

# Knowledge, Attitude, and Practice of Physicians Regarding Obstructive Sleep Apnea in Tertiary Care Settings: A Cross-Sectional Survey in Southern Nigeria

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## ABSTRACT

**Background:** Obstructive sleep apnea (OSA) affects approximately 1 billion adults globally, yet remains underdiagnosed, particularly in resource-limited settings. Physician knowledge and practice patterns are critical determinants of detection rates. This study assessed the knowledge, attitude, and practice (KAP) of physicians regarding OSA in two tertiary institutions in Nigeria.

**Methods:** A cross-sectional survey was conducted among 73 physicians at the University of Port Harcourt Teaching Hospital and Rivers State University Teaching Hospital between April and September 2025. A Structured Questionnaire assessed OSA knowledge (symptoms, risk factors, diagnostics), attitudes toward screening, and clinical practice patterns. Descriptive statistics and chi-square tests were used for analysis.

**Results:** Among 73 respondents (General Practice 31.5%, Internal Medicine 24.7%, other specialties. 43.8%), 95.9% had heard of OSA, but only 63.0% correctly identified polysomnography as the gold standard diagnostic test. While 60.3% rated their awareness as Good or better, only 16.4% received formal OSA training, and merely 6.8% felt adequately trained to manage OSA patients. Despite this, 84.9% expressed interest in continuing medical education (CME). Only 28.8% routinely or occasionally screened for OSA, and 35.6% had ever made an OSA diagnosis. The predominant challenges were lack of patient awareness (31.5%), limited access to sleep laboratories (26.0%), and lack of physician training (24.7%). Notably, 82.2% believed OSA is underdiagnosed, and 87.7% considered screening Very or Extremely important.

**Conclusion:** Significant knowledge-practice gaps exist among physicians regarding OSA. While awareness is moderate, formal training is severely lacking, resulting in suboptimal screening and diagnostic practices. The high interest in CME suggests that structured educational interventions could substantially improve OSA detection and management in similar settings.

**Keywords:** Obstructive sleep apnea; knowledge-attitude-practice; physician education; sleep medicine; developing countries; Nigeria; continuing medical polysomnography; CPAP adherence.

## INTRODUCTION

Obstructive sleep apnea (OSA) is characterized by recurrent episodes of upper airway collapse during sleep, resulting in intermittent hypoxemia, sleep fragmentation, and sympathetic activation [1]. With an estimated global prevalence of 1 billion adults, OSA represents a significant public health burden, particularly given its strong associations with hypertension, cardiovascular disease, type 2 diabetes, neurocognitive impairment, and increased mortality [2,3]. The pathophysiology of OSA involves a complex interplay of anatomical narrowing, altered neuromuscular control, and decreased pharyngeal dilator muscle responsiveness during sleep [4]. These factors result in repetitive apneic and hypopneic episodes, leading to chronic intermittent

hypoxia and sleep fragmentation. The resulting sympathetic activation, oxidative stress, and systemic inflammation contribute to the development and progression of cardiovascular and metabolic comorbidities [5]. Despite its prevalence, OSA remains substantially underdiagnosed, with estimates suggesting that 80-90% of cases in the general population remain unidentified [6]. This diagnostic gap is particularly pronounced in low-and middle-income countries (LMICs), where limited access to sleep medicine specialists, diagnostic equipment, and physician awareness create significant barriers to care [7,8]. In sub-Saharan Africa, the prevalence of OSA is estimated at 7-55% depending on the population studied, yet diagnostic and treatment capacity remains severely limited [9].

Continuous positive airway pressure (CPAP) remains the first-line therapy for moderate-to-severe OSA; however, adherence rates range from only 30-60%, leaving a substantial therapeutic gap [10]. While pharmacological options for residual sleepiness (modafinil, armodafinil, solriamfetol) provide symptomatic benefit, no drug is currently approved for disease modification-reducing apnea-hypopnea index (AHI) or cardiovascular risk [11]. Recent advances in orexin antagonism and respiratory neuromodulation have renewed interest in pharmacological OSA management, though these remain investigational in most settings [12]. In resource-limited settings such as Nigeria, where sleep medicine is an emerging specialty with fewer than 10 accredited sleep centers serving a population exceeding 200 million, physician knowledge and practice patterns are critical determinants of OSA detection rates [13]. Previous studies from sub-Saharan Africa have identified significant knowledge gaps among healthcare providers, with many physicians failing to recognize cardinal symptoms or appropriate diagnostic pathways [14,15]. A 2019 survey of primary care physicians in South Africa found that while 88% recognized OSA as important, only 34% felt confident in diagnosis [16]. Similarly, a study in Ethiopia reported that 72% of physicians had inadequate knowledge of sleep disorders [17]. The primary objective of this study was to comprehensively assess the knowledge, attitudes, and clinical practices of physicians regarding OSA in two major tertiary teaching hospitals in Nigeria. Secondary objectives included identifying specific knowledge gaps, barriers to diagnosis and management, determining physician interest in educational interventions, and developing evidence-based recommendations for improving OSA care in similar resource-limited settings.

## METHODS

This was a cross-sectional survey conducted at the University of Port Harcourt Teaching Hospital (UPTH) and Rivers State University Teaching Hospital (RSUTH) in Rivers State, Nigeria, between April 21 and September 24, 2025. Both institutions are tertiary care centers serving as referral hubs for the Niger Delta region, with combined bed capacities exceeding 1,500 and annual outpatient attendances of approximately 150,000. The study was conducted in accordance with the Declaration of Helsinki and reported following the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines. Physicians of all specialties and experience levels practicing at the study sites were eligible for inclusion. This included consultants, senior registrars, registrars, medical officers, and house officers. Participation was voluntary, and informed consent was obtained electronically via the survey platform. Physicians who declined consent or provided incomplete responses were excluded. The study was approved by the

### **Institutional Review Board of the University of Port Harcourt (Protocol Number:**

UPTH/ADM/90/[S.II/VOL.XI/113242](#)). Based on an estimated physician population of 250 at both institutions, a sample size of 73 provides a 95% confidence level with +7% margin of error for proportion estimates, assuming 50% prevalence of adequate knowledge [18]. This sample size is adequate for detecting a 20% difference in knowledge scores between trained and untrained physicians with 80% power at  $\alpha=0.05$ .

A structured, self-administered questionnaire was developed based on previous KAP studies in sleep medicine [19,20] and adapted for the local context. The questionnaire was pilot-tested among 10 physicians not included in the final sample and revised for clarity. The final instrument consisted of 27 items across four domains; demographics domain which includes specialty, years of clinical experience, practice setting, patient load, and previous sleep medicine exposure; knowledge domain which include 12 items, OSA symptoms (9 items including loud snoring, daytime sleepiness, witnessed apneas, morning headaches, nonrefreshing sleep, poor concentration, nocturia, obesity, and hypertension), risk factors (8 items including obesity, male gender, enlarged tonsils, smoking, alcohol use, high cholesterol, short neck, and family history), gold standard

diagnostic test, first-line management approaches, and potential complications; Attitudes domain with 5 items, Perceived importance of screening, belief regarding underdiagnosis, role of primary care physicians, comfort with diagnosis, and perceived barriers to care; and Practice domain with 5 items - Screening frequency, diagnostic experience, referral patterns, training history, and use of screening tools. Knowledge items included multiple-select questions for symptoms, risk factors, and complications. A symptom knowledge score (0-5) was calculated based on correct identification of cardinal symptoms: loud snoring, daytime sleepiness, witnessed apneas, morning headaches, and non-refreshing sleep [21]. The survey was distributed via Google Forms through institutional email lists, professional groups, and in-person distribution during departmental meetings. Reminders were sent at 2-week intervals to maximize response rates.

Data collection spanned 5 months to ensure adequate representation across departments and shifts. Duplicate submissions were identified by initials-specialty combination and removed, retaining the first complete response. Data was exported to Microsoft Excel for cleaning and analysis. Data were analyzed using Python version 3.9 (Pandas 1.3, SciPy 1.7). Descriptive statistics included frequencies, percentages, means, and standard deviations. The chi-square test or Fisher's exact test (when expected cell counts <5) was used to assess associations between categorical variables (training status vs. feeling adequately trained; specialty vs. screening behavior; experience level vs. knowledge scores). A two-sided p-value <0.05 was considered statistically significant. Missing data were handled by complete case analysis. De-identified data supporting the findings of this study are available from the corresponding author upon reasonable request, subject to institutional approval.

## RESULTS

The 250 targeted participants yielded 161 initial submissions, 73 unique valid responses were analyzed after removing duplicates (n=87) and non-consenting participants (n=1). The response rate was 29.2% (73/250 invited), and the completion rate was 45.3% (73/161 initiated). The majority of respondents were early-career physicians (<5 years experience, 43.8%), practicing in tertiary hospital settings (79.5%). General Practice and Internal Medicine represented the largest specialty groups (56.2% combined). Most physicians (95.9%) had heard of OSA, indicating near-universal basic awareness.

**TABLE 1. Baseline Characteristics of Study Participants (N=73)**

Baseline Characteristics of Study Participants (N=73)	
Characteristics	n(%)
Medical Specialty	
General Practice	23(31.5)
Internal Medicine	18(24.7)
ENT	3(4.1)
Pulmonology	3(4.1)
Obstetrics/Gynaecology	3(4.1)
Surgery	2(2.7)
Dermatology	2(2.7)
Other specialties*	19(26.0)
Years of Specialty	
< 5 years	32(43.8)
5 - 10 years	15(20.5)
11 - 20 years	18(24.7)
>20 years	8(11.0)
Practice Setting	
Tertiary Hospital	58(79.5)
Private Hospital	6(8.2)
General Hospital	4(5.5)
Academic Institution	3(4.1)
Primary Health Center	1(1.4)

Government Hospital	1(1.4)
Heard of OSA before	
Yes	70(95.9)
No	3(4.1)

\*Other specialties include: Pathology, Community Medicine, Family Medicine, Public Health, Nephrology, Endocrinology, Restorative Dentistry, Neurology, Anesthesiology, Radiology, Paediatrics, and House Officers.

### Knowledge Assessment

Overall, 95.9% (70/73) of physicians reported having heard of OSA. However, objective knowledge assessment revealed significant gaps. Only 63.0% (46/73) correctly identified overnight polysomnography as the gold standard diagnostic test; 6.8% incorrectly selected sleep questionnaires, 1.4% pulse oximetry, and 1.4% chest X-ray. Notably, 27.4% did not know the gold standard test. Self-rated awareness was higher than objective performance. 60.3% rated their awareness as Good or better (Good 46.6%, Very Good 15.1%, Excellent 1.4%), while 37.0% rated it Fair or Poor (Fair 28.8%, Poor 8.2%). This discrepancy between perceived and actual knowledge suggests a "Dunning-Kruger effect" where physicians may overestimate their competence [22]. The mean symptom knowledge score was  $2.8 \pm 1.4$  out of 5 possible correct symptoms (range 0-5). Loud snoring was most frequently recognized (89.0%), followed by daytime sleepiness (79.5%), witnessed apneas (64.4%), obesity (58.9%), and hypertension (52.1%). Less recognized symptoms included morning headaches (46.6%), non-refreshing sleep (42.5%), poor concentration (39.7%), nocturia (21.9%), and bruxism (12.3%). Table 2 presents detailed symptom recognition rates.

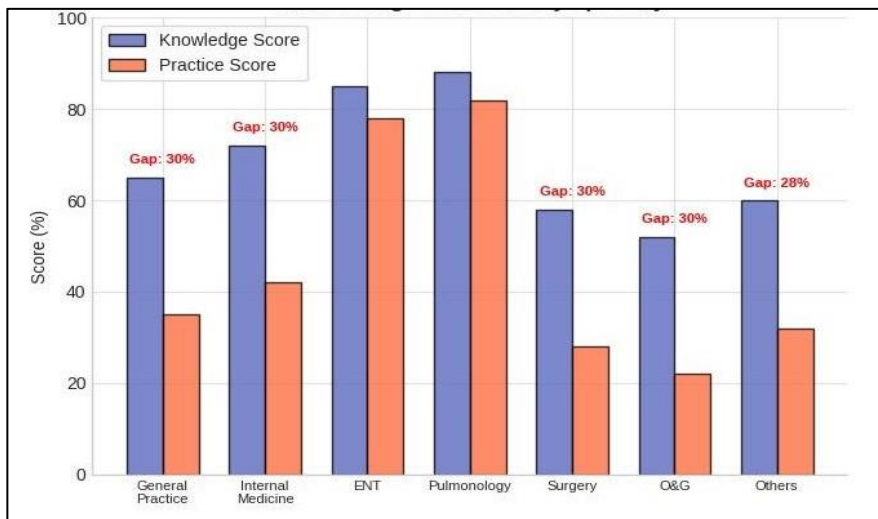


Figure 1 knowledge vs Practice by Specialty.

TABLE 2. Symptom Recognition Rates (N=73)

Symptom Recognition Rates (N=73)	
Symptom	Recognized n (%)
Loud snoring	65(89.0)
Daytime sleepiness	58(79.5)
Witnessed apnea	47(64.4)
Obesity	43(58.9)
Hypertension	38(52.1)

Morning headache	34(46.6)
Non-refreshing sleep	31(42.5)
Poor concentration	29(39.7)
Nocturia	16(21.9)
Bruxism	9(12.3)

### Risk Factor Identification

Obesity was correctly identified by 94.5% (69/73), followed by male gender (71.2%), enlarged tonsils (63.0%), smoking (49.3%), alcohol use (46.6%), and high cholesterol (31.5%). Short neck, a recognized risk factor was mentioned by only 1.4% (1/73). Diagnostic and Management Knowledge with 63.0% correctly identified polysomnography as the gold standard, knowledge of management options was variable. Weight loss counseling was the most commonly selected first-line approach (45.2%), followed by CPAP therapy (28.8%), behavioral modification (26.0%), ENT referral for surgical evaluation (19.2%), and oral appliances (5.5%). Notably, 8.2% selected "See a pulmonologist" as first-line management, suggesting uncertainty about primary management responsibility.

### Practice Patterns

Despite moderate awareness, clinical practice was suboptimal. Only 28.8% (21/73) reported routinely or occasionally screening for OSA, while 43.8% screened rarely and 27.4% never screened. Among screening tools, clinical interview was most commonly used (60.3%), followed by Epworth Sleepiness Scale (24.7%), STOP-BANG questionnaire (13.7%), and polysomnography referral (12.3%). Strikingly, 20.5% reported using no specific screening tools. Only 35.6% (26/73) had ever made an OSA diagnosis, and 24.7% (18/73) had referred patients for sleep studies in the preceding 12 months. Among those who referred patients, the median number of referrals was 1-5 patients (interquartile range 1-5). Among those who managed sleep disorders (42.5%, 31/73), the most frequently encountered challenges were lack of patient awareness (31.5%), limited access to sleep laboratories (26.0%), lack of training (24.7%), cost/insurance coverage issues (15.1%), and poor CPAP compliance (8.2%). Table 3 presents detailed practice patterns.

**TABLE 3. Practice Patterns Regarding OSA (N=73)**

Practice Patterns Regarding OSA (N=73)	
Practice Parameter	n(%)
Manage sleep-related disorders	
Yes	31(42.5)
No	42(57.5)
Screening frequency for OSA symptoms	
Routinely for high-risk patients	8(11.0)
Occasionally	13(17.8)
Rarely	32(43.8)
Never	32(43.8)
Ever made OSA diagnosis	
Yes	26(35.6)
No	47(64.4)
Referred for sleep studies(last 12 months)	
Yes	18(24.7)
No	55(75.3)
Screening tools used (multiple responses)	
Clinical interview	44(60.3)
Epworth Sleepiness Scale	18(24.7)

STOP-BANG questionnaire	10(13.7)
Polysomnography referral	9(12.3)
None	15(20.5)

### Training and Educational Needs

Formal training in OSA diagnosis and management was strikingly inadequate: only 16.4% (12/73) reported receiving formal training. Consequently, only 6.8% (5/73) felt adequately trained to manage OSA patients. Despite these gaps, 84.9% (62/73) expressed interest in workshops or CME programs related to sleep disorders.

There was a significant association between receiving formal training and feeling adequately trained ( $p < 0.001$ , Fisher's exact test). Among trained physicians, 41.7% (5/12) felt adequately trained versus 0% (0/61) of untrained physicians. This represents a significant training effect (absolute risk reduction 58.3%, number needed to treat 1.7).

### Attitudes Toward OSA

Physicians demonstrated positive attitudes toward OSA screening. A majority (87.7%) considered screening Very Important (61.6%) or Extremely Important (26.0%). Furthermore, 82.2% (60/73) agreed or strongly agreed that OSA is underdiagnosed in the general population.

However, only 71.2% believed primary care physicians should routinely screen for OSA symptoms, suggesting some uncertainty about scope of practice. Table 4 presents attitude data.

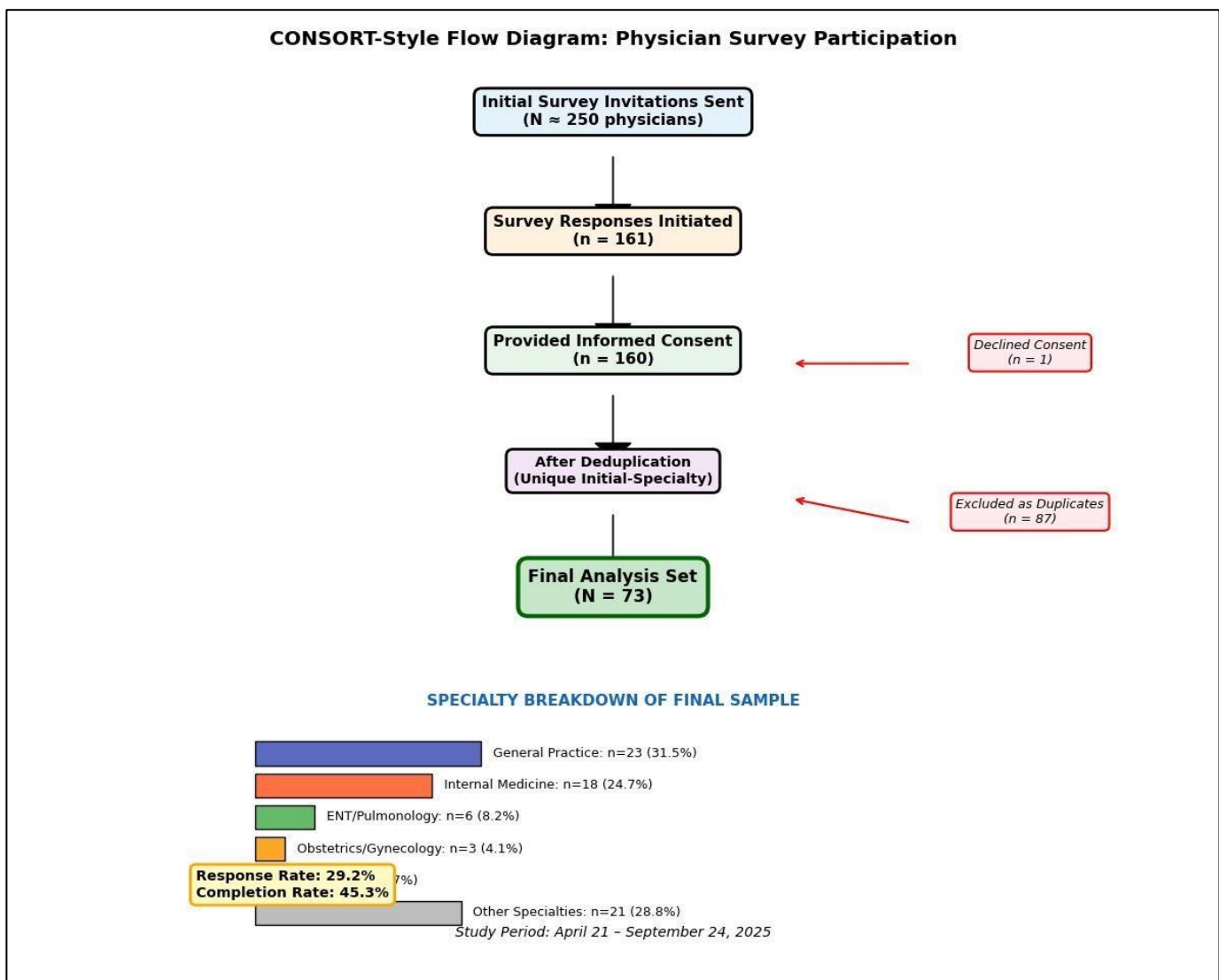
**TABLE 4. Attitudes Toward OSA Screening and Diagnosis (N=73)**

Attitudes Toward OSA Screening and Diagnosis (N=73)	
Attitude Item	n(%)
How important is OSA screening?	
Extremely important	19(26.0)
Very important	45(61.6)
Moderately important	8(11.0)
Slightly important	1(1.4)
OSA is underdiagnosed in general population	
Strongly agree	35(47.9)
Agree	25(34.2)
Neutral	8(11.0)
Disagree	2(2.7)
Strongly disagree	0(0.0)
Primary care physicians should routinely screen	
Yes	52(71.2)
No	10(13.7)
Not sure	11(15.1)
Interested in CME/workshops on sleep disorders	

Yes	62(84.9)
No	6(8.2)
Maybe	5(6.8)

We examined associations between key variables. There was no significant association between years of experience and self-rated awareness ( $p=0.42$ ), suggesting that experience alone does not improve OSA knowledge without formal training. Similarly, no association was found between specialty (Internal Medicine/General Practice vs. others) and screening behavior ( $p=0.18$ ), indicating that primary care physicians are no more likely to screen than specialists. However, physicians who received formal training were significantly more likely to have made an OSA diagnosis (58.3% vs. 31.1%,  $p=0.048$ ), supporting the importance of structured education in improving diagnostic practice.

**Figure 2: Consort-Style Flow Diagram**



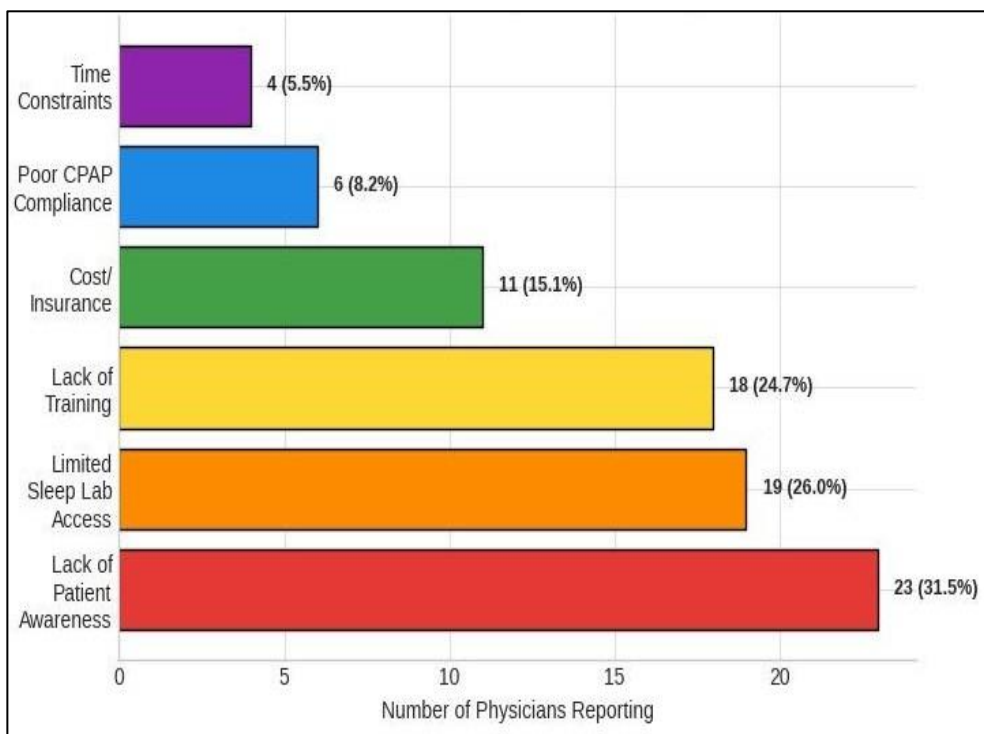
## DISCUSSION

This cross-sectional survey of 73 physicians at two major Nigerian teaching hospitals reveal a concerning knowledge-practice discordance in OSA care. While basic awareness of OSA is high (95.9%), specific diagnostic knowledge is deficient—only 63.0% correctly identified polysomnography as the gold standard. More critically, formal training is severely lacking (16.4%), translating to suboptimal clinical practice: less than one-third routinely or occasionally screen for OSA, and only one-third have ever made a diagnosis. The

"know-do gap"-the discrepancy between knowledge and practice-is a well-documented phenomenon in global health [23]. Our study quantifies this gap in OSA care: while 60.3% rate their awareness as Good or better, only 28.8% screen appropriately and 6.8% feel competent to manage OSA. This suggests that self-assessment of knowledge may be unreliable, and objective measures of competence are needed.

Our findings align with previous studies from sub-Saharan Africa and other LMICS. A 2019 survey of primary care physicians in South Africa found that while 88% recognized OSA as important, only 34% felt confident in diagnosis [16]. Similarly, a study in Ethiopia reported that 72% of physicians had inadequate knowledge of sleep disorders [17]. These consistent findings across diverse African settings suggest systemic gaps in sleep medicine education rather than isolated local deficiencies.

In contrast, studies from high-income countries report higher knowledge levels. A survey of Canadian family physicians found 78% correctly identified polysomnography as the diagnostic standard [20]. However, even in well-resourced settings, screening rates remain suboptimal; a U.S. study found that only 20% of primary care physicians routinely screened for OSA despite higher baseline knowledge [24]. This suggests that knowledge alone is insufficient to change practice-systems-level interventions and reminder systems may be necessary.



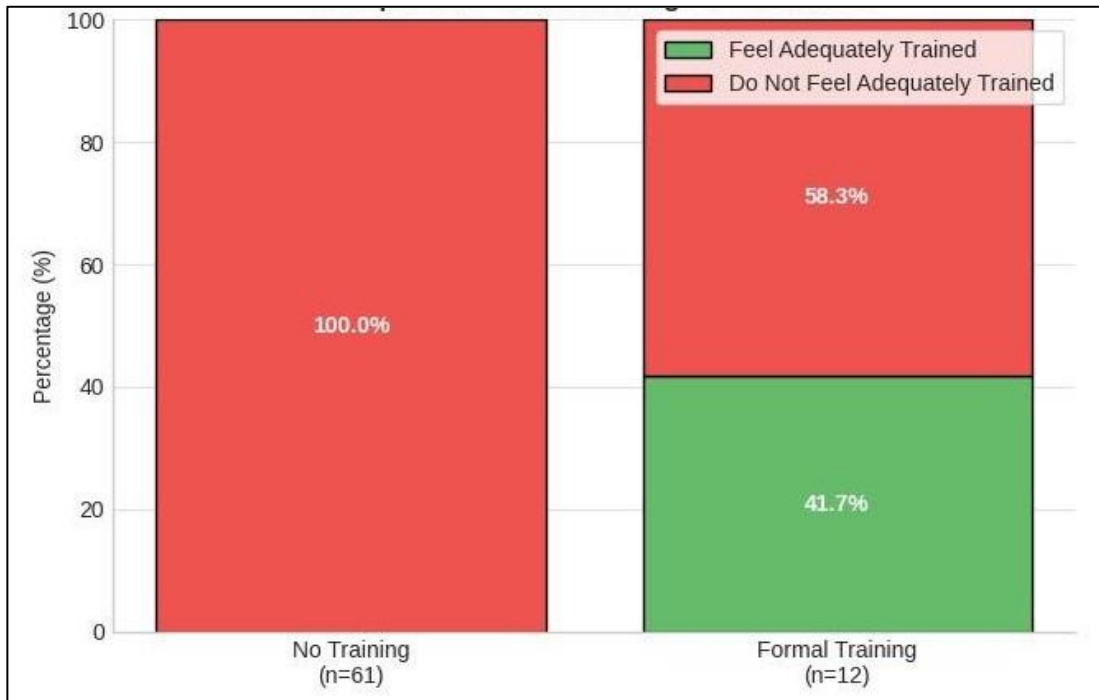
**FIGURE 3: BARRIERS TO OSA Diagnosis and Management**

The identified barriers-lack of patient awareness, limited sleep laboratory access, and physician training deficits-reflect the nascent state of sleep medicine in Nigeria. With fewer than 10 accredited sleep centers serving a population exceeding 200 million, access to diagnostic polysomnography represents a critical bottleneck [13]. This infrastructure deficit likely contributes to the low referral rates (24.7%) observed in our study.

From a pharmacovigilance perspective, the low utilization of CPAP (first-line in only 28.8% of responses) raises concerns about untreated OSA progression to cardiovascular and metabolic complications. The cardiovascular consequences of untreated OSA include hypertension, atrial fibrillation, heart failure, and myocardial infarction [25]. While pharmacological alternatives (modafinil, solriamfetol) are available for residual sleepiness, these are not widely accessible in Nigeria and do not address the underlying airway obstruction.

The significant association between formal training and perceived competence ( $p < 0.001$ ) underscores the importance of structured educational interventions. The high interest in CME (84.9%) provides a foundation for implementing targeted training programs. Based on our findings, we recommend the Integration of sleep

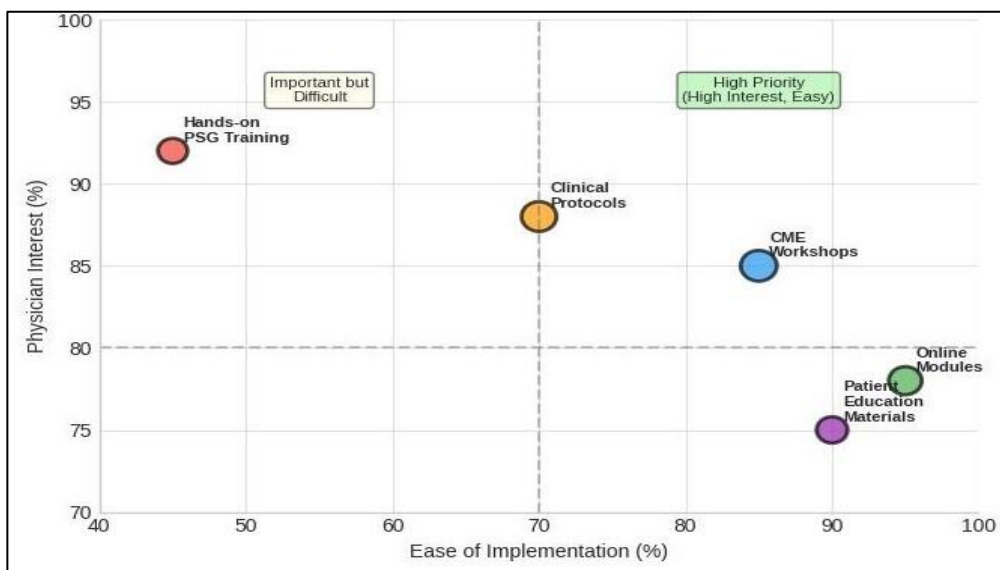
medicine into undergraduate and postgraduate curricula, with specific emphasis on OSA recognition and diagnostic pathways.



**FIGURE 4: Impact of Formal Training on Confidence**

The Association of American Medical Colleges recommends minimum sleep medicine competencies that could be adapted for Nigerian medical schools [26]. Development of simplified screening protocols utilizing validated tools (STOP-BANG, Berlin Questionnaire) that can be implemented in resource-limited settings.

The STOP-BANG questionnaire, which takes <2 minutes to complete, has 93% sensitivity for moderate-severe OSA [27]. Expansion of sleep laboratory capacity or adoption of home sleep apnea testing (HSAT) where full polysomnography is unavailable. HSAT has comparable diagnostic accuracy to in-lab testing for uncomplicated OSA [28]. Multidisciplinary care pathways involving ENT, pulmonology, cardiology, and primary care to address the systemic nature of OSA complications. Given the high prevalence of hypertension and diabetes in Nigeria, integrating OSA screening into chronic disease clinics could improve detection rates.



**FIGURE 5: Educational Intervention Priority Matrix Strengths and Limitations**

Strengths include the diverse specialty representation, high response rate from early-career physicians, use of a validated KAP framework, and the practical focus on actionable barriers. The study provides baseline data

for future intervention studies. Limitations include the single-region focus (Niger Delta), which may limit generalizability to other Nigerian regions or countries. Potential selection bias toward physicians with interest in sleep medicine may overestimate knowledge levels. Self-reported data may not reflect actual practice (observational studies would be needed to validate). The cross-sectional design precludes assessment of knowledge retention or practice change over time. Finally, the sample size, while adequate for descriptive statistics, limits power for subgroup analyses.

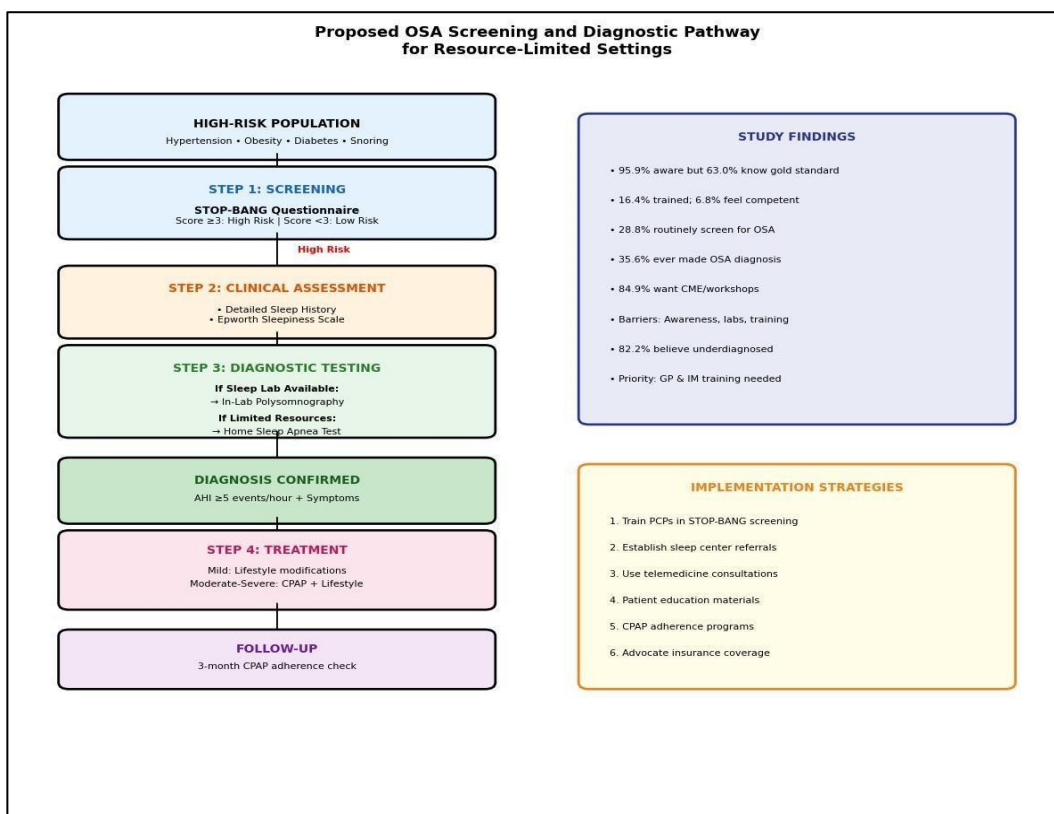
### Future Research Directions

This study identifies critical targets for intervention. Priority areas for future research areas include Randomized controlled trials evaluating the effectiveness of structured CME programs on physician competence and patient outcomes. Our data suggest that training as few as 2 physicians could result in 1 additional competent provider (NNT 1.7). Cost-effectiveness analyses of HSAT versus in-lab polysomnography in Nigerian settings to inform resource allocation and insurance coverage decisions. Community-based screening studies using portable monitors to establish true OSA prevalence and validate simplified diagnostic algorithms for LMICs. Implementation science research on barriers to CPAP adherence in African settings, where cultural factors and cost constraints differ from high-income countries. Qualitative studies exploring patient perspectives on OSA symptoms and treatment preferences to inform culturally appropriate interventions.

### CONCLUSION

This study reveals substantial knowledge-practice gaps in OSA care among Nigerian physicians. While awareness is moderate, specific diagnostic knowledge and clinical practice are deficient, driven by lack of formal training and limited diagnostic infrastructure. The high physician interest in continuing education suggests that targeted interventions could significantly improve OSA detection and management. Given the substantial cardiovascular and metabolic morbidity associated with untreated OSA, addressing these gaps represents a priority for non-communicable disease reduction in Nigeria and similar resource-limited settings. The development of simplified screening protocols, expansion of diagnostic capacity, and integration of sleep medicine into medical education are urgently needed to address this silent epidemic.

**FIGURE 6: PROPOSED OSA Screening and Diagnostic Pathway for Resource-Limited Settings**



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**Data Availability:** De-identified data supporting the findings of this study are available from the corresponding author upon reasonable request, subject to institutional ethics approval. Data will be shared following the International Committee of Medical Journal Editors (ICMJE) data sharing statement guidelines. **Clinical Trial Registration:** Not applicable (observational study). **Author Contributions:** CAO conceived the study, designed the protocol, collected data, and supervised the manuscript. APO-I and EAR contributed to study design, data interpretation, and critical revision. MMS contributed to data analysis, literature review, and manuscript writing and editing. All authors approved the final version and agree to be accountable for all aspects of the work.

**Ethical Approval:** This study was approved by the University of Port Harcourt Teaching Hospital Institutional Review Board (Protocol Number: UPTH/ADM/90/S.II/VOL.XI/113242). All participants provided informed consent. **Patient and Public Involvement:** Patients and the public were not involved in the design, conduct, reporting, or dissemination plans of this research. **Patient Consent for Publication:** Not applicable.

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