

**QUALITY OF SLEEP AND SLEEP DISORDERS IN
ADULT PATIENTS WITH END STAGE RENAL
DISEASE UNDERGOING HEMODIALYSIS AT
KENYATTA NATIONAL HOSPITAL**

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This study is my original work and has not been presented for a degree in any other University.

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DEDICATION

I dedicate this work to my parents, without whom any of this would not be possible, and to my wife Fatema and daughter Batul, whose continued love, support and sacrifices have enabled me to reach this far.

ACKNOWLEDGEMENTS

I would like to thank my supervisors: Professor J.K Kayima and Dr J.O Mecha for their encouragement, insightful comments and tireless guidance. I would also like to thank all my friends and colleagues who have always been a great support.

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ABBREVIATIONS

ESRD	End-stage renal disease
OSA	Obstructive sleep apnea
SDB	Sleep disordered breathing
RLS	Restless leg syndrome
PLMS	Periodic Limb movement syndrome
QOL	Quality of Life
EEG	Electroencephalogram
PSG	Polysomnography
BMI	Body Mass Index
PSQI	Pittsburgh sleep quality index
BQ	Berlin Questionnaire
ESS	Epworth Sleepiness Score
UON	University of Nairobi
ICSD	International Classification of sleep disorders
KNH	Kenyatta National Hospital
WHO	World health organization
GFR	Glomerular Filtration rate
ICD	International Classification of Diseases
KDIGO	Kidney disease improving global outcomes
REM	Rapid eye movement
NON-REM	Non rapid eye movement
RAAS	Renin Angiotensin Aldosterone System
CKD	Chronic Kidney Disease
SPSS	Statistical Package for social services
ICSD	International Classification of sleep disorders

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ABSTRACT

Introduction

The burden of poor sleep quality and sleep disorders is higher amongst patients with End-Stage Renal Disease (ESRD) on hemodialysis compared to the general population and is associated with increased morbidity and mortality. The quality of sleep and burden of sleep disorders amongst Kenyan patients with ESRD on hemodialysis is not known.

Objectives

The objective of the study was to assess the quality of sleep and the prevalence of insomnia and high risk for Obstructive Sleep Apnea (OSA) in patients with ESRD on hemodialysis and to determine the associated sociodemographic, clinical and biochemical parameters.

Study design

A hospital based cross-sectional descriptive study carried out over duration of three months.

Study participants and study site

Patients with ESRD on hemodialysis for more than three months at the renal unit, Kenyatta National Hospital (KNH)

Methods

Patients on hemodialysis were invited to participate in the study. All patients who met the inclusion criteria were recruited, after giving written consent, based on consecutive sampling. Targeted history was taken and anthropometric measurements done. Blood was drawn for biochemical parameters (hemoglobin and phosphate). Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), high risk for OSA using Berlins Questionnaire (BQ) and insomnia using the Athens Insomnia Scale (AIS). Associations between poor sleep quality, high risk for OSA, insomnia and various sociodemographic, clinical and biochemical factors were explored. Associated variables were subjected to logistic regression analysis with odds ratio reported. Data was analyzed using the Statistical Package for Social Sciences (SPSS) version 21.0 software.

Results

The study was conducted between August 2016 to October 2016. Out of the 115 patients analysed, 59.1% were males, mean age was 44.7(±16.1) and mean BMI was 23.1(±5.1) kg/m².

Of the 115 patients assessed, 80 (69.6%) had poor sleep quality, 54 (47%) had insomnia and 40(34.8%) had high risk for Obstructive Sleep Apnea.

Conclusion

We obtained a high prevalence of poor sleep quality and sleep disorders (insomnia and high risk for OSA), similar to that reported in other populations. Assessment for and management of quality of sleep and sleep disorders in ESRD patients on hemodialysis should be an important component of care.

1. INTRODUCTION

Good sleep quality is defined subjectively as one's perception of falling asleep easily, getting sufficient duration so as to wake up feeling rested, and making it through their day without experiencing excessive daytime sleepiness.

The prevalence of sleep abnormalities is greater in ESRD than the general population (1). Poor quality of sleep contributes to poor health related quality of life in hemodialysis patients (2).

Sleep disorders are common in ESRD patients and it is one of the most common symptoms with a prevalence of 44 % (3) . Sleep disorders contribute to poor sleep quality in ESRD patients (2). Sleep disorders affect African Americans more than Caucasians (4). There are more than 70 sleep disorders that have been described and they can be managed effectively once a diagnosis is made (5).The most common sleep disorders in hemodialysis patients are insomnia and OSA.

The World Health Organization (WHO) estimates one in every five men and one in every four women in Kenya aged between 65 and 74 suffer from Chronic Kidney Disease (CKD). The Kenyan Ministry of Health estimates that 10000 cases of kidney disease are diagnosed annually (6).

With this increasing burden of ESRD, attention should be given to all aspects of patients wellbeing. However sleep complaints are under recognized by health care providers (7). Improving the quality of sleep and treating sleep disorders may improve quality of life in these patients.

2. LITERATURE REVIEW

2.1 NORMAL SLEEP ARCHITECTURE

Sleep occurs in stages of 90-120 minute cycles, with 4-5 cycles occurring during a typical night of sleep. Normal Sleep is categorized as REM (rapid eye movement) and non-REM sleep.

REM recurs every 90-120 minutes and makes up 20-25% of total sleep. It occurs in 4-5 discrete episodes and is classified into two phases. The Phasic phase is sympathetically driven and characterized by phasic bursts of rapid eye movement, muscle twitches and respiratory variability. The tonic phase exists between the phasic bursts mediated by parasympathetic system consisting of atonia.

NON-REM Sleep predominates in the first two-thirds of sleep. It makes up 75-80% of total sleep and is divided into 3 stages:

N1- this is a transition from wakefulness to sleep. It is the lightest stage of sleep. It accounts for 2-3% of sleep time in young adults. It is characterized by low, amplitude fast frequencies in theta range (4-7 hz)

N2-this is sometimes called intermediate sleep. It accounts for 40-50% of total sleep time. It is characterized by slow frequency, high amplitude Electroencephalogram (EEG) pattern

N3- this is referred to as deep sleep or slow wave sleep. It accounts for 15% of total sleep time. It is characterized by low frequency, high amplitude delta EEG pattern.

Functions of Normal Sleep

The exact functions of normal sleep are not well known. REM sleep may be important in memory consolidation, emotional and cognitive wellbeing and NON-REM sleep in replenishing glycogen stores and removal of redundant synapses.

Sleep deprivation studies show that sleep deprivation causes the metabolic activity of the brain to decrease significantly, there is a decrease in immune system function and decrease in the release of growth hormone (8,9).

2.2 CLASSIFICATION OF SLEEP DISORDERS

The International Classification of Sleep Disorders (ICSD 3) classifies sleep disorders into 7 major categories(10): insomnia, sleep related breathing disorders(Central Sleep Apnea , OSA and sleep related hypoxemia/hypoventilation syndromes), hypersomnias of central origin, Circadian rhythm sleep disorders, parasomnias, sleep related movement disorders(Restless leg syndrome, periodic limb movement disorder, sleep related bruxism, and sleep related movement disorder) and other sleep disorders.

Insomnia according to ICSD 3 is further classified into chronic insomnia disorder, short-term insomnia disorder and other insomnia disorder. The criteria for diagnosing chronic insomnia disorder include 1) a report of sleep initiation or maintenance problems 2) adequate opportunity and circumstances to sleep 3) daytime consequences. The duration criterion for chronic insomnia disorder is three months, with a frequency criterion of three times per week. However, insomnia is an expected aspect of many medical and psychiatric conditions and the diagnosis of chronic insomnia disorder should only be used if insomnia is unexpectedly prolonged or especially prominent.

According to ICSD-3 the core criteria for diagnosing OSA requires either signs/symptoms (associated sleepiness, fatigue, insomnia, snoring, observed apnea, subjective nocturnal respiratory disturbance) or associated medical or psychiatric condition (atrial fibrillation, hypertension, coronary heart disease, congestive heart failure, stroke, diabetes, cognitive dysfunction or mood disorder) coupled with five or more predominantly obstructive events per hour of sleep during Polysomnography (PSG). Alternatively, a frequency of obstructive respiratory events of ≥ 15 per hour satisfies the criteria, even in the absence of associated symptoms or disorders.

As mentioned previously the commonest sleep disorders in ESRD are insomnia and OSA, however other sleep disorders such as periodic limb movement disorder and restless leg syndrome have also been studied in ESRD patients.

2.3 ASSESSMENT OF QUALITY OF SLEEP AND SLEEP DISORDERS

The gold standard for objectively measuring quality of sleep and sleep apneas is PSG. PSG consists of a simultaneous recording of multiple physiologic parameters related to sleep and wakefulness. These include electroencephalography, electrooculography and surface electromyography. PSG measures sleep duration, sleep fragmentation and architecture. However, it requires patient admission into an overnight sleep laboratory, it is expensive and not readily available.

Insomnia is primarily a clinical diagnosis and is most frequently diagnosed from data obtained from the history and from sleep diaries. PSG is not indicated in the initial evaluation of insomnia but may be necessary in chronic treatment-resistant cases.

The Pittsburgh Sleep Quality Index (PSQI) is the gold standard for subjective assessment of sleep quality (11). OSA can be screened using questionnaires such as the BQ and STOP-BANG, which determines high risk for OSA. Insomnia can be assessed using questionnaires such as the AIS and insomnia severity index. In our study we used the PSQI, BQ and AIS as they have frequently been used in previous studies in ESRD patients.

The PSQI, BQ and AIS are validated questionnaires. Questionnaires are a good screening tool, are easier to perform, less time consuming and cost effective. However, they are a subjective way to assess for sleep, may have recall bias, and less useful as a diagnostic tool.

Pittsburgh Sleep Quality Index (PSQI)

The PSQI is a self-administered questionnaire which assesses the quality of sleep during the previous month. It contains 19 self-rated questions yielding seven components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction over the previous month. Each component scores from 0 to 3 (a score of 3 represents worse scores) giving a global PSQI score between 0 to 21. Any score greater than 5 identifies poor quality sleepers.

It has been validated in several population and patient groups (12–15) and translated in 56 different languages. The PSQI has not been validated in Kenya, however there is a validation study in a Nigeria (14).

Berlin Questionnaire (BQ)

The BQ is a widely used self-administered questionnaire composed of 11 self-reported questions used to identify individuals with a high risk for OSA. It includes 5 items on snoring (category 1, items 1-5), 3 items on daytime somnolence (category 2, items 6-8), and 1 item on the history of

hypertension (category 3, item 9). It also includes information on age, gender, height, weight and BMI.

The overall score is based on the patient's responses to each of the 3 categories. High risk for OSA is considered as a positive score of 2 or more of the 3 categories.

A validation study done in Cleveland, Ohio against Polysomnography revealed that being in the high-risk group as per the Berlin Questionnaire predicted a Respiratory disturbance index (number of respiratory events per hour as measured by a portable sleep monitor) greater than 5 with a sensitivity of 86%, a specificity of 77%, a positive predictive value of 0.89, and a likelihood ratio of 3.79 (16).

Athens Insomnia Scale (AIS)

The AIS is widely used to measure insomnia. It was developed in Athens, Greece and consists of eight questions based on the International Classification of Diseases (ICD 10) definition of insomnia. It is self-administered and has 8 questions, the first five questions assess for nocturnal sleep, and the last three related to daytime dysfunction. The eight questions are rated on a scale of 0-3 and a cut off score of 6 is used to establish a diagnosis of insomnia

A validation study was done in Athens, Greece by Soldatos et al, against the sleep problem scale. The correlation with this scale was very high (coefficient of 0.90), internal consistency (Cronbach's alpha: 0.89) and test retest reliability were found to be very satisfactory (17). Soldatos et al established that the AIS can be used as a screening tool for reliably establishing the diagnosis of insomnia.

2.4 QUALITY OF SLEEP IN PATIENTS WITH ESRD ON HEMODIALYSIS

Unruh et al did a PSG study on hemodialysis patients on thrice weekly dialysis. The patients on hemodialysis had a significantly shorter sleep time, less REM sleep and more frequent awakenings compared to non-renal controls (18).

2.4.1 Epidemiology of quality of sleep

The reported prevalence of sleep-wake complaints is in the range of 50-80% (19,20) in patients with ESRD on hemodialysis.

Studies carried out in different cohorts, have found a range of 49%-75% for prevalence of poor quality of sleep.

Elder et al did a multi-center study in 11351 patients from 308 dialysis centers in seven countries in the Dialysis Outcomes and Practice Patterns Study between 1996 and 2001. Quality of sleep was assessed using a self reported sleep quality scale (patients were asked to rate their sleep on a scale of 0-10, where 0 represents very good and 10 very bad, a score of 5 or less represented poor sleep) and 49% of patients were found to have poor sleep quality (2).

A study in a Canadian population by Iliescu et al using the PSQI found 71% had poor quality of sleep (21). Similar studies carried out in Taiwanese and Brazilian patients found a prevalence of 66% and 75% respectively (22).

TABLE 1: Prevalence of poor quality of sleep using PSQI in hemodialysis patients

STUDY	SAMPLE SIZE	PREVALENCE
ELDER ET AL (2)	11351	49%
ILIESCU ET AL, ONTARIO CANADA (21)	116	71%
BASTOS ET AL, BRAZIL (23)	100	75%
CHEN WC ET AL, CHINA (22)	710	66%

2.4.2 Factors affecting quality of sleep

1. Sociodemographic

- (i) **Gender:** Female patients on hemodialysis have a poorer quality of sleep compared to males (2). A possible explanation is sleep loss enhances the inflammatory process more in females than in males, and increases the risk disorder in females (24)

- (ii) **Age:** Sleep difficulties are related to older age. This is similar in the general population where the prevalence and severity of sleep disorders is associated with advanced age. Sleep quality decreases with age and this can be attributed to multiple drug use, increased frequency of physical diseases, primary sleep disturbances or lifestyle modifications.

2. Clinical Factors

- (i) **Smokers:** Smoking is associated with difficulty in initiating sleep and sleep fragmentation (25). Sleep disorders may be more prevalent amongst smokers due to stimulant effects of nicotine, nighttime withdrawal from smoking, increased prevalence of sleep disordered breathing compared to non smokers (20). Studies done show that cigarette smoking is associated with poor sleep quality in ESRD (2,26).
- (ii) **Body Mass Index:** BMI more than 30 kg/m² is associated with poor sleep quality as compared to a BMI 20-30kg/m² (2). Obesity is associated with sleep disorders such OSA.
- (iii) **Dialysis vintage (length of time on dialysis):** The prevalence of poor sleep quality is more significant the longer the dialysis vintage. Accumulation of co morbidities such as cardiovascular diseases and peripheral neuropathy, whilst on long term dialysis contributes to sleep disordered breathing and hence poor quality of sleep. A study by De Santo et al showed that patients with subclinical or clinical sleep disorders had double the dialysis vintage compared to those without sleep complaints (27). In a study by Tatomir et al, patients who were on hemodialysis for more than 10 years all had disturbed sleep with frequent awakening and reduced sleep efficiency (28).

3. Biochemical

- (i) **Anemia:** Poor quality of sleep is associated with low hemoglobin (21) . Anemia is linked to Restless Leg Syndrome (RLS), Periodic Limb Movement Disorder (PLMD) and insomnia which contribute to poor sleep quality (29). Correcting anemia results in improved quality of sleep, as demonstrated by the SLEEPO study (30), in which by

normalizing hematocrit sleep quality improved, there was a reduction in PLMD and improved daytime alertness.

- (ii) **Phosphatemia:** Patients with poor sleep quality have higher phosphorus levels (2,4). Phosphatemia has been linked to RLS, which can lead to poor sleep quality. Phosphatemia also leads to uraemic pruritus, which can lead to insomnia. Narita et al, demonstrated that phosphatemia was an independent risk factor for development of severe pruritus (31).

2.5 POSSIBLE EXPLANATIONS FOR POOR SLEEP QUALITY IN ESRD

As suggested by Elder et al (2), the flowchart below shows relationships between factors associated with quality of sleep. Elder et al, found that quality of sleep was associated with sleep disorders, pruritus, depression, quality of life, medications and comorbidities.

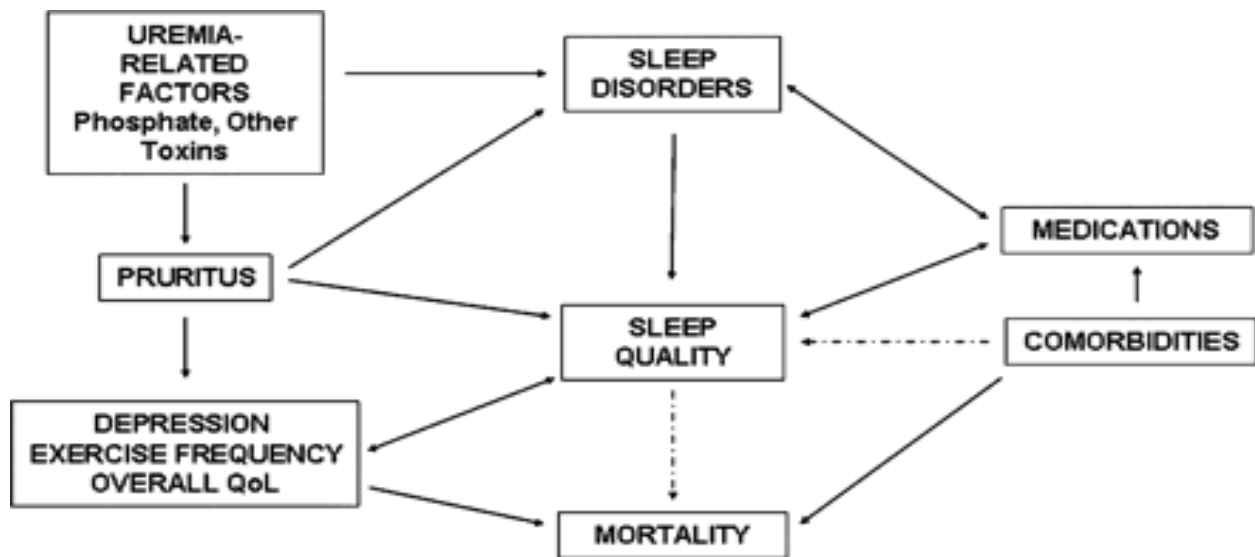


Figure 1: Possible factors associated with quality of sleep

SLEEP DISORDERS IN ESRD

Sleep disorders are common in ESRD patients and their prevalence is reported to be higher in ESRD than the general population (32). The most common sleep disorders in ESRD patients on hemodialysis are insomnia followed by OSA in patients with ESRD (29,32,33).

INSOMNIA

Epidemiology of Insomnia

The prevalence of Insomnia is high in ESRD and ranges from 19-64% in patients on hemodialysis (19,29,34,35). The prevalence estimates of insomnia vary because of differences in definition, diagnosis, population characteristics, and research methodologies.

Ibrahim et al studied the epidemiology of sleep disorders in Cairo, Egypt. In this cross-sectional survey patients were randomly selected from 16 dialysis centers (9 public and 7 private centers). Using the AIS to screen 264 patients, 57.4% had insomnia (33).

Bornivelli et al, noted a prevalence of 29% using the AIS in Tripoli Greece in sample of 45 patients on chronic hemodialysis (36).

Novak et al, compared insomnia in kidney transplant patients versus patients on dialysis awaiting transplant in a Hungarian population using AIS. Prevalence of insomnia was 15% in the patients on dialysis compared to 8% in the transplant group (37).

Nena et al studied quality of sleep, quality of life and prevalence of sleep disorders in 92 patients on hemodialysis in Greece. Using the AIS to assess for insomnia a prevalence of 28.3% was found (38).

A Study by Maiga et al in Senegal, Africa on the epidemiology of sleep disorders in ESRD, noted insomnia (based on International Classification of Sleep disorders to be the most prevalent sleep disorder, with a prevalence of 64.3% (29).

TABLE 2: Summary of the prevalence of insomnia using AIS in different countries

STUDY	SAMPLE SIZE	PREVALENCE
IBRAHIM ET AL, EGYPT(33)	264	57.4%
NENA ET AL, GREECE(38)	92	28.3%
BORNIVELLI ET AL, GREECE(36)	45	29%

Pathogenesis of insomnia in ESRD

Several factors contribute to insomnia in ESRD patients. These include metabolic factors such as uremia, anemia, bone pain, and pruritus.

Sleep disorders such as RLS, PLMD and sleep apnea can also contribute to insomnia. Musci et al found that patients with RLS were twice as likely to have insomnia as patients without RLS (39).

Poor sleep hygiene secondary to frequent napping during daytime dialysis is another cause of insomnia in these patients.

Plasma orexin levels are elevated in patients with ESRD. Kidneys are involved in clearing orexin from the body, and in ESRD it accumulates. Orexins are neuropeptides that regulate feeding behavior and promote wakefulness (40).

The diurnal rhythm of melatonin is disturbed in patients with ESRD, and it is also related to the degree of kidney dysfunction in patients with chronic kidney disease (CKD) (41). Melatonin produced by the pineal gland is a hormone that regulates the sleep-wake cycle.

OBSTRUCTIVE SLEEP APNEA

Epidemiology of Obstructive Sleep Apnea (OSA)

Reported prevalence of OSA in patients with ESRD on hemodialysis is more than 50% using PSG (35).

Maiga et al used the BQ to screen 127 patients on hemodialysis on 3 dialysis centers in 2012 in Senegal. They noted a prevalence of 49.1% for high risk for OSA (29).

Wali et al, in a multicentre study in Saudi Arabia, studied 355 patients for OSA. Using the BQ they found a prevalence of 44.2% (42).

Chen et al studied quality of sleep and high risk for OSA using BQ, in a large cohort of 700 Taiwanese patients. It was a multicentre study. They found a prevalence of 20% for high risk for OSA (22).

Sabry et al studied 88 patients on hemodialysis. Using BQ they noted a prevalence of 31.8% of high risk for OSA (43).

Merlino et al, conducted a study on sleep disorders in a large cohort (883 patients) of patients from 20 dialysis centres in Triveneto, Italy. Using BQ they found a prevalence of 27% (32).

TABLE 3: Prevalence of Sleep apnea using BQ in different countries

STUDY	SAMPLE SIZE	PREVALENCE
Wali et al, dec 2015 Saudi Arabia(42)	355	44.2%
Maiga et al, 2012 Senegal(29)	127	49.1%
Chen t al, 2006 Taiwan(22)	700	20%
Sabry et al, 2010 Egypt(43)	88	31.8%
Merlino et al,2005 Italy(32)	883	27%

Pathogenesis of OSA in ESRD

The prevalence of sleep apnea does not differ whether the patients are on hemodialysis or peritoneal dialysis and this suggests that the mode of dialysis is not a cause of sleep apnea. OSA occurs because of upper airway occlusion during sleep. These patients are prone to fluid overload contributing to pharyngeal narrowing by causing interstitial edema and/or increased

fluid volume in the neck and peripharngeal structures (44). Fluid displacement during sleep may increase neck circumference and pharyngeal resistance and reduce upper airway cross-sectional area (45).

Another cause of pharyngeal narrowing is upper airway dilator muscle dysfunction due to neuropathy or myopathy associated with chronic uremia or the underlying cause of ESRD, such as diabetes mellitus (46). Both sensory neuropathy and muscle denervation (47) have been demonstrated in the upper airway in OSA patients with normal renal function and may exacerbate the disease process in ESRD patients.

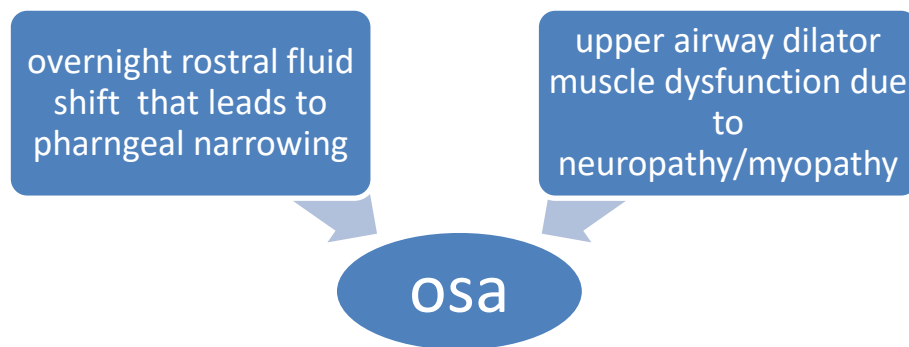


FIGURE 2: Factors causing obstructive sleep apnea

Other factors associated with poor quality of sleep include:

1. **UREMIC TOXINS:** The impact of uremic toxins is highlighted by the fact that sleep disorders are more frequent and more severe in dialyzed patients compared with subjects with predialysis CKD (32). In one study higher dialysis efficiency was associated with fewer sleep disturbances (18).
2. **COMORBIDITIES:** Comorbidities are independent predictors of sleep disturbances in patients on hemodialysis. Pain and discomfort associated with co-morbidities may contribute to poor quality of sleep. Coronary artery disease, diabetes, Gastrointestinal bleeding, lung disease and peripheral artery disease are associated with poor sleep quality (2).

- 3. DEPRESSION and QUALITY OF LIFE (QOL):** Depression is the psychiatric condition which is most commonly associated with sleep disorders in ESRD patients. Depression can be a cause as well as a consequence of insomnia. Iliescu et al showed that patients with a PSQI score >5 (poor sleepers) had a prevalence of depression of 20%, whilst among ESRD patients reporting normal sleep the prevalence of depression was almost nil (21).
Kamau et al, noted that the health related Quality of Life (QOL) was reduced in patients with ESRD on hemodialysis at the Kenyatta National Hospital (48). Iliescu et al demonstrated that poor sleep quality was associated with lower health related QOL and that PSQI score was an independent predictor of both mental and physical quality of life (21). Hence poor health related QOL can lead to poor quality of sleep.
- 4. PRURITUS:** It is common in patients with ESRD due to uremia. Uremic pruritus is characterized by daily bouts of itching worse at night and interferes with sleep. A study by Pisoni et al, found pruritus to be present in 42% of patients on hemodialysis and to be associated with poor sleep quality (49).

2.6 IMPLICATIONS OF SLEEP PROBLEMS IN ESRD

A) SLEEP DISTURBANCES AS A RISK FACTOR FOR DEVELOPMENT AND PROGRESSION OF CHRONIC KIDNEY DISEASE (CKD)

Insufficient sleep and poor sleep quality promote the development and exacerbate the severity of 3 important risk factors for CKD that is: hypertension, type 2 diabetes, and obesity. Hence sleep disturbances may have an indirect role in the development and progression of CKD.

There may be a direct impact of sleep disturbances on CKD and this is supported by the fact that under normal physiologic conditions, key hormones that regulate body fluid balance and blood pressure are exquisitely modulated by the sleep-wake cycle.

This direct effect may be through alterations in the sympathetic nervous system activation and Renin-Angiotensin-Aldosterone System (RAAS).

(i) Sympathetic nervous system activation: In normal sleep, especially in non-REM sleep there is increased vagal tone and decreased sympathetic activity, this is associated with nocturnal dipping of blood pressure associated with sleep. In sleep disordered breathing there is sleep fragmentation and nocturnal hypoxemia, leading to sympathetic activation and hence reduction in nocturnal dip in blood pressure (50).

It is well documented that hyperactivation of the sympathetic nervous system is often present in patients with CKD and it has been postulated that this may be a risk factor for CKD progression due to its effects on blood pressure and renal hemodynamics (51). Hence further activation of the sympathetic nervous system due to sleep disorders can exacerbate this risk in patients with CKD.

(ii) RAAS: The 24-hour sleep/wake cycle in humans is linked with homeostatic blood pressure regulation. The nocturnal dipping of blood pressure (as described above) is linked to elevation of nocturnal plasma renin activity (52).

Timing, quantity and quality of sleep affect both plasma renin and aldosterone levels. Both reduced sleep quality and sleep fragmentation (in OSA) reduce the nocturnal dipping of blood pressure and hence the sleep-related increases in renin and aldosterone levels are similarly affected. However during recovery sleep during daytime the plasma renin and aldosterone levels rise. This alteration in RAAS activity can have a role in CKD progression.

OSA can be a direct contributor to CKD development and progression. It causes intermittent hypoxia and reoxygenation, nocturnal blood pressure surges, and nocturnal sympathetic activation. The cycles of hypoxia and reoxygenation stimulate the formation of reactive oxygen species that promote inflammation and systemic endothelial dysfunction (53). Endothelial dysfunction, inflammation, and oxidative stress all have adverse effects on kidney function. Endothelial dysfunction and inflammation may lead to development of arterial stiffness. It is speculated that reduced elasticity of major arteries can result in microvascular damage and impair renal hemodynamics and hence lead to compromised kidney function.

Based on the multiple negative effects of OSA on the systemic and renal vasculature, it is reasonable to speculate that OSA may be an independent risk factor for CKD progression.

Sleep disturbances therefore may represent a novel risk factor for the development and progression of CKD. Optimizing sleep duration and quality and treating sleep disorders may reduce the severity and delay the progression of CKD.

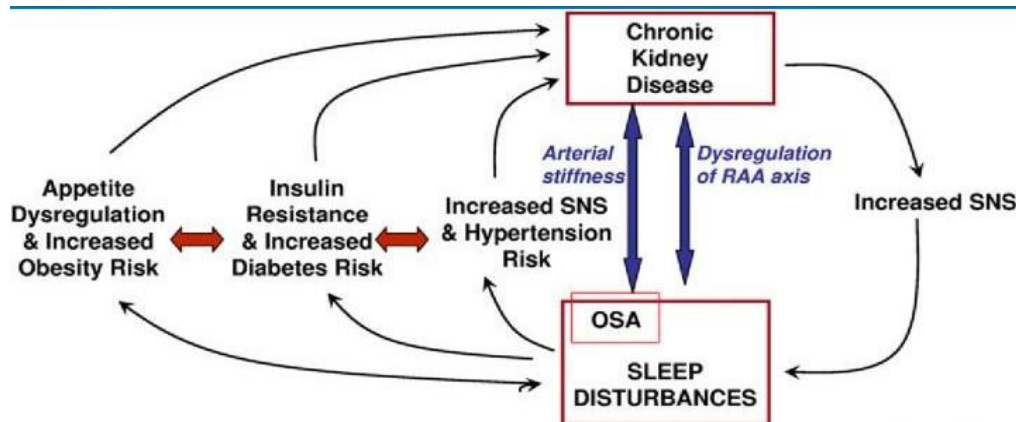


Figure 3: Putative mechanisms linking sleep disturbances and progression of CKD by Turek et al (54)

B HEALTH RELATED QUALITY OF LIFE, MORBIDITY AND MORTALITY

Poor quality of sleep is associated with poor health related quality of life, increased morbidity and mortality (2,21).

Insomnia is associated with increased mortality in ESRD (26). The mechanism of which may be due to increased systemic inflammation which has been associated with both ESRD and poor cardiovascular outcomes in ESRD (55).

Sleep apnea, if untreated, could lead to daytime fatigue, sleepiness, and impaired neurocognitive function which could impair health-related quality of life.

C OSA AND CARDIAC COMPLICATIONS

Sleep apnea may exacerbate the cardiac complications of these patients. It has been linked to the development of hypertension, accelerated atherosclerosis, heart failure and ischemic strokes.

Cardiovascular mortality remains the leading cause of death in ESRD (56).

2.7 INTERVENTIONS TO IMPROVE SLEEP PROBLEMS IN ESRD

A study by Sabbatini et al, in which they tested the effects of zaleplon (a non- benzodiazepine hypnotic) found that it improves sleep quality in maintenance hemodialysis patients (34).

In a study by Nejad et al, which was a 6 week randomized double blind cross-over trial, 3mg of melatonin or placebo was administered to patients at bedtime who were on daytime hemodialysis. Sleep was measured by PSQI, and there were marked improvements in global PSQI score after melatonin treatment (57).

For OSA, treatment is similar to that in the general population (weight loss and continuous positive airway pressure devices). In addition to these, because of nocturnal fluid shift, nocturnal hemodialysis may improve sleep apnea. Nocturnal hemodialysis is when patients receive hemodialysis at home during sleep. In a study by Hanly et al, seven subjects were changed from conventional three times weekly hemodialysis to nocturnal hemodialysis and this was associated with a reduction in the Apnea Hypopnea Index (approximately 46 to 9 per hour, respectively) (58). However, although nocturnal hemodialysis may reduce sleep apnea, it has the potential to cause sleep disruption for other reasons.

Treatment of insomnia in ESRD is the same as the general population, with the use of pharmacologic agents such as benzodiazepines, non-benzodiazepines, melatonin agonists and orexin antagonists.

Non-pharmacological interventions to improve sleep include:

Sleep Hygiene Instruction, which includes basic education on how sleep environment, nicotine, caffeine, alcohol, food and exercise affect sleep.

Sleep restriction which aims at curtailing the amount of time spent in bed, to increase the percentage time spent asleep.

Stimulus control which is based on the premise that certain sleep disorders associate the bedroom with awakening. Hence the main objective is to reassociate the bed and bedroom with rapid onset sleep.

Relaxation training techniques that teach patients to relax and improve their ability to sleep.

Cognitive behavioral modification which focuses on systematically introducing behavioural changes that have been proven to improve sleep. This could include changes in sleep schedule and managing thoughts and beliefs that interfere with sleep.

3. STUDY RATIONALE AND OBJECTIVES

3.1 STUDY JUSTIFICATION

There is an increasing burden of CKD and it is associated with significant morbidity and mortality. Sleep disturbances are associated with poor health related quality of life, and independently increase morbidity and mortality in ESRD patients. Moreover, sleep disturbances have been implicated in the progression of CKD. OSA increases cardiovascular risk in ESRD patients, and cardiovascular mortality remains the leading cause of death in these patients.

A high prevalence of sleep disorders has been found in ESRD as compared to the general population. Of the sleep disorders OSA and insomnia have been found to be the most prevalent as shown in previous studies in various populations, including studies in Africa (Senegal and Egypt).

Sleep disorders are an under treated threat to the public health and overall health related QOL and interventions exist to improve sleep problems.

No Kenyan studies have looked at quality of sleep and prevalence of sleep disorders in ESRD.

3.2 RESEARCH QUESTION

What is the burden of poor quality of sleep and sleep disorders in patients with ESRD on hemodialysis at the renal unit of KNH?

3.3 STUDY OBJECTIVES

3.3.1 Broad Objective

To determine the quality of nocturnal sleep, burden of insomnia and high risk for Obstructive Sleep Apnea in patients with End stage renal disease on hemodialysis.

3.3.2 Specific Objectives

Primary Objectives

1. To determine the prevalence of poor quality of sleep in End stage renal disease patients on hemodialysis using Pittsburgh Sleep Quality Index

2. To determine the prevalence of insomnia in end stage renal disease patients on hemodialysis using Athens Insomnia Scale
3. To determine the burden of high risk for Obstructive sleep apnea in End stage renal disease patients hemodialysis using Berlin Questionnaire

Secondary Objectives

1. To determine the association of poor quality of sleep, insomnia and high risk for OSA with age, sex, cause of ESRD, current cigarette smoking, BMI, neck circumference, duration on hemodialysis, hemoglobin and phosphate levels.

4. METHODOLOGY

4.1 STUDY DESIGN

This was a hospital based cross-sectional study

4.2 STUDY SITE

The study was carried out over a period of three months at the renal unit of KNH. KNH is located in Nairobi, with several general and specialized clinics which run on weekdays and special units like the renal unit which function 24 hours a day, 7 days a week. The renal unit has 18 hemodialysis machines. On average 50 people receive dialysis daily scheduled in three different shifts. The total cohort of patients on hemodialysis is approximately 160 patients.

4.3 CASE DEFINITION

ESRD: According to Kidney Disease Improving Global Outcomes (KDIGO) chronic kidney disease is defined as kidney damage or decreased kidney function for three or more months (to differentiate it from Acute Kidney Injury). End stage renal disease is stage 5 CKD with estimated glomerular filtration rate of <15 ml/min or on hemodialysis. For purposes of this study we defined ESRD patients as receiving hemodialysis of a period of three months or more.

4.4 STUDY POPULATION

Inclusion criteria:

1. All individuals above 18 years of age
2. On hemodialysis secondary to ESRD (duration > 3months)
3. All those who will consent to the study

4. Able to read English and/or Kiswahili

Exclusion Criteria:

1. Individuals with known psychiatric conditions (psychosis, mania, bipolar disorders)
2. Individuals on anxiolytics and hypnotics
3. Individuals on night shift work.

4.5 SAMPLE SIZE CALCULATION

According to KNH data from hospital records at the renal unit, an estimated number of 160 patients are on haemodialysis in the hospital. A representative sample was drawn from the population and the sample size calculated using the formula for finite population (Daniel, 1999). The calculation is as follows:

$$n' = \frac{NZ^2P(1-P)}{d^2(N-1) + Z^2P(1-P)}$$

Where:

n'= sample size with finite population correction,

N-Size of the target Population size (160)

Z – Z statistic for 95% level of confidence=1.96

P – Estimated prevalence of high risk for OSA= 49.1 % (Maiga et al, 2012)

d – Margin of error=5%

$$= \frac{160 \times 1.96^2 \times 0.491 \times 0.509}{0.05^2 (160-1) + 1.96^2 \times 0.491 \times 0.509}$$

$$= 113$$

A minimum of 113 hemodialysis patients will be sampled to estimate quality of sleep and OSA within 5% precision.

4.6 SAMPLING PROCEDURE

Consecutive sampling procedure was used to select patients to participate in this study. Patients were enrolled consecutively as they presented for their scheduled appointments for hemodialysis until the desired sample size was achieved.

4.7 PATIENT RECRUITMENT

The principal investigator and a trained research assistant (registered renal nurse) reviewed patients undergoing routine hemodialysis and their medical records for eligibility. Eligible patients were provided with study information in simple English and Kiswahili (see Appendix I) and invited to participate in the study. Consent was then obtained (see Appendix II)

4.8 DATA COLLECTION AND METHODS

4.8.1 Clinical Methods

A targeted history was taken by the principal investigator and the research assistant (registered renal nurse) directly from the patient/next of kin and from patient records from the files. This was captured in the study proforma (see appendix III).

Three sleep questionnaires: PSQI, BQ and AIS (see Appendix IV to VI) were provided to the subjects to be self-administered, in the preferred language: English or Kiswahili.

The questionnaires took on average fifteen minutes to fill and patients having difficulty understanding the questions were assisted solely by the principal investigator and this was limited to understanding of the question and not towards influencing the response.

This was followed by measurement of anthropometric variables for obesity, including height, weight and neck circumferences.

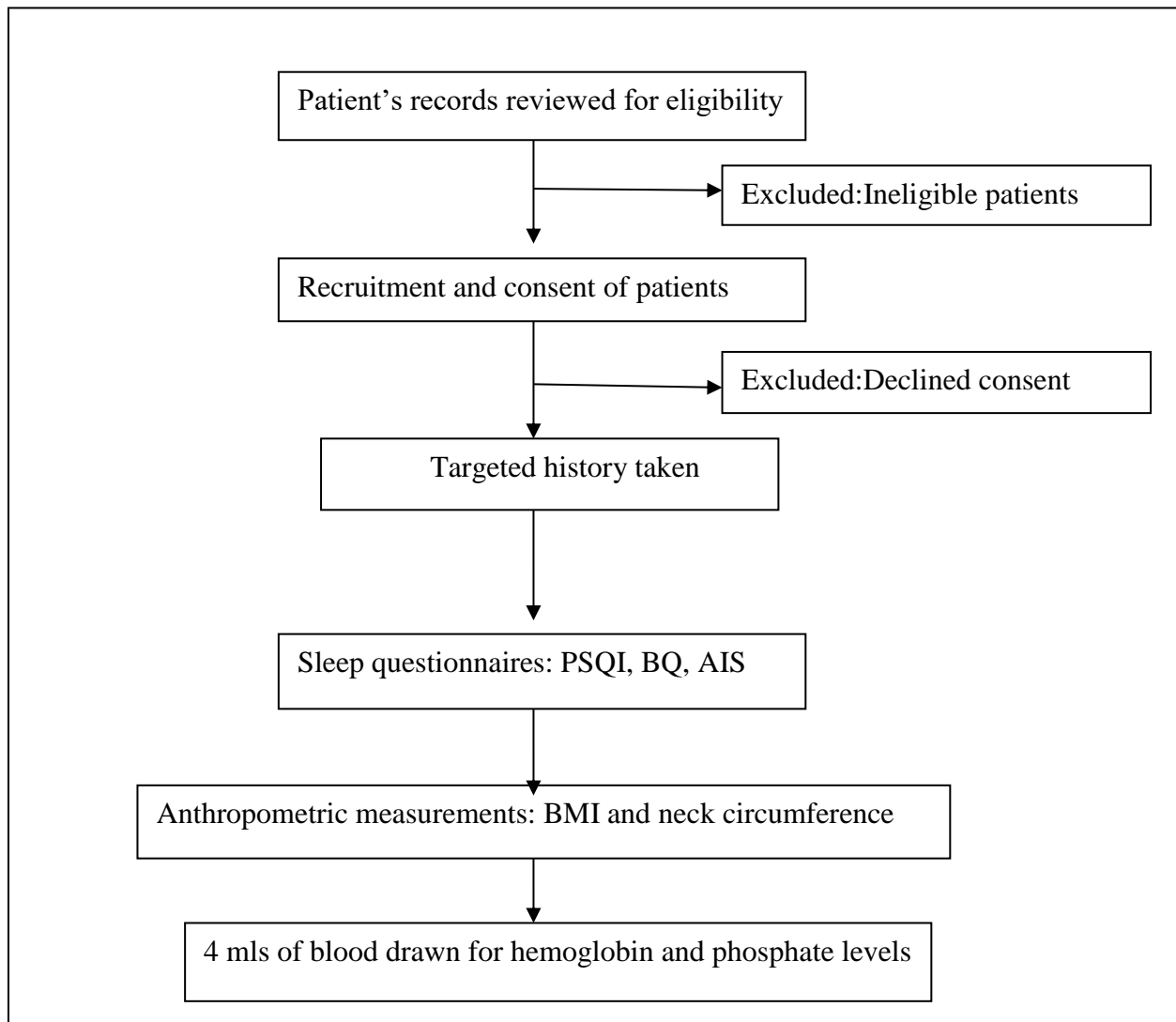
Body Mass Index (BMI)- defined as the individual's body weight divided by the square of his or her height, producing the unit of kg/m². Height was measured to the nearest 0.5cm using a metal measuring tape against a wall and a flat headboard at right angles to the wall. Weight was determined by a good quality bathroom scale with the subject in light clothing and without shoes.

Neck Circumference- with a flexible tape measure, this was measured to the nearest centimetre at a level just below the laryngeal prominence (Adam's apple) and perpendicular to the long axis of the neck.

4.8.2 Laboratory methods

Blood draws were done by the principal investigator and trained research assistant (registered renal nurse). 4 mls of venous blood sample were drawn and 2mls transferred to a red-topped bottle (for phosphate) and 2mls to a purple-topped bottle (hemoglobin). These bottles were assigned a code that matched with respective patient's codes. Samples were transported to Renal Unit laboratory within one hour of collection and analyzed using the Cell Dyn 3700 for hemoglobin and Biolis 50i for phosphate levels.

FLOWCHART SUMMARISING DATA COLLECTION AND METHODS



4.9 DEFINITION OF VARIABLES

- 1. Poor quality of sleep:** a global PSQI of >5 indicates poor sleep quality
- 2. High Risk for OSA:** individuals scoring positive in two or more categories on the BQ are considered as high risk for OSA
- 3. Insomnia:** an AIS score of >6
- 4. Obesity:** World Health Organization classification for general body obesity, based on BMI:
 - ✓ Underweight- <18.5 kg/m²
 - ✓ Normal- 18.5- 24.9 kg/m²
 - ✓ Overweight- 25- 29.9 kg/m²
 - ✓ Obesity-> 30 kg/m²
- 5. Neck circumference-** Abnormal Neck Circumference recorded as greater than or equal to 39.5 cm for men and greater than or equal to 36.5 cm for women.
- 6. Anemia-** According to WHO graded as below
Men: Normal 13 g/dl or higher, Mild: 11-12.9 g/dl, Moderate 8-10.9g/dl, Severe <8g/dl
Women: Normal 12g/dl or higher, Mild: 11-11.9g/dl, Moderate 8-10.96g/dl, Severe <8g/dl
- 7. Phosphate levels:** phosphate levels equal to or more than 4.6 will be considered as hyperphosphatemia. Normal levels for more than 18 years old both male and female are 2.5-4.5mg/dl.(59)
- 8. Smoking:** Current smoker is someone who has smoked 100 cigarettes in his/her lifetime and who at the time of survey continues smoking either daily or some days. Never smoker is someone who has not smoked 100 cigarettes in their lifetime. Former smoker is someone who has smoked 100 cigarettes in his/her lifetime, but has currently stopped. (60)
- 9. Duration on hemodialysis:** as reported by the patient, from the date of first dialysis to current date
- 10. Cause of ESRD:** as reported by the patient and confirmed from the patient's records
- 11.Age:** determined from date of birth of the patient
- 12. Sex:** reported as male or female

4.10 QUALITY ASSURANCE

Use of validated questionnaires that were translated into Kiswahili for ease of understanding of the patient.

The research assistant was trained on standardized techniques for anthropometric measures. Weighing scales and tape measures were assessed weekly by taking measurements of one person on each of the machines to ensure they were standardized.

The renal unit laboratory performs internal quality checks daily and external quality checks every two weeks. The machines are also calibrated regularly.

4.11 DATA MANAGEMENT

Data forms were kept in a secure lockable cabinet accessible only to the principal investigator and statistician. Data was entered and managed in a password protected Microsoft Excel 2013 database. Upon completion of data entry, the investigator checked the entered data against the hard copy forms and sorted out any inconsistencies. At conclusion of the study, sleep quality, risk of OSA, presence of insomnia global and component scores were placed in the patient's files for appropriate follow up and management.

4.12 DATA ANALYSIS

Data was analyzed using SPSS version 21.0 software. The study population was described using socio-demographic and clinical characteristics. Categorical variables were summarized into proportions and continuous data into means or medians. Sleep quality was categorized as poor or good and presented as percentages with 95% confidence interval. Also, insomnia and high risk of OSA was analyzed and presented as percentages. Sleep quality, insomnia and OSA were associated with categorical variables using Chi square test. Means for continuous variables were compared between groups using Student's t test while medians were tested between groups using Mann Whitney U test. Independent factors associated with the outcomes were determined using logistic regression analysis with odds ratios reported. All statistical tests were tested at 5% level of significance.

4.13 ETHICAL CONSIDERATIONS

The study was undertaken after approval by the Department of Clinical Medicine and Therapeutics, University of Nairobi and the KNH/ UON Ethics and Research Committee.

Patients eligible to participate in the study were included only after providing informed written consent following the process as outlined:

- i. The subjects were informed about the purpose of the research, with study procedures and all tests to be done explained clearly.
- ii. The subjects were assured that participation is voluntary, confidentiality would be maintained, and no medical attention would be denied should they decline to participate.
- iii. The subjects were assured of full and free access to their results and that therapeutic interventions recommended where necessary.

5. RESULTS

The study was carried out from mid August 2016 to the end of October 2016. Out of the 155 patients consecutively screened for eligibility, 38 did not meet the inclusion criteria. The remaining 117 were enrolled into the study and filled out the questionnaires. Two did not fill out the questionnaires fully and were excluded from the analysis leaving a study sample size of 115

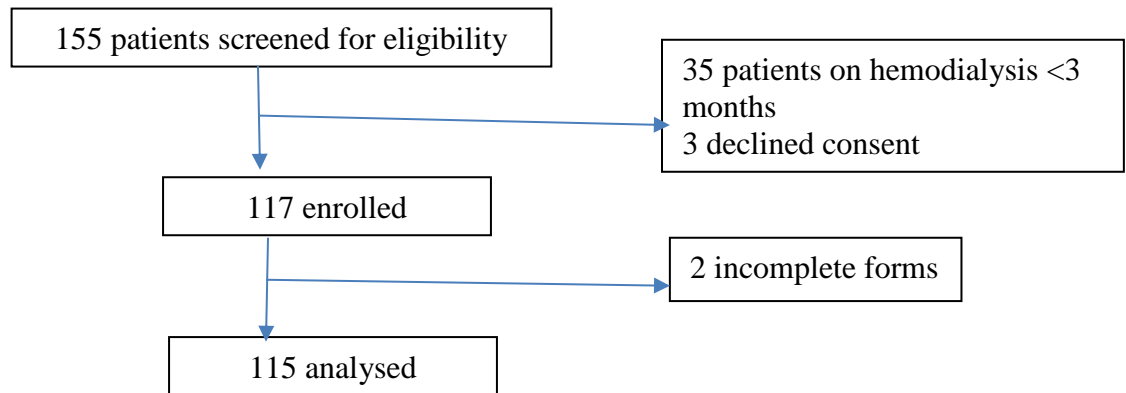


Figure 4: Flow of Patients

5.1 SOCIODEMOGRAPHIC, ANTHROPOMETRIC AND CLINICAL PARAMETERS:

The mean age of patients on chronic hemodialysis was 44.7(16.1) years. Male to female ratio was 1.4:1. The median duration on hemodialysis was one year (range of 0.25-10 years). Hypertension was reported as the cause of ESRD in 76.5% of patients, followed by diabetes in 17.4%. Majority (85.2%) of patients had never smoked and only 3 patients (2.6%) were current smokers. Table 4 demonstrates the sociodemographic and clinical characteristics of all patients undergoing hemodialysis.

The mean BMI was 23.5kg/m² (5.1) and it fell in the normal category (18.5-24.9 kg/m²). Sixty percent of patients had a normal BMI, with 26% having an elevated BMI (overweight and obese). The mean BMI did not differ between males and females, 23.4 versus 23.6 respectively. The mean neck circumference was 38.2(3.7 cm) in males 33.7 (3.1 cm) in females also approximately one thirds had an increased neck circumference. A total of 93 patients (80.9%) had moderate to severe anemia. Table 5 demonstrates the anthropometric and laboratory characteristics of all patients undergoing hemodialysis.

Table 4: Sociodemographic and Clinical Characteristics

Variable	Frequency (%)
Mean age (SD)	44.7 (16.1)
Sex	
Male	68 (59.1)
Female	47 (40.9)
Smoking status	
Current smoker	3 (2.6)
Never smoker	98 (85.2)
Former smoker	14 (12.2)
Duration on hemodialysis (years)	
Median (IQR)	1.0 (0.5-2.0)
Mean (SD)	1.7 (1.9)
Range	0.25-10
Cause of ESRD?	
Hypertension	88 (76.5)
Diabetes	20 (17.4)
Glomerulonephritis	5 (4.3)
Others	12 (10.4)

Table 5: Anthropometric and Laboratory characteristics

Variable	Frequency (%)
BMI	
Category, n (%)	
Underweight	16 (13.9)
Normal	69 (60.0)
Overweight	15 (13.0)
Obese	15 (13.0)
Neck circumference, mean (SD)	
Male	38.2 (3.7)
Female	33.7 (3.1)
Category, n (%)	
Normal	84 (73.0)
Increased	31 (27.0)
Hemoglobin (g/dl)	
Mean (SD)	9.9(1.7)
Normal	6 (5.2)
Mild	16 (13.9)
Moderate	82 (71.3)
Severe	11 (9.6)
Phosphate, mean (SD)	1.64 (0.5)

5.2 QUALITY OF SLEEP, INSOMNIA AND RISK FOR OBSTRUCTIVE SLEEP APNEA

Quality of Sleep:

The quality of sleep as assessed by the PSQI was poor (global score of >5) in 80 (69.6%) out of 115 patients and the median score on the PSQI was 7.

Insomnia:

Using the AIS to assess for insomnia, out of the 115 patients 54 (47%) had insomnia (score of >6). The median score on the AIS was 5.

Risk for Obstructive sleep apnea:

Using the BQ to assess for risk of OSA, out of the 115 patients 40(34.8%) had high risk for obstructive sleep apnea.

Table 6 shows the prevalence of poor sleep quality, insomnia and high risk for OSA. On analyzing component scores of Quality of sleep, patients had high scores (score of 3) in sleep latency and sleep efficiency. This is depicted in table 7.

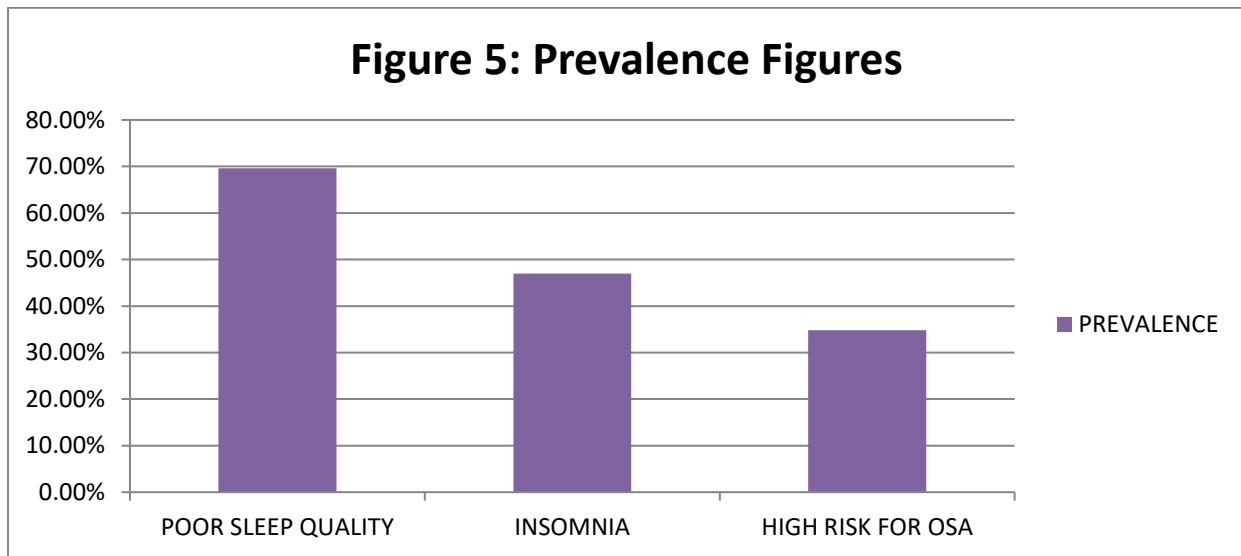
Of the two sleep disorders insomnia was more prevalent than high risk for OSA. Figure 5 illustrates the prevalence of poor quality of sleep, insomnia and high risk for OSA.

Table 6: Quality of sleep, insomnia and risk for OSA

Variable	Frequency (%)
Sleep quality score Median (IQR)	7 (4-12)
Poor Quality of sleep (n %)	80 (69.6)
Insomnia score Median (IQR)	5 (2-10)
Insomnia (n%)	54 (47.0)
Risk for OSA High Low	40 (34.8) 75 (65.2)

Table 7: Quality of Sleep component scores

Variable	0 n (%)	1 n (%)	2 n (%)	3 n (%)
Subjective sleep quality	33 (28.7)	51 (44.3)	16 (13.9)	15 (13.0)
Sleep latency	17 (14.8)	30 (26.1)	31 (27.0)	37 (32.2)
Sleep duration	58 (50.4)	20 (17.4)	18 (15.7)	19 (16.5)
Sleep efficiency	56 (48.7)	14 (12.2)	11 (9.6)	34 (29.6)
Sleep disturbance	7 (6.1)	63 (54.8)	35 (30.4)	10 (8.7)
Use of sleep medications	105 (91.3)	5 (4.3)	3 (2.6)	2 (1.7)
Daytime dysfunction	39(34.2)	39(34.2)	28(24.6)	8(7.0)



5.3 FACTORS ASSOCIATED WITH SLEEP DISORDERS

a) Factors associated with Poor Quality of Sleep

Patients with poor quality of sleep were younger, mean age of 44.1 (16) versus those with good sleep quality 46 (16.5), $p=0.554$. The patients with poor quality of sleep had a longer median duration on hemodialysis and were all current smokers. The mean BMI and neck circumference was no different amongst those with good versus poor quality of sleep. There were no associations between quality of sleep and age, sex, duration on hemodialysis, current smoking, anthropometric measures for obesity and laboratory parameters (phosphate and hemoglobin).

Table 8 depicts the factors associated with quality of sleep.

Table 8: Factors associated with Quality of Sleep

Variable	Sleep Quality score		OR (95% CI)	P value
	Poor (%)	Good (%)		
Mean age (SD)	44.1 (16.0)	46.0 (16.5)	-	0.554
Gender				
Male	47 (69.1)	21 (30.9)	1.0 (0.4-2.1)	0.900
Female	33 (70.2)	14 (29.8)	1.0	
Hypertension				
Yes	62 (70.5)	26 (29.5)	1.2 (0.5-3.0)	0.708
No	18 (66.7)	9 (33.3)	1.0	
Diabetes				
Yes	12 (60.0)	8 (40.0)	0.6 (0.2-1.6)	0.306
No	67 (71.6)	27 (28.4)	1.0	
Median Duration in years on hemodialysis (IQR)	1.0 (0.5-2.0)	0.8 (0.3-2.5)	-	0.620
Current Smoker				
Yes	3(100)	0	-	0.246
No	77(68.8)	35(31.2)	-	
Glomerulonephritis				
Yes	5 (100.0)	0	-	0.130
No	75 (71.6)	35 (31.8)	-	
BMI				
Mean (SD)	23.3 (5.1)	23.9 (5.3)	-	0.543
Category, n (%)				
Underweight	12(75.0)	4 (25.0)	1.2 (0.4-4.3)	1.000
Normal	49 (71.0)	20 (29.0)	1.0	
Overweight	11 (73.3)	4 (26.7)	1.1 (0.3-3.9)	1.000
Obese	8 (53.3)	7 (46.7)	0.5 (0.1-1.5)	
Neck circumference	36.1 (4.3)	37.0 (3.7)	-	0.300
Hemoglobin				
Mean (SD)	10.0 (1.8)	9.5 (1.4)	-	0.163
Phosphate, mean (SD)	1.7 (0.5)	1.6 (0.4)	-	0.367

b) Factors associated with Insomnia

Hypertension was associated with insomnia (OR 2.6;p=0.039). All the current smokers had insomnia, this approached but did not reach statistical significance (p=0.062). No associations

between insomnia and age, sex, anthropometric measures, duration on dialysis, hemoglobin and phosphate levels were found. Table 9 shows the factors associated with insomnia.

Table 9: Factors associated with insomnia

Variable	Insomnia	No insomnia	OR (95% CI)	P value
Mean age (SD)	44.6 (16.3)	44.7 (16.0)	-	0.970
Gender				
Male	31 (45.6)	37 (54.4)	0.9 (0.4-1.8)	0.724
Female	23 (48.9)	24 (51.1)	1.0	
Hypertension				
Yes	46 (52.3)	42 (47.7)	2.6 (1.0-6.6)	0.039
No	8 (29.6)	19 (70.4)	1.0	
Diabetes				
Yes	10 (50.0)	10 (50.0)	1.2 (0.4-3.0)	0.764
No	44 (46.3)	51 (53.7)	1.0	
Glomerulonephritis				
Yes	2 (40.0)	3 (60.0)	0.7 (1.2-4.6)	0.750
No	52 (47.3)	58 (52.7)	1.0	
Median duration in years on hemodialysis (IQR)	1.0 (0.7-2.0)	0.8 (0.4-2.0)	-	0.887
Current Smoker				
Yes	3(100)	0	-	0.062
No	51(45.5)	61(54.5)		
BMI				
Mean (SD)	23.1 (5.5)	23.8 (4.8)	-	0.464
Category, n (%)				
Underweight	11 (68.8)	5 (31.2)	3.0 (1.0-9.7)	0.054
Normal	29 (42.0)	40 (58.0)	1.0	
Overweight	8 (53.3)	7 (46.7)	1.6 (0.5-4.8)	0.424
Obese	6 (40.0)	9 (60.0)	0.9 (0.3-2.9)	0.885
Neck circumference, mean (SD)	36.0 (3.5)	36.7 (4.6)	-	0.416
Haemoglobin				
Mean (SD)	10.0 (2.0)	9.8 (1.4)	-	0.432
Phosphate, mean (SD)	1.6 (0.6)	1.7 (0.4)	-	0.713

c) Factors associated with high risk for OSA

Patients with high risk for OSA, were younger, had a longer duration on hemodialysis and had a lower mean hemoglobin. The BMI and neck circumference was no different amongst those with

high risk and low risk for OSA. No associations were found between age, sex, cigarette smoking, time on dialysis, anthropometric measures, and laboratory measures and risk for OSA. Table 10 demonstrates factors associated with high risk for OSA.

Table 10: Factors associated with risk for OSA

Variable	High risk n (%)	Low risk n (%)	OR (95% CI)	P value
Mean age (SD)	43.4 (16.5)	45.3 (15.9)	-	0.544
Gender				
Male	20 (29.4)	48 (70.6)	0.6 (0.3-1.2)	0.146
Female	20 (42.6)	27 (57.4)	1.0	
Hypertension				
Yes	33 (37.5)	55 (62.5)	1.7 (0.7-4.5)	0.269
No	7 (25.9)	20 (74.1)	1.0	
Diabetes				
Yes	6 (30.0)	14 (70.0)	0.8 (0.3-2.2)	0.621
No	34 (35.8)	61 (64.2)	1.0	
Glomerulonephritis				
Yes	1 (20.0)	4 (80.0)	0.5 (0.1-4.2)	0.478
No	39 (35.5)	71 (64.5)	1.0	
Median duration in years on hemodialysis (IQR)	1.0 (0.7-2.0)	0.8 (0.4-2.0)	-	0.253
Current Smoker				
Yes	2(66.7)	1(33.3)	-	0.240
No	38(33.9)	74(66.1)		
BMI				
Mean (SD)	23.4 (6.1)	23.5 (4.6)	-	0.912
Category, n (%)				
Underweight	8 (50.0)	8 (50.0)	2.1 (0.7-6.4)	0.172
Normal	22 (31.9)	47 (68.1)	1.0	
Overweight	5 (33.3)	10 (66.7)	1.1 (0.3-3.5)	0.913
Obese	5 (33.3)	10 (66.7)	1.1 (0.3-3.5)	0.913
Neck circumference, mean (SD)	36.1 (4.7)	36.5 (3.8)	-	0.170
Anemia				
Mean (SD)	9.6 (1.6)	10.0 (1.8)	-	0.247
Phosphate, mean (SD)	1.7 (0.6)	1.6 (0.4)	-	0.609

6. DISCUSSION

This study aimed to establish the prevalence of poor quality of sleep, insomnia and high risk for OSA in ESRD patients undergoing hemodialysis. The prevalence of poor quality of sleep was 69.6%, prevalence of insomnia was 47% and high risk for OSA 34.8%.

There is paucity of data in Kenya, on quality of sleep and sleep disorders in the hemodialysis cohort. The only regional study done was by Sokwala et al, who assessed quality of sleep and high risk for OSA in diabetic patients, and found a prevalence of 53% and 44% respectively (61).

We obtained a high prevalence of poor sleep quality of 69.6%, and this is consistent with the range found in previous studies (49%-75%) (2,21–23). Elder et al, conducted a populous (11351 patients) multicenter study and found a prevalence of poor sleep quality of 49%. However they used a self-reported sleep quality scale as compared to the PSQI (2). Our prevalence of 69.6% was in keeping with that of Chen et al and Iliescu et al who used the PSQI and found a prevalence of 66% and 71% respectively(21,22). This high prevalence of poor sleep quality may be explained by the presence of other sleep disorders and overall poor quality of life as eluded to by Elder et al. We found a high prevalence of insomnia and high risk of OSA and these can contribute to poor sleep quality. Kamau et al found that health related quality of life in hemodialysis patients is reduced at the KNH, and studies have shown that health related quality of life is linked to sleep quality(2,21).

We found a prevalence of insomnia of 47%. Prevalence of insomnia using the AIS, in chronic hemodialysis patients ranges from 28-57.4% (33,36,38). Our prevalence was much higher than that obtained by Nena et al and Bornivelli et al (prevalence of 28.3% and 29% respectively) who used a higher cut off of 9 (instead of 6) for insomnia on the AIS (36,38). Ebrahim et al, found a prevalence of insomnia in ESRD patients of 57.4% using the AIS (33). This was higher than the prevalence we obtained (47%). This maybe because Ebrahim et al had a much larger sample size than ours, was a multicenter study with a mean age much higher than ours.

In keeping with other studies, we found insomnia to be the most prevalent sleep disorder in dialysis patients (29,32,33). In the general population insomnia is also reported as the most common sleep disorder (63). This high burden of insomnia in ESRD may be because of the

presence of other sleep disorders such as restless leg syndrome and OSA which contribute to insomnia (31,32) .

We obtained a prevalence of high risk for OSA of 34.8%.The prevalence of high risk for OSA ranges from 20%-49.1% (22,29,32,42,43). Our prevalence was comparable to another African study done in Egypt by Sabry et al who found a prevalence of 31.8% (43). The differences in prevalence between the various studies may be explained by different patient characteristics.

Similar to previous studies that used PSQI to measure sleep quality, we did not obtain an association between age, gender, dialysis vintage, current smoking, anthropometric and laboratory parameters and poor quality of sleep (21–23). Our study may not be powered to determine any association if such exists.

Hypertension was found to be a risk factor for insomnia ($p=0.039$). No previous study has noted such an association. This may be explained by the use of antihypertensive medications such as beta blockers and Angiotensin Converting Enzyme inhibitors. Beta blockers cause inhibition of the nighttime secretion of melatonin and Angiotensin converting enzyme inhibitors cause a dry hacking cough which may keep patients up at night. Also, hypertension has been noted to be a risk factor for OSA, and OSA may contribute to insomnia.

In the general population age, male sex, obesity and smoking have been found to be risk factors for OSA. In our study age, sex, hypertension, anthropometric measures and laboratory parameters were not associated with high risk of OSA. Previous studies that used the BQ have shown mixed results on the association between age, male sex and obesity with high risk for OSA. BMI was not associated with high risk for OSA in Chinese and Italian populations (22,32). However both Wali et al and Ibrahim et al noted associations with obesity and sleep apnea (33, 42). This may implicate that other factors apart from obesity contribute to risk of OSA in the hemodialysis cohort.

6.1 STRENGTHS AND WEAKNESSES

This study was the first of its kind studying sleep quality and sleep disorders in our dialysis cohort. This was a questionnaire based study however we used validated questionnaires translated to Kiswahili for ease of understanding. Despite this a few individuals had difficulty in understanding some of the questions, based on how they were framed. However, the principal investigator and research assistant were available for any clarification.

The study was carried out in a public referral hospital in a center that receives the largest number of dialysis patients daily. However, it was not a multicenter study and the data presented may not be generalizable to all patients with ESRD on chronic hemodialysis in Kenya.

6.2 CONCLUSIONS/STUDY IMPLICATIONS

This study illustrates that patients on chronic hemodialysis have very poor sleep quality. Both insomnia and high risk for OSA are also very prevalent our hemodialysis cohort.

6.3 RECOMMENDATIONS

Due to the very high prevalence of poor sleep quality obtained in this study, all patients undergoing chronic hemodialysis should routinely be administered the PSQI to assess their sleep quality. The dialysis unit team (nephrologists, renal nurses, internal medicine residents) involved in the care of patients on chronic hemodialysis should enquire about sleep complaints in these patients and where appropriate screen patients for sleep disturbances (insomnia and high risk for OSA), those at high risk may be referred for polysomnography studies and medications initiated where appropriate.

Further studies are needed to further elucidate the relationship between hypertension and insomnia.

Since questionnaires assess sleep subjectively, further studies are warranted in the same cohort, perhaps with objective ways of assessing sleep (polysomnography).

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APPENDIX I: STUDY EXPLANATION FORM

STUDY TITLE: QUALITY OF SLEEP AND SLEEP DISORDERS IN ADULT PATIENTS UNDERGOING HEMODIALYSIS AT THE RENAL UNIT AT KENYATTA NATIONAL HOSPITAL

I am Dr Husein Jivanji, a Post-graduate student in the department of Internal Medicine at the University of Nairobi. We are conducting a study at the Renal Unit of Kenyatta National Hospital, Nairobi entitled as above. The study is also part of the curriculum requirements for successful completion of the Masters in Internal Medicine (MMed) program. The study is being carried out only after ethical approval by the Kenyatta National Hospital/ University of Nairobi Ethics and Research Committee. The ethical approval has been given for a period of one (1) year.

What is the study about?

The study is about getting to know how many patients on hemodialysis have sleep disturbances.

What does the study involve?

The study involves taking history from you and filling 3 sleep related questionnaires. We will take your weight, height and neck circumference. 4 mls of blood will be drawn to test for your hemoglobin and phosphate. All information you shall provide shall be kept confidential.

Are there any dangers involved?

Drawing of blood will involve pain as the needle pierces your skin, and there may be minimal bleeding from the site. Apart from this there are no dangers.

Will I benefit from the study?

Yes. After analyzing the study results we will be able to know your sleep quality and whether you are at a high risk of sleep related breathing problem and insomnia. The study will also provide information on the sleep quality in the patients attending the renal unit in general which will be useful for preventive and treatment aspects. You will be provided information on your sleep quality, risk for sleep related breathing problems and insomnia. Accordingly you will be advised on follow up by your primary physician. You will however not be compensated with money

Do I have to take part in the study?

It is up to you to decide whether or not to take part, taking part is voluntary. If you do decide to take part you will be given this information sheet to keep and be asked to sign a consent form.

Can I withdraw from the study?

You are free to withdraw from the study and this shall not affect your care in any way and you will not be discriminated in any way.

Confidentiality

The medical records and data collected for this study will only be accessible to authorized persons. This will minimize accidental disclosure to any unauthorized personnel. Results will only be made available to the patient and his/her primary care provider.

MAELEZO YA UTAFITI:

Mimi ni Dr Husein Jivanji, mwanafunzi katika Idara ya Tiba katika Chuo Kikuu cha Nairobi. Tunafanya utafiti katika kitengo cha maradhi ya figo katika Hospitali ya Kitaifa ya Kenyatta, Nairobi, kuhusu:

"UBORA WA USINGIZI NA MAGONJWA YA KULALA KWA WAGONJWA WA FIGO WANAHUDHURIA MATIBABU YA KUSAFISHWA FIGO KATIKA HOSPITALI HII YA KENYATTA"

Utafiti huu utafanyika baada ya kuidhinishwa na Idara ya Tiba na kamati ya maadili na utafiti ya chuo kikuu cha Nairobi na Hospitali kuu ya Kenyatta utafiti huu utafanywa kwa mwaka mmoja.

Je, utafiti unahusisha nini?

Katika utafiti utajaza maswali kadhaa kuhusiana na usingizi. Utapimwa uzito, urefu, mduara wa shingo. Utapimwa kiwango cha damu. Utadungwa sindano na kutolewa mililita 4 za damu itakayopimwa kutumia kidude cha kupima damu. Utaendelea na utafiti kiwango chako cha damu kikiwa cha kawaida. Kisipokuwa cha kawaida, utaelekezwa kufuatiliwa vile itahitajika. Taarifa yote utakayopeana itahifadhiwa na kuwekwa siri.

Je, kuna hatari inayohusika katika utafiti huu?

Kutolewa damu utasikia uchungu kidogo ukidungwa sindano ya kutoa damu, na kutokwa na damu kidogo. Mbali na hii hakuna hatari nyingine.

Je, nitafaidika na utafiti?

Ndio. Baada ya kuchambua matokeo ya utafiti tutakuwa na uwezo wa kujua ubora wa usingizi wako na ikiwa utakuwa na hatari kubwa ya shida ya kupumua usingizini. Utaelezwa majibu ya hali yako ya usingizi. Majibu yatawekewa katika faili yako na daktari wako atakuelezea zaidi vile unahitaji matibabu. Ukiwa katika kundi la kulinganisha na ukipatikana uno shida, tutakuelekeza kwa daktari atakayeweza kukutibu. Wanaojiunga na utafiti huu hawatapewa pesa.

Je, nitaruhusiwa kutoka kwa utafiti?

Utakuwa huru kutoka kwa utafiti bila kuathiriwa kwa huduma yako kwa namna yoyote na hutabaguliwa kwa njia yoyote. Asante kwa ushirikiano wako.

Je, rekodi zangu binafsi na matokeo ya vipimo vyangu yatawekwa siri?

Rekodi zako za matibabu na matokeo yote yatakayojulikana kutoka utafiti huu yataangaliwa na watafiti walioidhinishwa pekee yao. Tunatumaini kwamba kufanya hivi kutapunguza uwezekano ya watu nje ya utafiti huu kutambua mambo yako binafsi. Matokeo yatapeanwa kwa mgonjwa binafsi ama kwa mtu yule wa karibu aliyeidhinishwa kupokea matokeo ya matibabu yake.

APPENDIX II: CONSENT FORM

I,,have been requested to take part in a study concerning

“QUALITY OF SLEEP AND SLEEP DISORDERS IN ADULT PATIENTS UNDERGOING HEMODIALYSIS AT THE RENAL UNIT AT KENYATTA NATIONAL HOSPITAL”

I understand the study has been approved by the Ethics and Research Committee of KNH/ UoN and authorised to be conducted over a period of one year.

This study will involve taking a full history, general examination including neck circumference, weight and height. I will also be required to respond to three study questionnaires and will get 4ml of blood removed from a vein for assessment of hemoglobin and phosphate levels. The information provided shall be confidential. The data collected in form of questionnaires, notes e.t.c. shall be discarded upon study completion. The results of the study shall be relayed to my clinician for further evaluation and follow up as required.

I have been explained the implications of this study. This will put me at no risk.

I understand that I am free to either agree or refuse to participate in the study and this shall not interfere with my medical care.

Having agreed on the above I voluntarily agree to participate in the study.

Signed..... Date.....

Witnessed by..... Date.....

RESEARCHERS:

PRINCIPAL INVESTIGATOR:

Dr. Husein Onally Jivanji

Postgraduate student -Masters of Medicine in Internal Medicine, University of Nairobi.

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KNH/ UoN Ethics and Research Committee- 726300-9, 27263000 Extension 44355

FOMU YA IDHINI:

Mimi,, nimeombwa kushiriki katika utafiti kuhusu

**"KIWANGO CHA MAGONJWA YA KULALA KATIKA WAGONJWA WA FIGO
WANAOHUJHURIA KUSAFISHWA FIGO KWA UNITI YA FIGO KATIKA HOSPITALI
YA TAIFA YA KENYATTA"**

Nimeelewa ya kwamba huu utafiti umekubaliwa na kamati ya adili na utafiti katika Hospitali kuu ya
Kenyatta kukamilishwa kwa muda wa mwaka moja.

Huu utafiti utahusisha kuchukua historia kamili, uchunguzi wa jumla kama mduara wa shingo, uzito
na urefu. Nitahitajika kujibu maswali kadhaa ya utafiti na nitadungwa sindano kwa mshipa na
kutolewa damu (4 mls) kupimiwa kiwango cha kyasi ya damu, calcium na phosphate.

Taarifa itayotolewa itakuwa siri.

Nimeelezwa lengo la utafiti huu na haitanidhuru.

Nimeelewa kwamba niko huru kukubali au kukataa kushiriki katika utafiti bila kudhuru huduma
yangu ya matibabu.

Baada ya kuelewa hayo yalioelezwa, ninakubali kwa hiari kushiriki katika utafiti.

Sahihi Tarehe

Kushuhudiwa na Tarehe

INVESTIGATOR’S STATEMENT

I the investigator have educated the research participant on the purpose and implications of this
study.

Signed..... Date.....

APPENDIX III: STUDY PROFORMA

STUDY ID NO.....

DATE.....

SECTION 1: DEMOGRAPHICS

1. Age (years).....

2. Gender Male Female

3. Current Residence Urban Rural

4. Home County.....

5. Duration on hemodialysis (years).....

6. Cause of ESRD?

- a) Hypertension
- b) Diabetes
- c) Glomerulonephritis
- d) Others (specify).....

7. Smoking History

(i) Do you smoke?

Daily Some days Not at all

(ii) Have you smoked atleast 100 cigarettes in your life?

Yes No

(iii) Based on above, patient is a(*)

- a) Current Smoker b) Never Smoker c) Former Smoker

8. Current Medication use (specify all)

.....
.....
.....
.....
.....

() Current Smoker: someone who has smoked 100 cigarettes in his/her lifetime and who continues to smoke daily or some days. Never Smoker: someone who has not smoked 100 cigarettes in their lifetime. Former smoker: someone who has smoked 100 cigarettes but has currently stopped.*

SECTION II: CLINICAL PARAMETERS

- 1. Height (in metres).....
- 2. Weight (in kgs).....
- 3. BMI (kg/m2)(*).....
 - a) Underweight
 - b) Normal
 - c) Overweight
 - d) Obesity
- 4. Neck circumference (cm).....
- 5. Hemoglobin (g/dl) (**)......
 - a) Normal
 - b) Mild
 - c) Moderate
 - d) Severe
- 6. Phosphate (mmol/l).....

()BMI : Underweight <18.5 kg/m2, normal 18.5-24.9 kg/m2, overweight 25-29.9 kg/m2, obese >30 kg/m2*

*(**)Anemia: Normal > 13 g/dl or > 12 g/dl in men and women respectively, mild 11-12.9 g/dl and 11-11.9 g/dl in men and women respectively, moderate 8-10.9 g/dl, severe <8 g/dl*

SECTION III:

- 1. Sleep Quality Score.....
 - a) Poor sleep quality (score > 5)
 - b) Good sleep quality (score < 5)
- 2. Insomnia Score.....
 - a) Insomnia (score > 6)
 - b) No insomnia (score < 6)
- 3. Risk for OSA
 - a) High risk
 - b) Low risk

APPENDIX IV:PITTSBURGH SLEEP QUALITY INDEX

Name: _____

Date: _____

Pittsburgh Sleep Quality Index (PSQI)

Instructions: The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. **Please answer all questions.**

1. During the past month, what time have you usually gone to bed at night? _____
2. During the past month, how long (in minutes) has it usually taken you to fall asleep each night? _____
3. During the past month, what time have you usually gotten up in the morning? _____
4. During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spent in bed.) _____

5. During the <u>past month</u> , how often have you had trouble sleeping because you...	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
a. Cannot get to sleep within 30 minutes				
b. Wake up in the middle of the night or early morning				
c. Have to get up to use the bathroom				
d. Cannot breathe comfortably				
e. Cough or snore loudly				
f. Feel too cold				
g. Feel too hot				
h. Have bad dreams				
i. Have pain				
j. Other reason(s), please describe:				
6. During the past month, how often have you taken medicine to help you sleep (prescribed or "over the counter")?				
7. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?				
	No problem at all	Only a very slight problem	Somewhat of a problem	A very big problem
8. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?				
	Very good	Fairly good	Fairly bad	Very bad
9. During the past month, how would you rate your sleep quality overall?				

	No bed partner or room mate	Partner/room mate in other room	Partner in same room but not same bed	Partner in same bed
10. Do you have a bed partner or room mate?				
	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
If you have a room mate or bed partner, ask him/her how often in the past month you have had:				
a. Loud snoring				
b. Long pauses between breaths while asleep				
c. Legs twitching or jerking while you sleep				
d. Episodes of disorientation or confusion during sleep				
e. Other restlessness while you sleep, please describe:				

PITTSBURGH SLEEP QUALITY INDEX- MDODOSO (KISWAHILI)

Jina: _____ Tarehe: _____

Maelekezo: Maswali yafuatayo yanahusiana na tabia yako ya kawaida ya usingizi katika mwezi uliopita tu. Majibu yako yanahitaji kuonyesha jibu **sahihi zaidi** kwa wingi wa mchana na usiku katika mwezi uliopita. Tafadhali jibu maswali yote.

1. Katika mwezi uliopita, huwa unaingia kitandani usiku saa ngapi kwa kawaida? _____
2. Katika mwezi uliopita, kwa kawaida huwa inakuchukua muda gani (kwa dakika) kupata usingizi kila usiku? _____
3. Katika mwezi uliopita, kwa kawaida huwa unaamka asubuhi saa ngapi? _____
4. Katika mwezi uliopita, ni masaa mangapi halisi ulilala kila usiku? (Hii inaweza kuwa tofauti na idadi ya masaa uliokuwa kitandani). _____

5. Katika mwezi uliopita, ni mara ngapi umepata shida kulala kwa sababu:	Sikuwa na shida kwa mwezi uliopita	Si zaidi ya mara moja kwa wiki	Mara moja au mbili kwa wiki	Mara tatu au zaidi kwa wiki
a. Hukuweza kupata usingizi katika dakika 30 za kwanza				
b. Uliamka katikati ya usiku au asubuhi mapema				
c. Ulihita kuamka kutumia msalalani/ choo				
d. Hukuweza kupumua vizuri				
e. Ulikohoa au kukoroma kwa sauti kubwa.				
f. Ulihisi baridi sana				
g. Ulihisi joto sana.				
h. Ulipata ndoto mbaya.				
i. Ulihisi uchungu.				
j. Sababu zingine (tafadhali eleza zaidi):				
6. Katika mwezi uliopita, ni mara ngapi umetumia dawa za kukusaidia kulala (ilioagizwa na daktari au bila kuagizwa)?				
7. Katika mwezi uliopita, ni mara ngapi ulipata shida kukaa macho wakati wa kuendesha gari au kukula chakula au kufanya shughuli zako?				
	Sikuwa na tatizo lolote	Tatizo kidogo tu	Tatizo kiasi	Tatizo kubwa sana
8. Katika mwezi uliopita, ulikuwa na kiasi gani cha tatizo la hamu ya kutenda shughuli zako?				
	Mzuri sana	Mzuri kiasi	Mbaya kiasi	Mbaya sana
9. Katika mwezi uliopita, utapimaje kiwango/ubora wa usingizi wako kwa jumla?				
	Hapana	Yuko lakini hulala katika chumba kingine	Yuko Chumbani mwangu lakini hulala katika kitanda	Kitandani mwangu

			kingine	
10. Je, unatumia kitanda kimoja au chumba kimoja na mtu mwingine?				
	Sikuwa na shida kwa mwezi uliopita	Si zaidi ya mara moja kwa wiki	Mara moja au mbili kwa wiki	Mara tatu au zaidi kwa wiki
Ikiwa una mwenzako kwa kitanda kimoja au kwa chumba kimoja, muulize ni mara ngapi katika mwezi uliopita ulikuwa na:				
a. Mkoromo kwa sauti kubwa				
b. Misimamo mrefu (kuacha kupumua)katika pumzi katika usingizi/				
c. Miguu kupapatika au kutetemeka katika usingizi.				
d. Nyakati za kuchanganyikiwa unapoamka katikati ya usingizi.				
e. Nyakati za kutotulia kwa sababu zingine wakati ulipokuwa umelala, tafadhali eleza:				

Scoring the PSQI

The order of the PSQI items has been modified from the original order in order to fit the first 9 items (which are the only items that contribute to the total score) on a single page. Item 10, which is the second page of the scale, does not contribute to the PSQI score.

In scoring the PSQI, seven component scores are derived, each scored 0 (no difficulty) to 3 (severe difficulty). The component scores are summed to produce a global score (range 0 to 21). Higher scores indicate worse sleep quality.

Component 1: Subjective sleep quality—question 9

<u>Response to Q9</u>	<u>Component 1 score</u>
Very good	0
Fairly good	1
Fairly bad	2
Very bad	3

Component 1 score: _____

Component 2: Sleep latency—questions 2 and 5a

<u>Response to Q2</u>	<u>Component 2/Q2 subscore</u>
≤ 15 minutes	0
16-30 minutes	1
31-60 minutes	2
> 60 minutes	3

<u>Response to Q5a</u>	<u>Component 2/Q5a subscore</u>
Not during past month	0
Less than once a week	1
Once or twice a week	2
Three or more times a week	3

<u>Sum of Q2 and Q5a subscores</u>	<u>Component 2 score</u>
0	0
1-2	1
3-4	2
5-6	3

Component 2 score: _____

Component 3: Sleep duration—question 4

<u>Response to Q4</u>	<u>Component 3 score</u>
> 7 hours	0
6-7 hours	1
5-6 hours	2
< 5 hours	3

Component 3 score: _____

Component 4: Sleep efficiency—questions 1, 3, and 4

Sleep efficiency = (# hours slept/# hours in bed) X 100%

hours slept—question 4

hours in bed—calculated from responses to questions 1 and 3

<u>Sleep efficiency</u>	<u>Component 4 score</u>
> 85%	0
75-84%	1
65-74%	2
< 65%	3

Component 4 score: _____

Component 5: Sleep disturbance—questions 5b-5j

Questions 5b to 5j should be scored as follows:

Not during past month	0
Less than once a week	1
Once or twice a week	2
Three or more times a week	3

<u>Sum of 5b to 5j scores</u>	<u>Component 5 score</u>
0	0
1-9	1
10-18	2
19-27	3

Component 5 score: _____

Component 6: Use of sleep medication—question 6

<u>Response to Q6</u>	<u>Component 6 score</u>
Not during past month	0
Less than once a week	1
Once or twice a week	2
Three or more times a week	3

Component 6 score: _____

Component 7: Daytime dysfunction—questions 7 and 8

<u>Response to Q7</u>	<u>Component 7/Q7 subscore</u>
Not during past month	0
Less than once a week	1
Once or twice a week	2
Three or more times a week	3

<u>Response to Q8</u>	<u>Component 7/Q8 subscore</u>
No problem at all	0
Only a very slight problem	1
Somewhat of a problem	2
A very big problem	3

<u>Sum of Q7 and Q8 subscores</u>	<u>Component 7 score</u>
0	0
1-2	1
3-4	2
5-6	3

Component 7 score: _____

Global PSQI Score: Sum of seven component scores: _____

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Citation: Buysse, DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ: The Pittsburgh Sleep Quality Index (PSQI): A new instrument for psychiatric research and practice. *Psychiatry Research* 28:193-213, 1989

DODOSO BERLIN: (BERLIN QUESTIONNAIRE- KISWAHILI)

Urefu (m) _____ uzito (kg) _____ umri _____ Mwanaume / Mwanamke
Tafadhali chagua jibu sahihi kwa kila swali.

Sehemu 1

1. Je una koroma?

- a. Ndio b. La c. sijui

Kama unakoroma:

2. Mkoromo wako ni wa sauti:

- a. Kiasi kidogo zaidi kuliko sauti ya kupumua
b. Kama ya kuzungumza
c. Zaidi kuliko kuzungumza
d. Kubwa sana - inaweza kusikika katika vyumba vilivyo karibu

3. Ni mara ngapi wewe hukoroma

- a. Karibu kila siku. b. Mara 3-4 kwa wiki
c. Mara 1-2 kwa wiki. d. Mara 1-2 kwa mwezi
e. Kamwe au karibu kamwe

4. Je mkoromo wako umewahi kuwasumbua watu wengine?

- a. Ndio b. La c. Sijui

5. Kuna mtu yeyote aliyetambua unaacha kupumua katikati ya usingizi?

- a. Karibu kila siku. b. Mara 3-4 kwa wiki
c. Mara 1-2 kwa wiki d. Mara 1-2 kwa mwezi
e. Kamwe au karibu kamwe

Jamii 2

6. Ni mara ngapi unahisi uchovu baada ya kulala?

- a. Karibu kila siku. b. Mara 3-4 kwa wiki
c. Mara 1-2 kwa wiki. d. Mara 1-2 kwa mwezi
e. Kamwe au karibu kamwe

7. Katika muda wako wa uchao, unahisi uchovu, udhoofu ama kutoridhika?

- a. Karibu kila siku. b. Mara 3-4 kwa wiki
c. Mara 1-2 kwa wiki. d. Mara 1-2 kwa mwezi
e. Kamwe au karibu kamwe

8. Je, umewahi kuhisi usingizi au kusinzia unapoendesha gari?

- a. Ndio b. La

Kama ndio:

9. Hii hutokea mara ngapi?

- a. Karibu kila siku. b. Mara 3-4 kwa wiki
c. Mara 1-2 kwa wiki. d. Mara 1-2 kwa mwezi
e. Kamwe au karibu kamwe

Jamii 3

10. Je, una shinikizo la damu?(blood pressure/ hypertension)

- a. Ndio b. La c. Sijui

SCORING THE BERLIN QUESTIONNAIRE:

- The questionnaire consists of 3 categories related to the risk of having sleep apnea.
- Patients can be classified into High Risk or Low Risk based on their responses to the individual items and their overall scores in the symptom categories.

Categories and scoring:

- **Category 1:** items 1, 2, 3, 4, 5.
- Item 1: if 'Yes', assign 1 point
- Item 2: if 'c' or 'd' is the response, assign 1 point
- Item 3: if 'a' or 'b' is the response, assign 1 point
- Item 4: if 'a' is the response, assign 1 point
- Item 5: if 'a' or 'b' is the response, assign 2 points
- Add points. Category 1 is positive if the total score is 2 or more points
- **Category 2:** items 6, 7, 8 (item 9 should be noted separately).
- Item 6: if 'a' or 'b' is the response, assign 1 point
- Item 7: if 'a' or 'b' is the response, assign 1 point
- Item 8: if 'a' is the response, assign 1 point
- Add points. Category 2 is positive if the total score is 2 or more points
- **Category 3** is positive if the answer to item 10 is 'Yes' OR if the BMI of patient is greater than 30kg/m²
- **High Risk:** if there are 2 or more Categories where the score is positive
- **Low Risk:** if there is only 1 or no Categories where the score is positive. Additional question: item 9 should be noted separately.

APPENDIX V1: THE ATHENS INSOMNIA SCALE

ATHENS INSOMNIA SCALE

This scale is intended to record your own assessment of any sleep difficulty you might have experienced. Please check (by circling the appropriate number) the items below to indicate your estimate of any difficulty, provided, occurred at least three times per week during the last month.

1. SLEEP INDUCTION (time it takes you to fall asleep after turning-off the lights)

0 No problem	1 Slightly delayed	2 Markedly delayed	3 Very delayed or did not sleep at all
------------------------	------------------------------	------------------------------	--

2. AWAKENINGS DURING THE NIGHT

0 No problem	1 Minor problem	2 Considerable problem	3 Serious problem or did not sleep at all
------------------------	---------------------------	----------------------------------	---

3. FINAL AWAKENING EARLIER THAN DESIRED

0 Not earlier	1 A little earlier	2 Markedly earlier	3 Much earlier or did not sleep at all
-------------------------	------------------------------	------------------------------	--

4. TOTAL SLEEP DURATION

0 Sufficient	1 Slightly insufficient	2 Markedly insufficient	3 Very insufficient or did not sleep at all
------------------------	-----------------------------------	-----------------------------------	---

5. OVERALL QUALITY OF SLEEP (no matter how long you slept)

0 Satisfactory	1 Slightly unsatisfactory	2 Markedly unsatisfactory	3 Very unsatisfactory or did not sleep at all
--------------------------	-------------------------------------	-------------------------------------	---

6. SENSE OF WELL-BEING DURING THE DAY

0 Normal	1 Slightly decreased	2 Markedly decreased	3 Very decreased
--------------------	--------------------------------	--------------------------------	----------------------------

7. FUNCTIONING (PHYSICAL AND MENTAL) DURING THE DAY

0 Normal	1 Slightly decreased	2 Markedly decreased	3 Very decreased
--------------------	--------------------------------	--------------------------------	----------------------------

8. SLEEPINESS DURING THE DAY

0 None	1 Mild	2 Considerable	3 Intense
------------------	------------------	--------------------------	---------------------

ATHENS INSOMNIA SCALE

Kipimo hiki kinakusudia kusajili tatizo lolote unalolipitia wakati umelala. Tafadhali kwa kila sehemu, chagua (tia alama) kigezo sawa na tatizo unalokumbana nalo. Tatizo hili linajirudia mara ngapi kwa wiki kwa kipindi cha mwezi mmoja uliopita.

1. Mvuto wa usingizi. (unachukuwa muda gani kupata usingizi baada ya kuzima stima)

0	1	2	3
Sina tatizo.	Muda mfupi mno.	Kiasi cha masaa machache.	Muda mwingi au kutopata usingizi kamwe.

2. Kutolala vyema usiku.

0	1	2	3
Sina tatizo.	Tatizo ndogo.	Wastani.	Tatizo kubwa au kutopata usingizi kamwe.

3. Kuamka mapema kuliko wakati umezoea/ufaa.

0	1	2	3
Sina tatizo.	Mapema kidogo.	Mapema sana.	Mapema sana au kutopata usingizi kamwe.

4. Jumuisho la muda unaolala.

0	1	2	3
Unatosha.	Kidogo hautoshi.	Hautoshi kamwe.	Hautoshi au sikulala kamwe.

5. Ubora wa usingizi kwa jumla. (bila kuangazia umbali wa kipindi ulicholala)

0	1	2	3
Unaridhisha.	Kidogo hauridhishi.	Hauridhishi kamwe.	Hauridhishi kabisa na sikupata usingizi kamwe

6. Ushirikiano wako na wengine uko namna gani?

0	1	2	3
Kawaida.	Umepunguka kidogo.	Wastani.	Umepunguka kwa kiwango kikubwa.

7. Utenda kazi wa (mwili na akili) nyakati za mchana.

0	1	2	3
Kawaida .	Umepungua kidogo.	Wastani.	Umepunguka kwa kiwango kikubwa.

8. Usingizi nyakati za mchana.

0	1	2	3
Sina.	Kidogo.	Kiwango cha wastani.	Kiwango kikubwa.