ORIGINAL ARTICLE

# Prevalence and correlates of chronic kidney disease among civil servants in Bayelsa state, Nigeria

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## Abstract

**Introduction:** Chronic kidney disease (CKD) has become a public health problem with rising incidence and prevalence world-wide. Despite the fact that Sub-Saharan Africa, including Nigeria appears to be badly hit by this epidemic, there is a paucity of data on CKD prevalence in these regions and where data exists, they are mostly hospital-based.

**Objectives:** The present study was carried out to determine the prevalence and correlates of CKD in an urban civil service population in Bayelsa State, Nigeria.

**Materials and Methods:** A total of 179 civil servants in the Bayelsa State secretariat were screened for CKD during the World Kidney Day on March 2012. CKD was defined as estimated glomerular filtration rate <60 ml/min/1.73 $m^2$ body surface area and/or proteinuria. Socio-demographic data was obtained using interviewer-administered semi-structured questionnaire while anthropometric measurements were taken. Blood pressure (BP), urinalysis, serum urea and creatinine were also assessed.

**Results:** The prevalence of CKD in the study was 7.8%. Age >50 years was associated with CKD in univariate analysis but none of age, gender, body mass index, BP or hyperglycemia independently predicted it.

**Conclusion:** The prevalence of CKD among Nigerian civil servants was fairly high and was associated with advancing age. Routine screening for CKD in this population is recommended.

**Key words:** Bayelsa, civil servants, kidney disease, Nigeria, prevalence

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## Introduction

The irreversible and progressive deterioration of the kidneys as occurs in chronic kidney disease (CKD) and the subsequent high cost of care pose great challenges for affected individuals, families and the nation as a whole.[1]

Apart from the effect on kidney function *per se*, kidney damage is a major determinant for the development and progression of accelerated atherosclerosis, ischemic vascular disease and cardiovascular events.[2] Individuals with even the earliest signs of CKD are at increased risk of cardiovascular disease and may die long before they reach end-stage renal disease (ESRD).

The incidence and prevalence of CKD is thought to be on the increase globally.[3,4] The burden appears to be more marked in Sub-Saharan Africa.[5] Also disturbing is the fact that CKD in Sub-Saharan Africa tends to affect relatively younger individuals, most of which are in the economically productive age group.[5,6] This has important health and economic implications for the nation. In Sub-Saharan Africa, including Nigeria, hypertension (HTN) and diabetes mellitus are among the leading causes of ESRD.[7] By 2020, the burden of diabetes and cardiovascular disease will have increased by 130% in Africa alone, with concomitant increases in the

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prevalence of CKD and ESRD.[8] Other factors contributing to the dismal picture of CKD in this part of the world include late presentation, limited renal replacement therapy and its unaffordability, absence of kidney disease prevention programs and poor literacy level.[6]

The incidence of CKD in Nigeria has been shown to a range between 1.6% and 12.4%[9] respectively. However, these studies are hospital-based and fail to include many patients who lack access to hospital care. Furthermore, only few studies have been carried out in the Niger Delta region of Nigeria which is the hub of oil and gas production, an economic beehive and a major source of revenue generation for the country. No community-based study on CKD has been carried out in Bayelsa State to the best of the authors' knowledge.

Risk factors that have been associated with CKD in previous studies carried out elsewhere include age, elevated blood pressure (BP), presence of diabetes mellitus, habitual intake of analgesics and herbs and obesity.[10] Sedentary living and lack of physical activity are prevalent among civil servants in Nigeria[11] predisposing them to complications such as obesity, HTN and by extension, chronic kidney disease.

The aim of this study was to determine the prevalence of chronic kidney disease among civil servants in Bayelsa State, Nigeria and to also determine some correlates of CKD in that population.

## Materials and Methods

This cross-sectional observational study was carried out among civil servants working in the Bayelsa State secretariat. All participants who presented for CKD screening during the World Kidney Day in March 2012 were recruited for the study. The field workers included consultant nephrologists, registrars in internal medicine, medical officers, house officers, nurses, medical assistants, chemical pathologist and laboratory technicians of the Niger Delta University Teaching Hospital, Okolobiri and the Federal Medical Centre, Yenagoa, both in Bayelsa State.

Prior notification and sensitization of workers toward the screening program was done by direct invitation, bill boards and television program. Approval for the exercise was given by the State Ministry of Health.

The purpose of the study was explained to all volunteers. Participants were assured that participation was not compulsory. They were also assured of anonymity and confidentiality.

### Clinical evaluation

Interview- administered questionnaires were used to obtain demographic data including age and sex.

Clinical examination performed on the subjects included general examination, assessment of weight, body mass index (BMI) and BP measurements. Pregnant women, menstruating ladies, those who had undergone strenuous exercise in the last 24 hrs and those with acute febrile illness or evidence of urinary tract infection were excluded from the study as proteinuria in them may not necessarily be an indication of kidney damage.

Weight was taken using a standard measuring scale calibrated in kilograms (kg) with the subject bare-footed and without heavy garments while height was taken with a stadiometer with the subject also bare-footed. All head gears or coverings were removed. BMI was calculated for each individual by dividing the weight by the square of the height. Obesity was defined as BMI >30 kg/m$^2$ according to the WHO guidelines.[12]

Measurement of BP was done with the subject seated in a chair and arm at the level of the heart using the non-dominant arm. The Accoson brand of the mercury sphygmomanometer was used. Care was taken to ensure an appropriate size was used for each patient. The first Korotkoff sound was taken as the systolic blood pressure (SBP) while the fifth Korotkoff sound was taken as the diastolic blood pressure (DBP). After 5 min of rest, SBP and DBP were measured twice with at least 2 min interval between the two and the average of each was recorded.[13] The participants had not eaten, ingested alcoholic drinks, or smoked tobacco for at least 30 min before the measurements.[13] HTN was defined as SBP >140 mmHg and/or DBP >90 mmHg. Elevated SBP was defined as SBP >140 mmHg while elevated DBP was defined as defined as DBP >90 mmHg. Pulse pressure (PP) was defined as the difference between SBP and DBP and values >60 mmHg considered elevated. Mean arterial BP was calculated as 1/3 of PP + DBP.

### Biochemical evaluation

A volume of 5 ml of venous blood was taken from each participant and preserved in lithium heparin bottle for subsequent analysis of serum urea and creatinine. Samples were immediately transported to the Chemical Pathology Department of the Niger Delta University Teaching Hospital, Okolobiri for processing.

Detection of glycosuria, proteinuria, hematuria and nitrites in urine was done using a Combi 9 dipstick. Proteinuria was defined as the presence of at least 1+ of protein on dipstick urinalysis. Glycosuria was defined as the presence of at least 1+ of glucose in urine while hematuria was defined as the presence of >1+ of blood on dip-stick.

Blood samples were analyzed for blood glucose and serum creatinine. Random blood glucose (RBG) was estimated by an Accu-check glucometer with results expressed in mmol/l. Hyperglycemia was defined as RBG >11.1 mmol/l. Serum

urea and creatinine were estimated in the subjects using the diacetyl monoxine[14] and the modified Jaffe's methods[15] respectively. Serum urea values were expressed in mmol/l while creatinine was expressed in micro mol/l.

The glomerular filtration rate (GFR) was estimated using the Cockcroft and Gault equation standardized for body surface area (BSA)[16] which correlates well with measured creatinine clearance in Nigerians.[17]

CKD was defined as estimated GFR <60 ml/min/1.73 $m^2$ BSA and/or presence of proteinuria at least 1+ on dipstick urinalysis.

## Results

### Demographic, clinical and biochemical data of the subjects

The mean age of the subjects was 45.2 ± 10.3 years with a range of 22-76 years. Fifty seven (31.8%) participants were less than 45 years old, 119 (66.5%) were between 45 years and 65 years of age while three (1.7%) were more than 65 years old.

There were 95 (53.1%) males while 84 (46.9%) were females. The clinical and biochemical parameters of the participants are shown in Table 1.

### Prevalence of CKD and other renal abnormalities

The prevalence of CKD was 7.8% (14/179). 6 participants (3.4%) had Stage 1 CKD while 4 (2.2%) were in Stage 2 CKD and another 4 (2.2%) had Stage 3 CKD. None of the participants had Stage 4 or Stage 5 CKD. Proteinuria was found in 10/179 (5.6%) subjects. Hematuria was found in 2.2% of subjects.

### Distribution of CKD by age and gender

CKD was present in 3 (5.3%) of the participants <45 years old and 10 (8.4%) of those between 45 years and 65 years old while 1 (33.3%) participant older than 65 years old had CKD. Although, the prevalence was more with increasing age group, the difference was however not statistically significant ($P = 0.182$).

Out of 95 male subjects, 10 (11.0%) had CKD while CKD was present in 4 (4.7%) out of 84 females. Although the proportion of CKD subjects were more among males, this difference was not statistically significant ($P = 0.124$).

### Correlation of estimated glomerular filtration rate with clinical parameters in the participants

The correlation of eGFR with clinical parameters is shown in Table 2.

The eGFR in the participants was significantly and positively correlated with weights and body mass indices but negatively correlated with their ages ($P < 0.001$). There was no correlation between eGFR and SBP, DBP, mean arterial BP or blood glucose ($P > 0.05$).

### Association of variables with CKD in regression models

Only age was positively associated with CKD in univariate regression. Gender, BMI, HTN, SBP elevation, DBP elevation and hyperglycemia had no association with CKD [Table 2].

In multivariate logistic analysis, none of age, gender, SBP elevation, DBP elevation, PP elevation and presence of HTN or hyperglycemia showed independent association with CKD [Table 3].

## Discussion

This study documents for the 1st time the burden of chronic kidney disease in a population in Bayelsa State. The prevalence of chronic kidney disease in this study was 7.8%. Approximately one in a dozen of the participants

**Table 1: Clinical and biochemical characteristics of the study group**

| Variable | Mean | Standard deviation | Range | Frequency (%) |
|---|---|---|---|---|
| Clinical | | | | |
| SBP (mmHg) | 128.5 | 17.5 | 88-180 | - |
| DBP (mmHg) | 81.8 | 13.2 | 40-120 | |
| Weight (kg) | 76.3 | 14.4 | 45-120 | - |
| Height (cm) | 1.71 | 0.11 | 1.42-1.98 | - |
| BMI (kg/$m^2$) | 26.4 | 5.1 | 14.4-44.6 | - |
| Biochemical | | | | |
| RBG (mmol/l) | 5.8 | 3.0 | 1.7-23.3 | - |
| S. Cr ($\mu$mol/l) | 82.5 | 15.0 | 5.9-121 | - |
| S. urea (mmol/l) | 3.41 | 1.25 | 1.2-9.8 | - |
| Hyperglycemia | - | - | - | 12 (6.7) |
| Glycosuria | - | - | - | 9 (5.0) |

RBG=Random blood glucose, S. cr=Serum creatinine, S. urea=Serum urea, SBP=Systolic blood pressure, DBP=Diastolic blood pressure, BMI=Body mass index

**Table 2: Correlation of eGFR with parameters in the participants**

| Parameter | *R* | *P* |
|---|---|---|
| Age | −0.291 | <0.001 |
| Body weight | 0.537 | <0.001 |
| BMI | 0.279 | <0.001 |
| SBP | 0.023 | 0.761 |
| DBP | 0.081 | 0.280 |
| MABP | 0.017 | 0.819 |
| RBG | −0.068 | 0.370 |

BMI=Body mass index, MABP=Mean arterial blood pressure, RBG=Random blood glucose, eGFR=Estimated glomerular filtration rate, SBP=Systolic blood pressure, DBP=Diastolic blood pressure

**Table 3: Association of variables with CKD in univariate regression models**

| Variable | Odds ratio | 95% CI | *P* |
|---|---|---|---|
| Age>50 years | 0.932 | 0.879-0.988 | 0.018 |
| Male gender | 0.425 | 0.128-1.410 | 0.162 |
| BMI≥30 kg/m$^2$ | 0.642 | 0.137-3.007 | 0.574 |
| HTN≥140/90 mmHg | 0.945 | 0.314-2.846 | 0.920 |
| SBP≥140 mmHg | 0.925 | 0.296-2.891 | 0.893 |
| DBP≥90 mmHg | 0.950 | 0.304-2.968 | 0.930 |
| PP elevation>60 mmHg | 0.750 | 0.088-6.388 | 0.792 |
| Hyperglycemia≥11.1 mmol/l | 0.703 | 0.145-3.412 | 0.662 |

BMI=Body mass index, HTN=Hypertension, PP=Pulse pressure, CKD=Chronic kidney disease, SBP=Systolic blood pressure, DBP=Diastolic blood pressure, CI=Confidence interval

evaluated had chronic kidney disease. In Nigeria, as in many other developing countries, accurate data on the community prevalence of CKD is lacking principally due to unavailability of a national renal registry. Although, this was a community-based study, the finding is not much different from earlier hospital-based prevalence reports of 8-10% from the South-Western part of the Country.[18,19] ESRD accounted for 8% of medical admissions in South Eastern Nigeria.[5] Comparisons between studies are of course fraught with difficulty as the definitions, study design and criteria of selection of participants may substantially differ. A study by Abu-Aisha *et al*. found prevalence rates of 7.7% and 11.0% using the 4-variable MDRD and the Cockroft-Gault equations respectively in a community pilot study among police officer households in Sudan.[20] Although ethnic disparity has been reported in CKD with a higher prevalence among blacks possibly from the complex interaction between socio-cultural, genetic and environmental factors,[21] our findings are quite similar to reports emanating from Caucasians. Amato *et al*., Coresh *et al*. and Fox *et al*. found CKD prevalence rates of 8.5%, 7.0% and 8.6% respectively in America from 2003 to 2006.[22-24] Furthermore, Cirillo found overall prevalence of 6.4% in Italy.[25] Nitsch *et al*. found prevalence of 8.1% in Switzerland[26] while in Iceland, prevalence of CKD was 7.2%.[27] Studies from Asia and Australia revealed prevalence rates of 6.8% in Thailand,[28] 6.6% in Singapore,[29] 10.3% in Japan[30] and 12% in Australia.[31] Most of these rates do not differ much from the findings of this study. However, our use of dipstix proteinuria as a marker of kidney damage rather than urinary albumin excretion as used in some of these studies may not allow for adequate comparison.

In a recent population based study in south eastern Nigeria, Ulasi reported prevalence of early markers of CKD as 26.8%.[32] Markers of early CKD were taken as protein creatinine ratio (PCR) ≥30 mg/g), hematuria or eGFR Stages 1-3. This contrasts with our study where hematuria was not considered a marker of CKD. PCR may be considered as a more sensitive marker of proteinuria than dipstick measurement. These may partly explain the higher prevalence of CKD in that study. The rate obtained in this study is also less than the 19.0% (using Cockcroft-Gault equation) and 12.4% (with MDRD equation) obtained in the Democratic Republic of Congo.[33] In that study, 24 h urinary protein was estimated and values of at least 300 mg/dl considered significant as evidence of kidney damage. We are of the view that this may have contributed to the observed differences.

Proteinuria was present in 5.6% of participants. This finding is similar to those obtained during routine screening studies in other parts of Nigeria. A study by Amira *et al*. found prevalence of up to 4.9% in a population in South-West Nigeria.[34] Dip-stick hematuria on the other hand was detected in 2.2% of participants. This corroborates the report by Olanrewaju and Aderibigbe in their cohort of non-hypertensive control group selected from the general population in Ilorin.[35] Nearly 5% of participants had glycosuria. This is in agreement with the report of Fatiu *et al*. who found prevalence of 4.5% in an apparently healthy market population in Ile-Ife.[36]

We also report a positive association between chronic kidney disease and age in this population. Age was positively correlated with CKD in this study even though it was not an independent predictor of CKD. The association of age with CKD has been reported severally in literature.[11,19,37] It is a well-known fact that renal function decreases with age.[38,39] Although BMI was positively correlated with eGFR in our study, there was no association between BMI and CKD per see. While some studies have reported a positive association between BMI and CKD,[28,40,41] other reports have been on the contrary.[32,42] The reason for these contradictory findings is not clear and demands further investigations.

Gender differences did not have a significant association with CKD in this study. This does not agree with the findings of many other studies, in which the male gender was reported to be a non-modifiable risk factor for CKD.[43,44] Female preponderance of CKD has however been documented in Asia.[45] However, just like in our study, Afolabi *et al*. found no sex predilection.[12] The reason for these differences is not obvious but may be related to sample sizes and relative proportion of each gender in these series. Contrary to expectation, the study found no association between CKD and HTN in the participants. There was also no association between hyperglycemia and CKD in this study. Several studies have however reported an association between CKD and hyperglycemia (diabetes) and HTN.[37,41,46] A Congolese study similarly found no association in multivariate analysis between the presence of HTN, diabetes or obesity and CKD or proteinuria among high school children.[47] Subsequent studies on this regard may therefore also be needed.

The study had some other limitations. Being a snapshot study, kidney function and blood sugar could not be assessed

at a later period as required. Proteinuria was assessed with urine stix testing rather than timed specimen collection or spot urine albumin/PCR which has higher sensitivity and specificity for protein excretion.[48] Also some participants with Stages 1 and 2 CKD could have been missed because of absence of imaging thus underestimating CKD. However, the result of the study is tenable and still highlights the burden of kidney disease in the studied population.

## Conclusion

The present study is the first epidemiologic study designed to survey the prevalence of CKD in a population in Bayelsa State, Nigeria. Its strength also lies in being a community-based study rather than a hospital-based one.

The prevalence of CKD in this Bayelsa state population was quite high. This is consistent with earlier studies in other parts of Africa and across the globe.

Age, weight and BMI were correlated with GRF in these subjects, but were not predictors of CKD. Gender, BP and blood glucose were also not predictors of CKD in the participants.

Routine screening for CKD is therefore recommended among civil servants in Nigeria. There is also need for subsequent studies on CKD prevalence among other population in Bayelsa state and indeed in other parts of Nigeria and Sub-Saharan Africa.

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