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Sleep quality and associated factors among patients with chronic kidney disease in Nigeria: a cross-sectional study

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ABSTRACT

Objective Poor sleep quality adversely affects the overall well-being and outcomes of patients with chronic kidney disease (CKD). However, it has not been well studied in Africans with CKD. We determined the prevalence of poor sleep quality and associated factors among patients with CKD.

Design This was a cross-sectional study that involved patients with CKD.

Settings The study was carried out in the outpatient clinic of nine hospitals in Nigeria.

Methods Sleep quality, depressive and anxiety symptoms and quality of life (QoL) were assessed among 307 patients with CKD using Pittsburgh Sleep Quality Index Questionnaire, Hospital Anxiety Depression Scale Questionnaire and 12-item Short Form Health Survey Quality of Life Questionnaire, respectively. The prevalence of poor sleep quality and associated factors were determined. A p<0.05 was considered as statistically significant.

Results The mean age of the study participants was 51.40±15.17 years. The male/female ratio was 1.5:1. One hundred and twenty-one (39.4%) of the patients were on maintenance haemodialysis (MHD). The prevalence of poor sleep quality, anxiety symptoms and depressive symptoms among the patients was 50.2%, 37.8% and 17.6%, respectively. The prevalence of poor sleep quality was significantly higher in MHD patients compared with predialysis patients with CKD stages 3, 4, 5 and 5D was 38.1%, 42.6%, 52.2% and 58.7%, respectively. The prevalence of poor sleep quality was significantly higher in MHD patients compared with predialysis CKD (59.5% vs 43.6%; p=0.008). Factors associated with poor sleep quality were CKD stage (p=0.035), anaemia (p=0.003), pruritus (p=0.045), anxiety symptoms (p=0.001), depressive symptoms (p=0.001) and reduced QoL (p=0.001). On multivariate analysis, factors associated with poor sleep were anxiety (AOR 2.19; 95% CI 1.27 to 3.79; p=0.005), anaemia (AOR 5.49; 95% CI 1.43 to 21.00; p=0.013) and reduced physical component of QoL (AOR 4.11; 95% CI 1.61 to 10.47; p=0.003).

Conclusion Poor sleep quality is common among patients with CKD especially in the advanced stage. The significant factors associated with poor sleep quality were QoL, anaemia and anxiety symptoms. These factors should be adequately managed to improve the overall outcomes of patients with CKD.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ The study provided evidence on the need to routinely assess sleep quality in patient with chronic kidney disease in Nigeria.
⇒ A validated, but subjective method of assessment of sleep quality was used.
⇒ Participants provided responses about their previous sleep experiences which could introduce recall bias.

INTRODUCTION

Chronic kidney disease (CKD) is a chronic illness that has a negative impact on physical, mental, economic well-being and quality of life (QoL) of the patients, their caregivers and family members.1–5 The quality and duration of sleep are factors that affect both physical and mental well-being of individuals.4,5 Sleep deprivation is associated with adverse cardiovascular, endocrine, metabolic and inflammatory consequences in the general population.6 Previous studies established the association between duration of sleep, cardiovascular outcomes and mortality.7,8

Poor sleep quality is common in both predialysis patients with CKD and those with end-stage renal disease (ESRD) on renal replacement therapy (RRT).9–14 Previous reports showed that the prevalence of poor sleep quality in patients with CKD was between 37% and 87%.9–14 It is caused by interplay of multiple factors in patients with CKD. These factors include medication side effects, high level of daytime melatonin, tyrosine deficiency, uraemia, stress, anxiety, depression, restless leg syndrome and change in normal body temperature rhythm and dialysis treatment.15

Poor sleep quality has been identified as a novel cardiovascular risk factor for development and progression of CKD.16,17 Sleep...
disturbances and deprivation are associated with increase in sympathetic nervous system stimulation, heart rate, fluid retention, blood pressure, vascular non-compliance, endothelial dysfunction, which may cause progression of CKD to ESRD.\textsuperscript{16}

Despite the impact of sleep quality on overall well-being and outcomes of patients with CKD, it has not received the deserved attention in CKD management. Mental well-being of patients with CKD which includes sleep quality is not routinely assessed during their evaluation and management. This leads to loss of opportunity for intervention, which may improve their overall outcomes. Presently, there are limited data on sleep quality among patients with CKD in Africa including Nigeria.\textsuperscript{18}

The aim of this study was to determine the prevalence of poor sleep quality and associated factors among patients with CKD. The information from this study will provide the basis to advocate for regular mental health evaluation in CKD management with the aim of improving their overall QoL and outcomes.

MATERIALS AND METHODS
Study design
This was a cross-sectional study that was conducted over a 9-month period between September 2021 and May 2022. The study was carried out among patients with CKD in the nephrology departments of nine hospitals in seven States of Nigeria.

Sample size calculation
The sample size was determined using the formula for single proportion.\textsuperscript{19} The prevalence of poor sleep quality in patients with CKD used in this calculation was 77.8% based on report from a previous study.\textsuperscript{12} The confidence interval was taken as 95% and the power of the study was 80%. The minimum sample size for this study was 293 after including 10% attrition.

Study participants
Participants for this study were selected from the nephrology departments of nine participating health institutions, which were conveniently selected. These institutions were located in 7 out of 36 states in Nigeria and representing both Southern and Northern regions of the country. Sample size for each institution was determined using proportional allocation that was based on their respective patient population, which ranged from 30 to 150. Within the respective nephrology department, patients were selected using systematic sampling with the weekly patient population list serving as the sampling frame. Only those who met the inclusion criteria were recruited for the study after screening.

Inclusion criteria for the study were stages 3–5 patients with CKD determined by Kidney Disease Improving Global Outcome classification guideline who were yet to commence maintenance dialysis, patients with CKD who were receiving maintenance haemodialysis (MHD) in the hospital, and the absence of established diagnosis of mental health illness. Clinically unstable patients with CKD and those with acute illness were excluded from the study.

A researcher-administered questionnaire was used to obtain sociodemographic and clinical information from study participants. The 12-item Short Form Health Survey (SF-12) questionnaire was used to assess QoL. While the Health Hospital Anxiety and Depression Scale were used to assess study participants for anxiety and depressive symptoms.\textsuperscript{20, 21} Sleep qualities of study participants were assessed with Pittsburgh Sleep Quality Index (PSQI).\textsuperscript{22} PSQI contains 24 questions and seven components (first component: subjective sleep quality, second component: sleep latency, third component: sleep duration, fourth component: habitual sleep efficiency, fifth component: sleep disturbances, sixth component: use of sleeping medication, seventh component: daytime dysfunction. In every domain of the scale, scoring was performed within a range of 0–3. The sum of the scores of these seven components constituted the total index score. High scores indicated that sleep quality is impaired. In this scale, the total value can be between 0 and 21. Good quality was defined as PSQI score of 0–5 while poor quality sleep was defined as PSQI score ≥6.\textsuperscript{22}

The SF-12 is a multipurpose short form survey with 12 questions that assesses mental and physical functioning and overall health-related QoL. Reverse scoring was done for 4 items after which 35 indicator variables were created. Weighting of indicator variables and computation of aggregate scores for physical and mental summary scales were done. Each summary scale score was transformed to the norm-based scoring. A formal check of the accuracy of scoring was done to eliminate errors. Reduced QoL score was taken as value less 50.\textsuperscript{23}

Hospital Anxiety and Depression Scale is a 14-item scale. Each item was scored from 3 to 0 (‘yes definitely’ to ‘not at all’) with reversal of the scoring system for items 7 and 10. Anxiety score was based on items 2, 4, 6, 8, 11, 12 and 14 while depression score was based on items 1, 3, 5, 7, 9, 10 and 13. The total score range for both anxiety and depressive symptoms is 0–21. Non-case is designed as score of 0–7, borderline case as score of 8–10 and case as score of ≥11. CKD stage was based on Kidney Disease Improving Global Outcomes.\textsuperscript{24} Anaemia was defined as packed cell volume less than 36%.\textsuperscript{25}

Patient and public involvement
Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Data analysis
Data generated were analysed using the SPSS V.21.0. Missing data for individual variables occurred randomly and was less than 5%. These were automatically excluded during data analysis. Discrete variables were presented as frequency and percentages. Continuous variables were

presented as means and SD. Subgroup analysis was done between predialysis and dialysis patients using \( \chi^2 \) was used to find association between categorical variables. Multivariable logistic regression analysis was used to determine factors associated of poor sleep quality. A p<0.05 was considered as statistically significant.

**RESULTS**

Three hundred and seven patients with CKD with a mean age of 51.40±15.17 years participated in this study. The male:female ratio was 1.5:1. About half of the patients had tertiary education while 68.7% were married. Forty-six per cent of the participants were between ages 40 and 60 years while majority (81.4%) were employed. Among the patients with CKD, 63 (20.5%) had CKD stage 3, 54 (17.6%) had CKD stage 4, 69 (22.5%) had CKD stage 5 while 121 (39.4%) had CKD stage 5D. The common aetiologies of CKD in this study were hypertension (34.5%), diabetes mellitus (25.7%) and chronic glomerulonephritis (21.2%) (table 1).

The prevalence of poor sleep quality was significantly higher in MHD patients compared with predialysis CKD (59.5% vs 43.6%; p=0.008). Also, depression was significantly higher in the MHD patients (23.8% vs 13.3%; p=0.022). Reduced QoL was also significantly lower in the MHD group compared with the predialysis CKD group (<0.001) (table 2).

The prevalence of poor sleep quality in the CKD stages 3, 4, 5 and 5D was 38.1%, 42.6%, 52.2% and 58.7%, respectively. Significant factors associated with poor sleep quality were anaemia (p=0.003), pruritus (p=0.045), CKD stage (p=0.035), anxiety (p≤0.001), depression (p≤0.001) and reduced QoL (p≤0.001) (table 3).

A higher proportion of patients on MHD had score of 2 points and 3 points when compared with predialysis patients with CKD for the various components of the sleep quality assessment (figure 1).

On multivariate analysis, factors associated with poor sleep were anxiety (AOR 2.19; 95% CI 1.27 to 3.79; p=0.005), anaemia (AOR 5.49; 95% CI 1.43 to 21.00; p=0.013) and reduced physical component of QoL (AOR 4.11; 95% CI 1.61 to 10.47; p=0.005) (table 4).

**DISCUSSION**

This study determined the prevalence of poor sleep quality and associated factors among patients with CKD. Poor sleep quality was found in about half of the patients with CKD and was more common in those with advanced CKD. The significant factors associated with poor sleep among the patients with CKD were QoL, anaemia and anxiety symptoms. The prevalence of poor sleep quality in this study was 50.2% which is significantly higher than 25.7% reported among the general population in Nigeria by Ogunsemi et al. The finding of this study suggests that CKD is associated with poor sleep quality. The prevalence of poor sleep quality in this study falls between 37% and 87% that has been reported among CKD population in some previous studies. The prevalence in this study is higher than 37% and 36.2% reported by Yamamoto et al and Tu et al. respectively. However, it is lower than 68.6% and 87% reported by Zubair and Butt and Edalat-Nejad and Qlich-Khani, respectively. These differences may be due to the study setting, patient demographics, and the use of different sleep quality assessment tools.

<table>
<thead>
<tr>
<th>Table 1 Sociodemographic parameters of study participants (N=307)</th>
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<tbody>
<tr>
<td>Characteristic</td>
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<tr>
<td>Age (years)</td>
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<td>Mean age 51.40±15.17 years</td>
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<td>Level of education</td>
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<tr>
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<tr>
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<tr>
<td>Aetiology of CKD</td>
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<tr>
<td>Hypertension</td>
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<tr>
<td>Diabetes mellitus</td>
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<tr>
<td>Chronic glomerulonephritis</td>
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<td>HIVAN</td>
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<td>ADPKD</td>
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<td>Obstructive uropathy</td>
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<tr>
<td>SLE</td>
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<tr>
<td>Others</td>
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<td>CKD stage</td>
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ADPKD, autosomal dominant polycystic kidney disease; CKD, chronic kidney disease; HIVAN, HIV-associated nephropathy; SLE, systemic lupus erythematosus.
partly related to the differences in clinical characteristics of the study population. While Tu et al.27 included patients with CKD in early stages, that is, stages 1 and 2, Edalate-Nejad and Qlich-Khani14 and Zubair and Butt28 studied patients who were only on MHD. This study involved both predialysis patients with CKD in stages 3–5 and patients with ESRD on MHD. Other factors that may contribute to these varied prevalence rates in the various studies are differences in the sociodemographic characteristics, behavioural factors, environmental factors and method of assessment of sleep quality.

There was a significant association between the prevalence of poor sleep quality and CKD stage in this study. This agrees with a report that showed increasing trend in the prevalence of poor sleep quality across CKD stages.18 However, some previous studies did not find a significant association between poor sleep quality and renal function.10 27 29 In this study, the prevalence of poor sleep quality among predialysis CKD and MHD patients were 43.6% and 59.5%, respectively. In fact, the proportion of study participants with higher scores in the various components of the sleep quality assessment was more common in HD patients compared with predialysis patients with CKD. The significantly higher prevalence of poor sleep quality in the MHD patients is similar to report by Mujahid et al.30 However, this finding is different from report of Shafi and Shafi11 who did not find any significant difference in the prevalence of poor sleep quality between MHD and predialysis population.

Majority of HD patients in Nigeria are not optimally dialysed due to financial cost of RRT which is beyond their reach.31 32 Suboptimal dialysis may contribute to higher prevalence of poor sleep quality in MHD patients.
Conditions such as pain, anxiety, depression which are more common in HD patients may also have significantly contributed to the higher prevalence of poor sleep quality compared with predialysis patients. In addition, patients with advanced stages of CKD especially those on MHD usually have elevated levels of inflammatory cytokines, orexin and reduced level melatonin which can cause sleep disturbances by altering the circadian rhythm.

There was a significant association between poor sleep quality, anxiety and depressive symptoms. This is similar to findings from some previous studies. Those with anxiety were twice more likely to have poor sleep quality compared with those without anxiety. The significant association between poor sleep quality, depression and anxiety may be related to the fact that sleep disturbances are common features of both depression and anxiety. This underscores the need to routinely assess patients with CKD for depressive and anxiety symptoms.

There was no significant difference in the prevalence of poor sleep quality between male and female patients with CKD in this study. This is similar to reports from some previous studies. However, this finding is at variance to the report of some other studies that reported significantly higher prevalence of poor sleep quality in female patients with CKD. Also, there was no significant association between poor sleep quality and age in this study. This is similar to some previous reports. However, this finding is not surprising because there is no significant association between poor sleep quality and age in this study. This is similar to some previous reports. Older age was reported to be significantly associated with sleep quality in some previous studies. The findings in this study suggest that sleep quality should be assessed in patients with CKD irrespective of their sociodemographic characteristics.

Poor sleep quality was associated with anaemia in our study. Patients with CKD with anaemia had sixfold increased risk of having poor sleep quality in this study. This is in keeping with previous reports. However, this difference may be due to the relatively small sample size in their study. The link between sleep quality, insomnia and anaemia is not well understood. However, a plausible explanation is that anaemia is associated with fatigue which may lead to poor quality of sleep.

There was an association between mental and physical components of QoL and poor sleep quality in this study, which agrees with some previous reports. Pruritus was found to be significantly associated with poor sleep quality. This is corroborated by the report of systematic review by Huang et al that showed that pruritus is one of the significant factors associated with poor sleep quality among patients with CKD. This finding is not surprising because
In conclusion, poor sleep quality is common among patients with CKD especially in the advanced stage. It was associated with advanced CKD (both stages 5 and 5D), pruritus, anaemia, reduced QoL and depressive and anxiety symptoms. Sleep quality and other psychological problems such as anxiety and depression in some CKD population in Nigeria which has not been previously done. Also, it has provided evidence on the need to assess sleep quality among patient with CKD and institute appropriate care in routine clinical practice in Nigeria.
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Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Consent obtained directly from patient(s).

Ethics approval This study involves human participants and ethical approval for this study was obtained from the Human Research and Ethics and Committee of the Delta State University Teaching Hospital, Nigeria. The approval reference number was DELSU/HREC/2021/040/0549. Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available on reasonable request.

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