40% over the past three decades.[3] The prevalence of CKD has been increasing globally and currently, it is estimated to be 13.4% worldwide.[4] Thus, it is projected that globally, avoidable mortality due to CKD will continue to rise significantly in the coming decades.[5] Sub-Saharan countries account for a disproportionately higher burden of CKD.[3,6,7,8] Whereas the prevalence of CKD has plateaued or even declined in high income countries, the prevalence of CKD continues to rise unabated in SSA.[9,10] Efforts to tackle the burden of CKD in SSA are hampered in part by sparse epidemiologic data on CKD, as many regions within SSA lack robust data derived from population studies.[8] This is important as the prevalence and impact of CKD vary regionally due to differences in their demographic composition and varying access to healthcare infrastructure and personnel.[7,8]

To the best of our knowledge, the community prevalence and burden of CKD in Anambra State, Nigeria has not been documented. In an effort to bridge this knowledge gap and gain a better understanding of the epidemiology of CKD in Anambra State, we embarked on a survey of normal adult residents in Ukpor, a rural town in the State. This article is thus a report of the prevalence of CKD among adults residing in rural Anambra state, Nigeria.

METHODOLOGY

This was a cross-sectional study in Ukpor – a rural community in Anambra State. Anambra State is one of the 36 states of Nigeria, located in the south-eastern part of the country. It was conducted between September and November 2019.

Study Population and Sample Size

These were consenting adults aged 18 years and above who were residents of Ukpor. A resident was defined as one who had lived continuously in Ukpor for at least 6 months prior to the commencement of this study. Pregnant women, people who were acutely ill or oedematous were excluded from the study.

The population of adults aged 18 years and above in Ukpor in 2019 was estimated to be 41,544 based on projections by the National Population Commission, Nigeria from the 2006 census.[11] The minimum sample size of 384, (based on 95% confidence interval) was calculated using the formula for community survey.[12]

Sampling Technique

A multistage sampling technique, using the traditional administrative zones in Ukpor as template, was used to select study participants. In stage one, two administrative zones (Amaka and Durumaduru) out of three were chosen via simple random sampling. In the second stage, two villages from each of the chosen zones were selected randomly via balloting: Amakom and Ebe villages were selected from Amaka; Uhuori and Umudike from Durumaduru.~~y~~. In the third stage, a list of settlements in each selected village was compiled and a settlement from each of these villages was chosen from the list using simple random sampling. Household units (called compounds in local parlance) in the selected settlements were then enumerated. Between two and six adults were estimated to reside in a compound. Using this proportion-to-size, ninety six compounds were selected the settlements. Then all consenting eligible adults living in the selected compounds were enrolled in the study.

Study Protocol

The STEPwise approach to chronic disease surveillance survey recommended by the World Health Organization (WHO) was adopted.[13] Ten milliliters (ml) of urine was obtained from each participant and assayed for urine albumin/creatinine ratio (UACR); 5ml of venous blood was also taken for serum creatinine assay. Serum creatinine concentration was measured using the modified kinetic Jaffe's reaction which is traceable to an isotope dilution mass spectrometry reference measurement.[14] The serum creatinine concentration was used to estimate glomerular filtration rate (eGFR) using the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) formula.[14] Albuminuria and eGFR were categorized according to the Kidney Disease: Improving Global Outcome (KDIGO) criteria.[15] Albuminuria was defined as UACR ≥30mg/g while decreased kidney function was regarded as eGFR<60ml/min/1.73m^2. Chronic kidney disease was defined as eGFR<60ml/min/1.73m^2 or eGFR>60ml/min/1.73m^2 in the presence of UACR ≥30mg/g. The primary outcome was the prevalence of CKD whereas the prevalence of decreased kidney function and albuminuria were the secondary outcomes.

Data Management

Data were analyzed using *Epi Info*™ ver 7.2.2.16 (Centers for Disease Control and Prevention, Georgia, USA). Continuous variables were expressed as median (interquartile range, IQR) whereas categorical variables were presented as frequencies (percentages). The prevalence of reduced kidney function, albuminuria and CKD were expressed as percentages. Kruskal-Wallis H test was used to compare continuous variables while Chi square test (or Fisher exact test, where observations were less than 5) was used for categorical variables. A two-sided p-value <0.05 was regarded as significant.

Ethical Considerations

This study was approved by the Health Research Ethics Committee of Nnamdi Azikiwe University Teaching Hospital, Nnewi, Nigeria (NAUTH/CS/66/VOL.11/006/2018/006). All participants were informed about the aims, scope and benefits of the study. Written informed consent was obtained from each of them.

Political and administrative support was sought and obtained from the town union leaders to facilitate the entry of the research team into the community. Three months prior to the commencement of the study, advocacy visits were paid to the traditional ruler of the town, chiefs and other *de facto* leaders of the selected communities. During these visits the aims and benefits of the study were explained and request for the community leaders' support for the study sought

RESULTS

There were 391 participants made up of 142 (36.3%) males and 249 (63.7%) females. The age range was 18 – 92 years; median (IQR) - 60.0 (47.0 to 70.0) years. The age and sex distribution is shown in Table 1.

Table 1. Age distribution of participants according to gender

Age (Years)	Male (%)	Female (%)	Total (%)
< 40	22 (15.5)	44 (17.7)	66 (16.9)
40 – 64	53 (37.3)	117 (47.0)	170 (43.5)
≥ 65	67 (47.2)	88 (35.3)	155 (39.6)
Total	**142 (36.3)**	**249 (63.7)**	**391 (100.0)**

A total of 26 participants had decreased kidney function; this gives a prevalence of 6.6% (95% CI: 4.6-9.6%). The serum creatinine of the participants ranged from 42.8 to 142.0µmol/L; the median (IQR) was 71.0 (66.0 to 85.5) µmol/L. The eGFR of the participants ranged from 38.0 to 152.0ml/min/1.73m^2 while the median (IQR) eGFR was 98.0 (81.0 to 110.0) ml/min/1.73m^2. Figure 1 shows that there was a general decline in median eGFR with increasing age, with the sharpest decrease was between the 30-39 year and 40-49 year age groups (H=73.184; p<0.001).

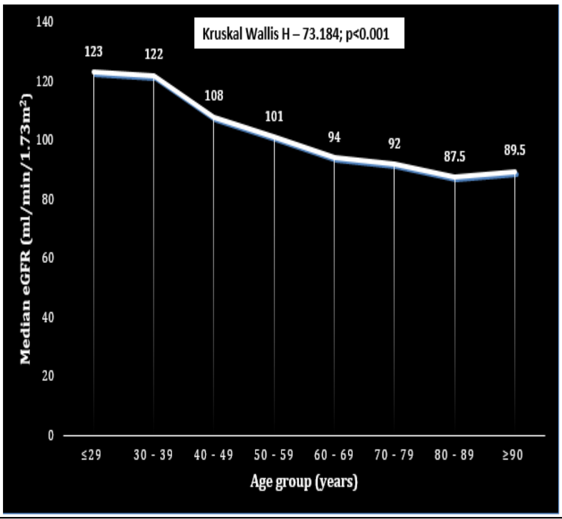

Figure 1. The median estimated Glomerular Filtration Rate (eGFR) in the different age categories

There were 31 participants with albuminuria thus giving a prevalence of albuminuria was 7.9% (95% CI: 5.6-11.0%). The median UACR (IQR) was 7.5mg/g (3.6 to 16.2mg/g). There was no statistically significant difference in median UACR across the age groups (p>0.05) (Table 2).

Table 2. Median Urine Albumin Creatinine Ratio (UACR) in different age categories

Age (Years)	Frequency	UACR, median (IQR)	Kruskal-Wallis H	p value
<40	66	8.1(3.6-19.4)	1.2994	0.522
40 - 64	170	7.1(3.6–5.6)		
≥65	155	7.9(3.8–5.9)		

In Table 3 is shown the distribution of decreased kidney function according to KDIGO CKD stages.[14] All participants with decreased kidney function were in the KDIGO stages G3a and G3b. Also, all the persons with albuminuria were in KDIGO A2 (Figure 2). The highest proportion of participants with decreased kidney function was recorded in those aged 65 years and above. Similarly, as shown in Figure 2, the highest proportion of persons with albuminuria was also seen in persons who were 65 years and older. However, these associations were not significant (p>0.05).

Table 3. The association of decreased kidney function with age

Age (Years)	KDIGO* G3a, (%)	KDIGO* G3b, (%)	p value
≤39	3 (13.6)	0 (0.0)	0.391
40 – 64	8 (36.4)	0 (0.0)	
≥65	11 (50.0)	4 (100.0)	
Total	**22 (100.0)**	**4 (100.0)**	

**KDIGO: Kidney Diseases Improving Global Outcomes*

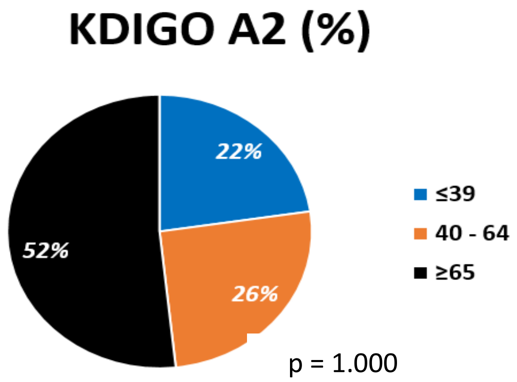

Figure 2. The association of albuminuria with age. KDIGO: Kidney Diseases Improving Global Outcomes

Forty two (10.7%) participants had both decreased kidney function and/or albuminuria. Thus, the prevalence of CKD derived from a composite of eGFR and albuminuria was 10.7% (95% CI: 8.0-14.2%). Table 4 shows that though the prevalence of CKD was higher in persons 65 years and older, this association was not statistically significant (p>0.05).

Table 4: Association of chronic kidney disease with age

Age (years)	CKD (%)	No CKD (%)	Total	χ2	p value
≤39	7 (10.6)	59 (89.4)	66	3.626	0.163
40 – 64	13 (7.6)	157(92.4)	170		
≥65	22(14.2)	133(85.8)	155		
Total	**42(10.7)**	**349(89.3)**	**391**		

DISCUSSION

The findings from this study showed that the overall prevalence of CKD in Anambra State, Nigeria is high - 10.7% (95% CI: 8.0-14.2%). The prevalence of decreased kidney function and albuminuria in this study were 6.6% (95% CI: 4.6-9.6%) and 7.9% (95% CI: 5.6-11.0%) respectively. It was also observed that there was a statistically significant decline in the estimated glomerular filtration rate (eGFR) with increasing age ($p<0.001$), but the association of age with the prevalence of decreased kidney function, albuminuria or CKD was not significant ($p>0.05$).

The CKD prevalence recorded in this study (10.7%) slightly exceeds the global prevalence of CKD, which is 9.1%.[3] This buttresses the disproportionately higher burden of CKD in SSA relative to the rest of the world. However, this is comparable to results of CKD prevalence from earlier studies in other parts of Nigeria: Enugu (11.4%),[16] Jos (10.5%),[17] Kwara (12%),[18] and Ekiti (14.2%)[19] which defined CKD based on a combination of eGFR≤60ml/min/1.73m^2 and either albuminuria or proteinuria. However, it is higher than the prevalence of 7.8% obtained in Umuahia where Okwuonu *et al* studied a younger population and also repeated eGFR and proteinuria after three months.[20]

Our results also compare favorably with the reported prevalence of CKD from Central Africa (12.4%)[21] and Eastern Uganda (12.5%)[22] but it is considerably lower than the prevalence in Western Kenya (3.7%)[22] and Southwestern Uganda (3.9%).[22] Another multinational study of CKD prevalence in Burkina Faso, Ghana, Kenya and South Africa determined an overall prevalence of 10.7%, comparable to the results of the index study.[23] But there were significant differences between these countries as it was higher in South Africa (14.4%) and Kenya (13.4%) compared to the west African countries – Ghana (6.4%) and Burkina Faso (5.2%).[23] This underscores the sub-regional variation of CKD prevalence in SSA and highlights the need for more studies in other parts of SSA to characterize the epidemiology of CKD better.

Some authors have tried to estimate the burden of CKD using the prevalence of either decreased kidney function (eGFR<60ml/min/1.73m^2) or albuminuria/proteinuria. The prevalence of decreased kidney function in the present study: (6.6%) is lower than the 7.8% in Bayelsa State[24], Lagos (7.5%)[25] and Asaba (43.5%)[26]. It should be noted that these earlier studies were conducted in urban populations in contrast to ours which was determined in a rural population. The prevalence of albuminuria in the present study was 7.9%. It is significantly lower than 15.0% reported by Ajibare *et al* from Lagos.[27] This may be because Ajibare *et al* studied a restricted population consisting of older male socialites residing in an affluent part of Lagos.[28]

The normal eGFR range from 120 – 130ml/min/1.73m^2 in adults less than 40 years of age; after 40 years, it starts to decline at an average rate of 1ml/min/year as a result of aging and not due to any disease process.[28] This pattern was observed in the present study population, where the median eGFR was stable in participants younger than 40 years and then followed by decline in participants who were 40 years and older ($p<0.001$). Interestingly, the decline was most marked between the 30-39 year and 40-49 year age groups.

Increasing age has been implicated as a risk factor for CKD but it is a matter of intense debate within the nephrology community whether most of the elderly people categorized as CKD (especially stage 3 CKD) have any renal pathology.[15,29] Because eGFR normally declines with increasing age, some authorities are of the opinion that a huge proportion of elderly people categorized as having CKD may simply be a reflection of the physiologic decline in eGFR with age.[15,29] In the present study population, there was a statistically significant decline in eGFR after 40 years which is consistent with age-related decline in eGFR seen in persons who are 40 years and above.[28] But despite this age-related decline in eGFR, there was no significant association of age with the prevalence of decreased kidney function, albuminuria or CKD ($p>0.05$). This implies that the decreased kidney function detected in the elderly participants of this study reflected pathologic perturbation of kidney function and not merely age-related decline in eGFR.

We acknowledge that our inability to repeat kidney function and albuminuria tests in participants identified with CKD three months after the first tests is a limitation of this study. This can lead to overestimation of the prevalence values obtained because participants with transient perturbations in

kidney function might have been included. However, we controlled for this by excluding participants who had any symptoms or were menstruating, from the study.
The following are the strengths of this study. This study provides the first documented prevalence of CKD among adults residing in Anambra State, Nigeria. Since this prevalence was obtained from a community based survey, it is more reflective of the true value in the community. We used a rigorous sampling technique to ensure that the study sample was an accurate representation of the community.

CONCLUSION

We have found a high prevalence of CKD (10.7%) in adults residing in Anambra State, Nigeria. There is need to institute regular screening programs for CKD in order to detect people at earlier stages of CKD when appropriate measures can be taken to prevent or retard their progression to kidney failure.

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