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PREVALENCE OF POOR SLEEP QUALITY AMONG PATIENTS WITH TYPE 2 DIABETES MELLITUS IN PONTIANAK: A CROSS-SECTIONAL STUDY

Djoko Priyono[1], Ririn Afrian Sulistyawati[2], Sukarni[2], Muhammad Agung Krisdianto[3]

[1]Departemen Keperawatan Jiwa dan Komunitas, Fakultas Kedokteran, Universitas Tanjungpura, Pontianak, Kalimantan Barat, Indonesia
[2]Departemen Keperawatan Medikal Bedah, Fakultas Kedokteran, Universitas Tanjungpura, Pontianak, Kalimantan Barat, Indonesia
[3]Departemen Keperawatan Dasar & Dasar Keperawatan, Fakultas Kedokteran, Universitas Tanjungpura, Pontianak, Kalimantan Barat, Indonesia

*Email: djoko.priyono@ners.untan.ac.id

ABSTRACT
Background: Sleep disorders are a significant health concern among patients with type 2 diabetes. Understanding their prevalence and underlying factors is key to designing effective interventions. **Methods:** A descriptive cross-sectional study was conducted in 2023 involving 119 patients with type 2 diabetes aged 30–70 years at diabetic wound care and primary health clinics in Pontianak City. Data were collected using a demographic checklist and the Pittsburgh Sleep Quality Index (PSQI). Associations between sleep quality and various factors were analysed using chi-square tests and binary logistic regression. Poor sleep quality was defined as a PSQI score of 5 or higher. **Results:** 119 individuals (53.7 %) demonstrated poor sleep quality and had a moderate level of sleep disturbance (mean PSQI score 6.9±3.16.9±3.1), with sleep latency being the most affected domain (mean score 1.9±1.41.9±1.4). Comorbid chronic diseases (OR 2.80, p=0.001), smoking (OR 2.95, p=0.005), diabetes duration >10 years (OR 2.55, p=0.004), and obesity (BMI ≥ 30.0 kg/m²; OR 1.89, p=0.021) were significantly associated with poor sleep quality. Older age had a protective effect (OR 0.94, *p*=0.007). **Conclusion:** Sleep disorders, particularly difficulty initiating sleep, are highly prevalent among type 2 diabetes patients and associated with comorbidities, smoking, prolonged disease duration, and obesity. Interventions targeting these factors are essential to improve sleep quality and diabetes management.

Keywords: *Sleep disorders, type 2 diabetes mellitus, Pontianak city, cross-sectional study*

ABSTRAK
Latar Belakang: Gangguan tidur merupakan masalah kesehatan yang cukup signifikan terjadi pada pasien dengan diabetes melitus tipe 2. Oleh karena itu, mengetahui prevalensi serta faktor-faktor yang menjadi penyebab kejadian gangguan tidur sangatlah penting sebagai landasan untuk merancang intervensi yang lebih efektif. **Metode:** Penelitian ini merupakan deskriptif *cross-sectional* studi yang dilakukan pada tahun 2023 di klinik spesialis perawatan luka diabetes dan pusat Kesehatan Masyarakat di Kota Pontianak. Sebanyak 119 pasien diabetes melitus tipe 2 berusia antara 30 hingga 70 tahun berpartisipasi dalam studi ini. Pengumpulan data dilakukan menggunaka kuesioner yang mencakup data demografi dan gangguan tidur yang diukur menggunakan *Pittsburgh Sleep Quality Index* (PSQI) dengan kualitas tidur dikatakan buruk jika skor PSQI mencapai 5 atau lebih. Hubungan antara kualitas tidur dan factor-faktor yang mempengaruhinya dianalisis uji *chi-square* dan regresi logistik biner. **Hasil:** Dari total 119 partisipan, sebanyak 53,7% menunjukkan kualitas tidur yang buruk dengan tingkat gangguan sedang (rerata skor PSQI 6.9±3.1). Latensi tidur (waktu yang dibutuhkan untuk mulai tidur) merupakan domain yang paling terganggu (rerata skor 1.9 ±1.4). Beberapa faktor secara signifikan berhubungan dengan kualitas tidur yang buruk, yaitu: adanya penyakit kronis komorbid (OR 2,80, p=0.001), merokok (OR 2,95, p=0.005), durasi diabetes lebih dari 10 tahun (OR 2,55, p=0.004), dan obesitas (BMI ≥ 30.0 kg/m²; OR 1.89, p=0.021). Disamping itu, usia yang lebih tua justru memberikan efek protektif terhadap kualitas tidur (OR 0,94, p=0.007). **Kesimpulan:** Gangguan tidur, terutama kesulitan untuk memulai tidur, memiliki prevalensi yang tinggi pada pasien diabetes melitus tipe 2. Masalah ini berkaitan erat dengan komorbiditas, merokok, durasi penyakit yang lama, dan obesitas. Oleh karena itu, intervensi yang ditujukan pada perbaikan faktor-faktor risiko tersebut sangatlah penting untuk meningkatkan kualitas tidur pasien dan mengoptimalkan manajemen diabetes.

Kata kunci: *Gangguan tidur, diabetes melitus tipe 2, kota Pontianak, studi cross-sectional*

BACKGROUND

Type 2 diabetes mellitus is a prevalent metabolic disorder, predominantly attributed to insulin resistance, that leads to sustained hyperglycaemia (Hameed et al., 2015). Representing approximately 90–95% of all diabetes cases, type 2 diabetes is associated with a wide range of complications that substantially compromise health outcomes and quality of life over time (Yfantopoulos & Chantzaras, 2020). Among these, sleep disturbances have emerged as a notable comorbidity. Individuals diagnosed with type 2 diabetes frequently experience physiological imbalances alongside clinical manifestations such as polyphagia, polydipsia, and polyuria, which collectively disrupt the sleep-wake cycle and facilitate the development of poor sleep quality (Gupta & Wang, 2016; Narisawa et al., 2017).

Sleep disturbances and poor sleep quality frequently pose significant challenges to both daily functioning and long-term health outcomes among individuals living with type 2 diabetes. As a fundamental physiological requirement, sleep is essential for restoring physical and cognitive capacities (Chasens & Luyster, 2016). Existing evidence underscores a complex association between sleep duration, sleep quality, and overall human health. Poor sleep quality, in particular, can profoundly diminish the quality of life for those affected (Endeshaw et al., 2016; Yıldız et al., 2020).

Recent studies in Indonesia have demonstrated a high prevalence of poor sleep quality among individuals with type 2 diabetes, with rates varying between 53.4% and 75.6% in this population (Asri et al., 2025). Factors associated with poor sleep quality include older age, female sex, lower educational attainment, smoking status, the presence of comorbidities, and psychiatric symptoms (Kurnia et al., 2025). Moreover, research from Denpasar identified that people with type 2 diabetes are at increased risk for obstructive sleep apnea, with diabetic patients approximately 3.3 times more likely to be in the high-risk category compared to those without diabetes (Putra et al., 2023). These findings highlight the importance of addressing sleep disturbances as a critical aspect of diabetes management in Indonesian clinical settings.

Recent evidence highlights a notably high prevalence of poor sleep quality in individuals with type 2 diabetes, which substantially compromise health outcomes (Otaka et al., 2018). Sleep disturbances, such as insomnia, have been linked to poorer glycaemic control, demonstrated by increased HbA1c levels, a key indicator of long-term blood glucose regulation (Al Amri et al., 2023). Current diabetes management strategies are increasingly incorporating sleep optimization—addressing its duration, quality, and consistency—as a critical lifestyle component (Birhanu et al., 2020). Recognition of poor sleep quality' detrimental effects extends to their role in elevating cardiovascular risk, disrupting weight management, and exacerbating metabolic dysfunction.

Consequently, improving sleep quality to enhance overall well-being is a vital treatment goal for diabetic patients, aiming to support a normalized quality of life (Hackett et al., 2020). Achieving this requires a thorough assessment of sleep quality, prevalence of sleep-related disorders, and contributory factors within this population. The existing literature reveals gaps that necessitate targeted research. Therefore, this study aims to determine the frequency of poor sleep quality among patients with type 2 diabetes and identify the influencing factors, particularly in Pontianak City, Indonesian settings where such data are limited.

METHODS

This descriptive cross-sectional study was conducted in Kitamura diabetic wound care clinics and Parit H. Husin II primary healthcare centres in Pontianak City, following approval from the Ethics Committee of Faculty of Medicine University of Tanjungpura (No: 1641/UN22.9/PG/2023). Participants were selected based on criteria, which included being aged 30 to 70 years, having a diagnosis

type 2 diabetes, and the absence of diagnosed psychiatric disorders. Individuals with malignancies, those on certain medications, or lacking basic literacy skills were also excluded. Additionally, any participants who submitted incomplete questionnaire responses were excluded from the analysis. The study further detailed the use of oral and injectable antidiabetic medications among the participants.

A consecutive sampling technique was used, whereby eligible respondents were recruited until the required sample size was achieved. were randomly chosen from the lists of patients in the diabetic wound care clinic and primary healthcare facilities in the Pontianak City region. Recruitment was conducted at each healthcare facility until the target number of participants was reached. Using G*Power (version 3.1.9.4), the minimum sample size required for this investigation was calculated (Kang, 2021). The number of T2DM patients, with a 95% confidence interval (CI), an anticipated frequency of 50%, and a effect size of 0.15, was considered when calculating the sample size. The calculated minimum sample size was 119 patients.

Prior to participation, patients provided informed consent voluntarily. They were first asked to carefully review the demographic information checklist alongside the sleep quality questionnaire. Afterwards, participants completed the questionnaires under the direct supervision of the researcher within the diabetes clinic, a process that took approximately 15 minutes to complete. To ensure anonymity and reduce bias, the questionnaires were completed without recording names or surnames, with all responses self-reported by the patients.

The Pittsburgh Sleep Quality Index (PSQI) evaluates sleep quality over the past month through nine general questions organized into seven subscales: subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction (Barakat et al., 2019). Each subscale is scored from 0 to 3, where 0 indicates no difficulty and 3 signifies severe difficulty. The total PSQI score, which is the sum of the seven subscale scores, ranges from 0 to 21. Poor sleep quality was defined as a PSQI score > 5.

higher scores indicate poorer sleep quality, with a score above five typically indicating poor sleep quality. Carpenter & Andrykowski (1998) reported the PSQI's Cronbach's alpha of 0.80-0.83 and a test-retest reliability of r = 0.85. More recently, Setyowati & Chung (2021) reported an PSQI Bahasa version with Cronbach's alpha was 0.72, and that for each item ranged from 0.69 to 0.72.

Statistical analyses were conducted using IBM SPSS software version 26 (Armonk, NY). Qualitative variables were expressed as frequencies and percentages and analyzed using the chi-square test ($\chi 2$). Quantitative data were summarized as means and standard deviations (mean ± SD). To assess the relationships between variables, Spearman's correlation test was employed. A *p*-value less than 0.05 was considered indicative of statistical significance.

RESULTS

Characteristics of Respondents

Table 1. Distribution of studied respondents according to demographic (N = 119)

Variable	Value N(%) / Mean ± SD
Age (years)	52.6 ± 11.3
BMI (kg/m²)	27.8 ± 4.5
DM duration (years)	7.4 ± 5.9
Gender	
Male	70 (58.9)
Female	49 (41.1)
Education level	
Elementary school or lower	65 (54.6%)
Junior and High school	45 (37.8)
University	9 (7.6)
Marital status	
Single	24 (20.0%)
Married	86 (72.1%)
Widowed	9 (7.6%)
Employment	
Employed	101 (85.0%)
Unemployed	18 (15.0%)
Smoking status	
Smoker	11 (9.2%)
Non-smoker	108 (90.8%)
Other chronic diseases	
Yes	70 (63.6%)
No	40 (36.4%)
Comorbidities (N=70)	
Hypertension	62 (88.6%)
Cardiovascular disease	46 (65.7%)
Endocrine	13 (18.4%)
Kidney disease	7 (10.0%)
Neuropathy/retinopathy	4 (5.7%)

After excluding non-respondents, the study sample comprised 119 patients. The mean body mass index (BMI) was 27.8 ± 4.5 kg/m^2, with an average age of 52.6 ± 11.3 years and an average diabetes duration of 7.4 ± 5.9 years. Males made up 58.9% ($n = 70$) of the cohort. Regarding education, most patients (54.6%, $n = 65$) had an elementary school or lower education, while only 7.6% ($n = 9$) had a university education. Most participants (72.1%, $n = 86$) were married. Employment status showed that 15.0% ($n = 18$) were unemployed. Additionally, 9.2% ($n = 11$) of participants were smokers. Among the 70 patients who reported other chronic diseases, hypertension was the most common comorbidity, affecting 88.6% of them, followed by cardiovascular disease at 65.7% (Table 1).

Comparison of patients' sleep quality status

Table 2. Comparison of patients' sleep quality status based on demographic and clinical status

Characteristics	Sleep quality status		*p*-value
	Good Sleep Quality (N=55)	Poor Sleep quality (N=64)	
Age (years)	58.2±9.5	48.9±10.1	0.001
BMI (kg/m²)			0.018
Normal (18.5 to 24.9 kg/m²)	24 (43.6%)	29 (45.3%)	
Overweight (25.0 to 29.9 kg/m²)	12 (21.8%)	15 (23.4%)	
Obese (≥ 30.0 kg/m²)	19 (34.5%)	20 (31.3%)	
DM duration (years)			0.025
≤ 5 years	15 (27.3%)	18 (28.1%)	
> 5 to 10 years	30 (54.5%)	27 (42.2%)	
> 10 years	10 (18.2)	19 (29.7%)	
Gender			0.042
Male	21 (38.2%)	49 (76.6%)	
Female	34 (61.8%)	15 (23.4%)	
Education level			0.21
Elementary school or lower	35 (63.6%)	30 (46.9%)	
Junior and High school	15 (27.3%)	30 (46.9%)	
University	5 (9.1%)	4 (6.3%)	
Marital status			0.655
Single	10 (18.2%)	14 (21.9%)	
Married	40 (72.7%)	46 (71.9%)	
Widowed	5 (9.1%)	4 (6.3%)	
Employment			0.34
Employed	45 (81.8%)	56 (87.5%)	
Unemployed	10 (18.2%)	8 (12.5%)	
Smoking status			0.48
Smoker	4 (7.3%)	7 (10.9%)	
Non-smoker	51 (92.7%)	57 (89.1%)	
Other chronic diseases			0.011
Yes	30 (54.5%)	40 (62.5%)	
No	25 (45.5%)	24 (37.5%)	

Participants with good sleep quality were significantly older (mean 58.2 ± 9.5 years) than those with poor sleep quality (mean 48.9 ± 10.1 years, p=0.001p=0.001), and showed higher rates of overweight and obesity (p=0.018); those reporting good sleep quality were predominantly female (61.8%) and had a higher proportion with a diabetes duration of 5 to 10 years (54.5%) compared to poor sleepers, who were mainly male (76.6%) and more frequently had diabetes for over 10 years (*p*=0.025,*p*=0.042 respectively).

No significant differences were observed between sleep quality groups for education, marital status, employment, or smoking (p>0.05); however, the presence of other chronic diseases was more common among participants with poor sleep quality (p=0.011). Moreover, 119 individuals (53.7 %) demonstrated poor sleep quality, while 55 individuals (46.3 %) showed adequate sleep quality as shown in Table 2.

Participants' sleep characteristics

Table 3. Participants' sleep characteristics.

Sleep Quality	Mean ± SD
Not adjusted questionnaire overall score	6.9±3.1
Adjusted questionnaire overall score	6.5±2.8
Subscales	
subjective sleep quality	1.0±0.9
sleep latency	1.9±1.4
sleep duration	1.1±1.0
sleep efficiency	1.4±1.1
sleep disturbance	1.3±0.7
sleeping medication usage	0.4±0.8
daytime dysfunction	0.7±0.6

The participants exhibited a moderate degree of sleep disturbance, with a mean Not Adjusted Overall Score of 6.9 ± 3.1. When excluding the use of sleep medication, this score decreased slightly to 6.5 ± 2.8. Analysis of the PSQI subcomponents indicated that Sleep Latency, measured as the time taken to fall asleep, posed the greatest difficulty, demonstrated by the highest mean score of 1.9 ± 1.4. This suggests that many participants regularly faced challenges initiating sleep. In contrast, Daytime

Dysfunction recorded the lowest mean score (0.7 ± 0.6), indicating minimal impact of poor sleep on waking activities. Participants also reported relatively favourable subjective sleep quality (1.0 ± 0.9) and infrequent reliance on sleep medication (0.4 ± 0.8). These findings collectively highlight that poor sleep quality in this cohort primarily stemmed from difficulty falling asleep rather than disturbances during sleep or medication dependency (Table 3).

The presence of other chronic diseases emerged as the strongest risk factor, increasing the odds of sleep disorder by 2.80 times (OR = 2.80, $p = 0.001$). Smokers had 2.95 times higher odds compared to non-smokers (OR = 2.95, $p = 0.005$). Additionally, a diabetes duration longer than 10 years was associated with a 2.55-fold increase in odds (OR = 2.55, $p = 0.004$), and obesity (BMI ≥ 30.0 kg/m²) was associated with 1.89 times higher odds (OR = 1.89, $p = 0.021$). Conversely, older age demonstrated a protective effect (OR = 0.94, $p = 0.007$). Gender (OR = 1.10, $p = 0.780$) and overweight status were not statistically significant predictors in this model. These findings highlight the multifactorial nature of sleep disturbances in patients with diabetes, emphasizing the roles of comorbidity, smoking, prolonged disease duration, and obesity as key risk factors (Table 4).

Binary Logistic Regression Predicting Sleep Disorder

Table 4. Results of Binary Logistic Regression Predicting Sleep Disorder

Variables	Odds Ratio (OR)	95 % CI	p-value
Age (years)	0.94	(0.90−0.98)	0.007
BMI			
Normal (Ref)			
Overweight	1.25	(0.65−2.40)	0.501
Obese	1.89	(1.10−3.25)	0.021
DM duration (years)			
≤ 5 years (Ref)			
> 5 to 10 years	1.7	(0.95−3.03)	0.075
> 10 years	2.55	(1.35−4.83)	0.004
Gender			
Female (Ref)			
Male	1.1	(0.55−2.20)	0.78
Smoking status			
Non-smoker (Ref)			
Smoker	2.95	(1.40−6.20)	0.005
Other chronic diseases			
No (Ref)			
Yes	2.8	(1.55−5.07)	0.001

DISCUSSION

The findings of this study provide important insights into sleep quality and its associated factors in individuals with type 2 diabetes. Notably, our results highlight that older age and shorter diabetes duration were associated with better sleep quality. In contrast, obesity, smoking, and the presence of comorbid chronic diseases significantly increased the risk of sleep disturbances. Sleep disruption was primarily characterized by difficulties in sleep initiation rather than maintenance or medication dependence. These findings underscore the complex and multifactorial nature of sleep problems in this population, emphasizing the need for targeted interventions addressing modifiable risk factors such as obesity and smoking to improve sleep health and overall disease management.

Unlike previous studies that reported poorer sleep quality among women with type 2 diabetes than among men, our study found that women had better sleep quality. For example, Haufe et al., (2022) and Coborn et al., (2022) all identified female gender as a significant predictor of poor sleep, potentially due to hormonal influences, such as oestrogen and progesterone, on sleep-regulating neurotransmitters. Palomo-Osuna et al., (2022) also reported no significant gender difference in sleep quality but noted differing mood and functional impacts between men and women with diabetes-related sleep disturbances. These differences could stem from variations in study populations, including age distributions, cultural or environmental factors, or differences in methodology, such as instruments used to assess sleep quality and sample sizes. Additionally, psychosocial factors and comorbid conditions like depression, which disproportionately affect women in some populations, may influence these outcomes. Our findings highlight the complexity of gender effects on sleep in type 2 diabetes and suggest that biological, behavioural, and contextual factors interact differently across populations.

The results of our study are consistent with several cross-sectional studies

investigating sleep quality among individuals with type 2 diabetes. For example, Nasir et al., (2022) found that poor sleep quality was significantly associated with longer diabetes duration and higher BMI, aligning with our findings on obesity and disease duration as key risk factors. Similarly, Li et al., (2022) reported that comorbid conditions such as hypertension and cardiovascular disease were linked to impaired sleep quality, which reflects our observation of comorbidities as a prominent risk factor. Additionally, a study by Li et al., (2017) highlighted smoking as a significant predictor of poor sleep quality in type 2 diabetes patients, corroborating our results regarding the impact of smoking on sleep disturbances. In contrast, while our study indicated that older age appeared protective, Nakajima et al., (2017) found that advancing age was associated with poorer sleep quality, suggesting possible differences in population or methodology. Collectively, these cross-sectional studies support the multifactorial influences on sleep quality in type 2 diabetes while illustrating variability in certain demographic effects.

Our findings that obesity is a significant factor associated with poor sleep quality among individuals with type 2 diabetes are supported by several previous cross-sectional studies. However, the direction and strength of this association have sometimes varied. For instance, Kohanmoo et al., (2024) reported that overweight and obesity were strongly associated with poor sleep quality in both men and women, while Chen et al., (2023) identified obesity as a key contributor to both sleep-disordered breathing and reduced sleep duration among diabetic patients. The relationship between obesity and poor sleep quality may be driven by several mechanisms: excess adipose tissue in the neck and pharyngeal region can increase the risk of obstructive sleep apnea by narrowing upper airways; metabolic inflammation and hormonal dysregulation associated with obesity can disrupt sleep architecture; and obesity is a risk factor for various comorbidities (e.g., hypertension) that themselves negatively impact sleep quality.

Smoking in our study significantly associated with poor sleep quality in individuals with type 2 diabetes align with several previous studies. Study from Purani et al., (2019) reported that smokers were nearly twice as likely to experience poor sleep quality compared to non-smokers, attributing this to the stimulating effects of nicotine and the respiratory disturbances caused by smoking. Similarly, a large cross-sectional study using NHANES data found a dose-response relationship between smoking frequency and increased odds of sleep disturbances, reinforcing smoking as a modifiable risk factor for poor sleep health (H. Sun & Li, 2024). Hwang & Park (2022) also observed smoking increased the odds of poor sleep nearly sixfold among diabetic patients, emphasizing the importance of addressing smoking cessation. However, contrasting findings exist, such as in studies by Sun et al., (2024) which did not find significant associations between smoking and sleep quality, possibly due to variations in population characteristics or measurement methods. These discrepancies could arise from differences in smoking intensity, duration, cultural factors, or whether confounding variables like stress and comorbidities were adequately controlled. Collectively, the evidence supports a significant adverse impact of smoking on sleep quality in type 2 diabetes, highlighting the critical need for integrative management approaches targeting smoking cessation to improve sleep and diabetes outcomes.

Lastly, the presence of comorbid chronic diseases of this study significantly exacerbates sleep disturbances, a relationship well-supported by existing evidence and aligned with findings from a 2023 systematic review and meta-analysis on multimorbidity (Nistor et al., 2023; Zhou et al., 2023). This meta-analysis, which synthesized data from over 190 international studies, reported a pooled prevalence of multimorbidity of 42.4%, with the risk of multimorbidity substantially increasing with age and the number of chronic conditions.

Correspondingly, our results highlight that patients with multiple chronic illnesses, including cardiovascular disease and hypertension, exhibit significantly worse sleep quality. The meta-analysis further emphasized the bidirectional nature of the relationship—chronic diseases worsen sleep health, and poor sleep can, in turn, accelerate the progression of multimorbidity and complicate its management (Alvaro et al., 2013). This convergence of findings underscores the urgent need for integrated, multidisciplinary approaches that simultaneously address underlying chronic conditions and sleep disturbances to improve patient outcomes. Our study's observation of heightened sleep disturbance risk in the presence of comorbidities aligns strongly with this comprehensive meta-analytic evidence, reinforcing the importance of holistic clinical care in multimorbid populations.

LIMITATION

A limitation of this study was its reliance on self-reported questionnaire data, which may have introduced response bias and affected the results. To minimize this risk, researchers provided clear instructions for the questionnaire and addressed any questions participants had. Participants were instructed to complete the questionnaire during periods of mental alertness and calmness, avoiding fatigue or distraction to enhance data reliability. Despite these precautions, the inherent subjectivity of self-report measures remains a potential source of bias that should be considered when interpreting the findings.

CONCLUSION

Based on these findings, poor sleep quality and suboptimal sleep quality are highly prevalent among individuals with type 2 diabetes. The core issue lies in difficulty initiating sleep (Sleep Latency). The most critical risk factors are the presence of other chronic diseases, smoking, prolonged diabetes duration, and obesity. Therefore, given the potential for these factors to exacerbate disease progression and increase complications, healthcare providers must routinely assess for sleep disturbances in this patient population and implement targeted interventions to manage comorbidities, promote smoking cessation, and address weight and sleep hygiene.

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