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ORIGINAL RESEARCH

# Insomnia Among Patients with End-Stage Kidney Disease on Hemodialysis: Prevalence and Associated Factors – A Cross-Sectional Study in Vietnam

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**Background and Aims:** The prevalence of insomnia among patients with end-stage kidney disease undergoing hemodialysis is high. Insomnia in patients undergoing hemodialysis may reduce their quality of life. The purpose of this study was to estimate the prevalence of insomnia and to examine the risk factors associated with insomnia among patients with end-stage kidney disease undergoing hemodialysis.

**Subject and Methods:** This cross-sectional study included 216 patients with end-stage kidney disease undergoing hemodialysis at 175 Military Hospital, Ho Chi Minh City, Vietnam. Psychiatrists evaluated insomnia using clinical criteria of The Diagnostic and Statistical Mental Disorders, 5th Edition (DSM5). Participants were recruited using convenience sampling at 175 Military Hospital in Vietnam, with all eligible patients invited. Descriptive statistics (counts, percentages, means, standard deviations) were used to describe population characteristics and insomnia prevalence. Data were collected on patients' sociodemographic factors such as sex, age, marital and economic status; clinical factors including duration of end-stage kidney diseases, duration of hemodialysis, number of hemodialysis sessions per week, co-morbidities (diabetes, hypertension…) and environmental factors (eg, excessive noisy or light bedrooms). Logistic regression analysis model was used to analyze the factors associated with insomnia disorders in patients with end-stage kidney disease undergoing hemodialysis.

**Results:** The prevalence of insomnia among patients with end-stage kidney disease was 48.1%. Multivariate logistic regression showed diabetes (OR=0.331 for no diabetes, 95% CI: 0.148–0.738, p<0.01), daytime napping (OR=2.122, 95% CI: 1.159–3.885, p=0.02, excessive noisy or light bedrooms (OR=0.251 for no exposure, 95% CI: 0.074–0.854, p=0.03) were significantly associated with insomnia.

**Conclusion:** The prevalence of insomnia in patients with end-stage kidney disease was high. These results may help clinicians in the dialysis department pay more attention to insomnia symptoms in patients with end-stage kidney disease on dialysis and consider collaboration with psychiatrists to explore treatment strategies is also recommended.

**Keywords:** end-stage kidney disease, hemodialysis, insomnia, prevalence, associated factors, Vietnam

## Introduction

In daily clinical practice, we observed that patients with end-stage kidney disease undergoing hemodialysis often complained of symptoms of sleep disturbance, with insomnia being the most common. Insomnia, defined per Diagnostic and Statistical Manual of Mental Disorders 5th edition (DSM 5) as difficulty initiating or maintaining sleep or experiencing non-restorative sleep with daytime impairment occurring at least 3 nights per week for three months or longer.[1] Studies around the world showed that the rate of sleep disorders including insomnia was very

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common in patients with end-stage kidney disease and on hemodialysis, with a rate ranging from 30% to 80%.[2] In Vietnam, Phan The Thanh's study showed that 66.4% of patients with end-stage chronic kidney disease undergoing hemodialysis had poor sleep quality.[3] Phan The Thanh et al highlighted a high prevalence of sleep disturbances among Vietnamese hemodialysis patients, emphasizing the need for further investigation in this context. Prior studies have identified factors such as anxiety, depression, prolonged hemodialysis duration, co-morbidities, sex, age and psychosocial stressors as contributors to insomnia in hemodialysis patients.[4–6] However, data from Vietnam were limited.

Insomnia, if not well managed, leads to dysfunction of organ systems in the body, such as the cardiovascular and neuroendocrine systems, reducing the patient's quality of life and higher mortality risk,[7] and could lead to more serious psychiatric disorders such as anxiety, depression, and even suicide.[8] The study by Ye et al indicated that the prevalence of depression and anxiety in hemodialysis patients was 68.93% and 36.89%, respectively,[9] while the study by Nagy et al reported corresponding rates of 55% and 49.6%.[10] Despite the growing evidence, few studies have comprehensively examined the prevalence and associated factors of insomnia in Vietnamese dialysis patients. While many studies rely on screening tools such as The Pittsburgh Sleep Quality Index (PSQI)[3,11] or Insomnia Severity Index (ISI)[12] to assess insomnia not using clinical criteria such as DSM 5. DSM 5 provides standardized criteria for diagnosing insomnia disorder base on clinical interviews, but objective measures like polysomnography are often limited by resource constraints, particularly in developing countries.[1] Therefore, this study addressed this gap by investigating the prevalence of insomnia, diagnosed using DSM 5 criteria, and its associated factors in hemodialysis patients may support the development of management strategies, though further research is needed to confirm impacts on treatment outcomes and complications. This study aimed to estimate prevalence of insomnia and identify associated factors among hemodialysis patients in Vietnam.

# Subjects and Methodology

## Subjects

A total of 216 patients over 18 years of age with end-stage kidney disease on hemodialysis were selected from their medical records at the Department of Nephrology and Hemodialysis, 175 Military Hospital, Ho Chi Minh City, from September 2023 to July 2024. Patients were invited to enroll in the study if they met the following inclusion criteria: over 18 years of age, on hemodialysis for at least three months, signed the written informed consent form, and had the ability to answer the questionnaire. Exclusion criteria were follows: Patient under 18 years old, those with severe psychiatric disorders (eg, schizophrenia, bipolar disorder, acute psychosis…), severe physical illness (eg, severe heart failure, terminal cancer…), severe cognitive impairment, individuals with hearing or visual impairments preventing completion of the questionnaire, and those who did not consent to participate in the study.

## Size of Sample

The sample size was calculated using the formula for evaluating disorder prevalence in the community.

$$n= [z^2_{(1-a/2)} * p(1-p)]/d^2$$

n: number of participants, $Z_{(1-a/2)} = 1.96$ (confidence interval: 95%), d: 0.05, p = 83.8%.[6] The sample size was calculated based on an expected insomnia prevalence from Al – Ali F's study,[6] with ± 5% precision and 95% confidence. We estimated that the sample size required for statistical significance should include at least 209 participants. Eligible participants were selected using a convenient sampling due to resource and feasibility constraints, with all eligible patients at the hospital during the study period invited to participate. During the study period, we selected 216 patients with end-stage kidney disease on hemodialysis.

# Methods

## Research Design

This cross-sectional study included descriptive and statistical analyses.

## Data Measurement

DSM 5 criteria was used to diagnose insomnia based on critical criteria (coded in DSM 5 as 780.52) in the participants. The diagnosis was made by two independent psychiatrists who were not included in the research group. Insomnia diagnosis was based on a standardized clinical interview following DSM 5 criteria. If the diagnosis between the two psychiatrists is different, a third psychiatrist was invited to re-diagnose and the final diagnosis was the diagnosis of the two people with the same diagnosis, ensuring high inter-rater reliability (Cohen's Kappa, $\kappa$=0.85). These psychiatrists all have clinical experience of 10 years or more.

To collect data on risk factors associated with insomnia, participants used a structured questionnaire on socio-demographic information such as age, sex, occupation, economic status, marital status, level of education, income per year, clinical information including duration of chronic kidney failure (defined as duration since diagnosis of chronic kidney disease (in months)), duration of hemodialysis (defined as duration of treatment since initiation (in months)), number of hemodialysis sessions per week. Clinical data were extracted from medical records including co-morbidities such as diabetes mellitus, hypertension, dyslipidemia, other kidney diseases, anemia, blood pressure, body mass index, plasma urea level, and plasma creatinine level within 24 hours prior to the hemodialysis session. Information related to health behaviors such as alcohol consumption and smoking was also collected. In addition, other factors such as napping or sleeping during the day, whether the bedroom is noisy or has a lot of light, using TV, phone too much before bedtime, and having stressful events/conflicts in the past three months were also surveyed. Questionnaire to explore the risk factors based on previous studies on insomnia in hemodialysis patients, focusing on common clinical, psychosocial factors and sleep environmental factors; pilot-tested on 20 patients for clarity and cultural and health setting appropriateness. No data were missing in this study, as all required variables were fully collected.

## Statistical Analysis

All statistical analyses were performed using SPSS version 20.0. Chi-square tests were used to measure differences in characteristics between those with and without insomnia; for the categorical variables with expected cell counts less than 5, we used Fisher's exact test instead of the chi-square test to ensure statistical validity. For continuous variables (eg, age, hemodialysis duration, body mass index, plasma urea…) were described using means and standard deviations or median and IQR. To compare means or median between two groups (insomnia group vs non-insomnia group) we used *t* test for normally distributed data, for non-normally distributed data, we applied the Mann–Whitney *U*-test. The Odds ratios (OR) and its 95% confidence intervals (CIs) were estimated. Statistical significance was set at $p < 0.05$. Univariate and Multivariate logistic regression analyses were employed to identify potential factors associated with insomnia in patients with end-stage kidney disease undergoing hemodialysis. Variables for the multivariate logistic regression analysis model were selected based on statistical significance in univariate analysis ($p<0.05$), clinical relevance and environment factors (age, co-morbidities, hemodialysis duration, Duration of end-stage kidney disease…). We confirm that logistic regression assumptions, including linearity of logit for continuous variables and absence of multicollinearity, were met, ensuring the model's suitability for analysis.

## Ethics

All clinical data were extracted from medical records. Ethics approval was obtained from the Biomedical Ethics Committee of Hue University of Medicine and Pharmacy (No H2023/403, issued 02/6/2024). This study was conducted in accordance with the principles of the Declaration of Helsinki.

**Table 1** Prevalence of Insomnia According to DSM 5 Criteria Among Participants

| Prevalence of Insomnia According to DSM 5 Criteria | Number | Percentage (%) |
|---|---|---|
| Insomnia | 104 | 48.1 |
| Without insomnia | 112 | 51.9 |

# Results

## Prevalence of Insomnia According to DSM 5 Criteria Among Participants

A total of 216 patients with end-stage kidney disease on hemodialysis, with a mean age of 56.7 (SD 14.5), 98 women (45.4%) and 118 men (54.6%), participated in the study and completed the questionnaire. Among them, 104 participants (48.1%) had insomnia, according to the DSM – 5 criteria (Table 1).

## Socio-Demographic Characteristics of the Participants and Differences Between Insomnia and without Insomnia Groups

The mean age was significantly higher in the insomnia group than in the non-insomnia group (p=0.03) (Table 2). While mean age was higher in the insomnia group (p=0.03), age as a categorical variable (<60 vs ≥60) was not significantly associated with insomnia (p=0.18), suggesting age-related risk may not follow a simple dichotomous pattern. There were no significant differences between the insomnia and non-insomnia groups in terms of sex, education level, marital status, and job status (p>0.05).

## Clinical and Laboratory Characteristics Associated with Insomnia Among Participants

The results in Table 3 show that the duration of end-stage kidney disease and hemodialysis in the group with insomnia were significantly longer than those in the group without insomnia (p=0.01 and 0.02, respectively). Other clinical and laboratory factors were not associated with insomnia in the study subjects.

**Table 2** Socio-Demographic Characteristics of the Participants and Differences Between Insomnia and Without Insomnia Groups

| Characteristics \ Insomnia | | No | Yes | p |
|---|---|---|---|---|
| | | n (%) | n (%) | |
| **Age (year)** | < 60 | 63 (56.2%) | 49 (43.8%) | 0.18 |
| | ≥ 60 | 49 (47.1%) | 55 (52.9%) | |
| **Average of age (year) ± SD** | | 54.7 ± 15.6 | 58.9 ± 12.9 | 0.03 |
| **Gender** | Male | 62 (52.5%) | 56 (47.5%) | 0.82 |
| | Female | 50 (51.0%) | 48 (49.0%) | |
| **Level of education** | Primary school or under | 12 (41.4%) | 17 (58.6%) | 0.45 |
| | Secondary/ high school | 64 (52.5%) | 58 (47.5%) | |
| | Above high school | 36 (55.4%) | 29 (44.6%) | |
| **Marital status** | Single | 32 (58.2%) | 23 (41.8%) | 0.28 |
| | Married | 80 (49.7%) | 81 (50.3%) | |
| **Job status** | Unemployment | 50 (48.5%) | 53 (51.5%) | 0.35 |
| | Employment | 62 (54.9%) | 51 (45.1%) | |

**Table 3** Clinical and Laboratory Characteristics Associated with Insomnia Among Participants

| Characteristics \ Insomnia | | Yes | No | p |
|---|---|---|---|---|
| | | Median (IQR) | Median (IQR) | |
| **Duration (Months)** | End-stage kidney disease | 102.5 (48.0–179.0) | 69.0 (36.25 −120) | 0.01 |
| | On hemodialysis | 63.5 (24.0–128.5) | 42.0 (24.0–74.5) | 0.02 |
| | | Mean ± SD | Mean ± SD | p |
| **Body Mass Index (BMI) (kg/m$^2$)** | | 20.82 ± 2.94 | 20.87±3.18 | 0.91 |
| **Plasma urea** (mmol/L) | | 26.23±5.92 | 26.33±6.74 | 0.91 |
| **Plasma creatinine** (mcrmol/L) | | 925.65±257.28 | 946.64±252.11 | 0.55 |
| **Estimated GFR** | | 5.23±1.84 | 5.30±2.17 | 0.79 |
| **Red blood cells (M/uL)** | | 2.928±0.600 | 3.013±0.688 | 0.33 |
| **Hemoglobin (g/dL)** | | 9.22±1.37 | 9.41±1.66 | 0.36 |
| **Hematocrit (%)** | | 28.71±4.43 | 29.21±5.24 | 0.45 |
| | | n (%) | n | p |
| **Anemia** | No | 1 (14.3%) | 6 (85.7%) | 0.68 |
| | Yes | 103 (49.3%) | 106 (50.7%) | |
| **Number of hemodialysis session per week (the average duration of each session was 3.5 hours)** | 2 sessions | 4 (26.7%) | 11 (73.3%) | 0.11 |
| | 3 sessions | 100 (49.8%) | 101 (50.2%) | |

## Co-Morbidities Associated with Insomnia Among the Participants

Among the co-morbidities, only diabetes was associated with insomnia (p=0.047) (Table 4).

## Health Behaviors and Other Factors Associated with Insomnia Among Study Subjects

Daytime napping and many light/noisy bedrooms were associated with insomnia, with p<0.01 and p=0.02, respectively (Table 5).

**Table 4** Co-Morbidities Associated with Insomnia Among the Participants

| Co-morbidities \ Insomnia | | Yes | No | p |
|---|---|---|---|---|
| | | n (%) | n (%) | |
| **Diabetes Mellitus** | No | 78 (44.8%) | 96 (55.2%) | 0.047 |
| | Yes | 26 (61.9%) | 16 (38.1%) | |
| **Hypertension** | No | 1 (50.0%) | 1 (50.0%) | 1.0 |
| | Yes | 103 (48.1%) | 111 (51.9%) | |
| **Dyslipidemia** | No | 102 (48.8%) | 107 (51.2%) | 0.45 |
| | Yes | 2 (26.8%) | 5 (71.4%) | |
| **Cardiovascular diseases** | No | 81 (50.6%) | 79 (49.4%) | 0.22 |
| | Yes | 23 (41.1%) | 33 (58.9%) | |


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**Table 5** Health Behaviors and Other Factors Associated with Insomnia Among Study Subjects

| Factors \ Insomnia | | Yes (n, %) | No (n, %) | p |
|---|---|---|---|---|
| **Smoking** | No | 88 (47.3%) | 98 (52.7%) | 0.54 |
| | Yes | 16 (53.3%) | 14 (46.7%) | |
| **Drinking alcohol** | No | 97 (47.5%) | 107 (52.5%) | 0.47 |
| | Yes | 7 (58.3%) | 5 (41.7%) | |
| **Nap during the day** | Yes | 49 (59.8%) | 33 (40.2%) | <0.01 |
| | No | 55 (41.0%) | 79 (59.0%) | |
| **Watching TV, phone or using other electronic devices before bed** | No | 32 (49.2%) | 33 (50.8%) | 0.84 |
| | Yes | 72 (47.7%) | 79 (52.3%) | |
| **Much light/noisy bedroom** | No | 91 (45.7%) | 108 (54.3%) | 0.02 |
| | Yes | 13 (76.5%) | 4 (23.5%) | |
| **Stressful events/ conflicts in the past three months** | No | 99 (47.6%) | 109 (52.4%) | 0.41 |
| | Yes | 5 (62.5%) | 3 (37.5%) | |

## Factors Associated with Insomnia Through Multivariate Logistic Regression Analysis Model

A history of diabetes (OR=0.331 for no diabetes, 95% CI: 0.148–0.738, p<0.01) and nap during the day (OR= 2.212, 95% CI: 1.159–3.885, p=0.02) and too many light/noisy bedrooms (OR= 0.051, 95% CI: 0.074–0.854 for no exposure, p=0.03) were independently associated with insomnia (Table 6).

**Table 6** Factors Associated with Insomnia Through Multivariate Logistic Regression Analysis Model (Only Variables That Were Significant in the Univariate Analysis (P<0.05) From Table 3 and 5 Were Selected for Inclusion in the Multivariate Analysis)

| Independent Variables | | OR | 95% CI | | p |
|---|---|---|---|---|---|
| **Nap during the day** | No | 1 | – | – | – |
| | Yes | 2.122 | 1.159 | 3.885 | 0.02 |
| **Too much light/ noisy bedroom** | Yes | 1 | – | – | – |
| | No | 0.251 | 0.074 | 0.854 | 0.03 |
| **Diabetes Mellitus** | Yes | 1 | – | – | – |
| | No | 0.331 | 0.148 | 0.738 | <0.01 |
| **Duration of hemodialysis (month)** | | 1.006 | 0.999 | 1.012 | 0.1 |
| **Duration of end-stage kidney disease (year)** | | 1.004 | 0.999 | 1.009 | 0.09 |
| **Age** | | 1.016 | 0.995 | 1.039 | 0.14 |

# Discussion

## Prevalence of Insomnia

Previous studies have shown that the prevalence of insomnia is high among patients with end-stage kidney disease undergoing hemodialysis.[3–6,13] The findings of this study showed that prevalence of insomnia according to DSM 5 criteria was 48.1% among patients with hemodialysis (Table 1). Our study focused exclusively on assessing insomnia disorder based on the clinical criteria of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), without evaluating other sleep disorders. Additionally, due to resource constraints, this study did not employ objective sleep assessment methods, such as polysomnography. To address this limitation, we implemented a rigorous diagnostic process involving two independent psychiatrists to evaluate insomnia disorder. In cases of diagnostic disagreement, a third independent psychiatrist was consulted to reassess, ensuring high inter-rater reliability (Cohen's Kappa, $\kappa$=0.85). This approach enhanced the accuracy and consistency of our diagnoses, compensating for the absence of objective measures. Despite these efforts, the reliance on clinical assessments alone may limit the generalizability of our findings. Future studies could incorporate polysomnography or actigraphy to validate clinical diagnoses and explore other sleep disorders in hemodialysis patients. By focusing on DSM-5 criteria, our study contributes to the literature by providing a robust clinical perspective on insomnia disorder prevalence and associated factors in this understudied population in Vietnam. The prevalence of insomnia among patients with end-stage kidney disease undergoing hemodialysis varies widely across countries and studies. Tan et al performed a meta-analysis of 93 out of 3808 articles on the same topic and found that the pooled rate of insomnia among patients with chronic kidney disease undergoing hemodialysis was 46%.[14] Lufiyani et al studied 125 patients with end-stage kidney disease undergoing hemodialysis in Jakarta, Indonesia realized that prevalence of insomnia was 56%. Insomnia was assessed using the Insomnia Severity Index (ISI).[12]

Sabbatini M studied 694 patients undergoing hemodialysis using a specific questionnaire and found that 311 patients, accounting for 45%, complained of sleep disorders.[15] Tomita et al investigated 138 patients undergoing hemodialysis found that the prevalence of insomnia, assessed the Japanese version of Pittsburgh Sleep Quality Index (PSQI), was 54.3%.[11] Rai M. conducted a study of 69 outpatients undergoing maintenance hemodialysis in India, the results showed that the prevalence of insomnia by a battery of questions was 60.9%.[16] In Vietnam, Phan et al's study showed that prevalence of insomnia by PSQI was 66.4% among 68 patients undergoing hemodialysis at Viet Duc Hospital, Hanoi, Vietnam.[3] The difference in the prevalence of insomnia among studies was due to the use of different assessment tools. Most studies used scales such as the ISI, PSQI, and specific questionnaires for assessment, and our study used the clinical criteria of DSM 5 to assess insomnia, which was performed by psychiatrists.

## Associated Factors

The mean age was significantly higher in the insomnia group than in the non-insomnia group (p =0.03) (Table 2). However, age was no longer an independent factor associated with insomnia in the study participants when analysed using multivariate regression (Table 6). The association between age and insomnia in dialysis patients is inconsistent. Some studies suggest that older age increases the risk of insomnia in hemodialysis patients,[13,14,17,18] while other studies indicate no association between age and insomnia in dialysis patients.

Benetou et al studied 100 patients undergoing hemodialysis in Greece and reported that age > 60 years was associated with insomnia in participants.[11] In their meta-analysis, Tan et al showed that the prevalence of insomnia in group age–51–60 years and > 60 years was significantly higher than that in patients aged < 50 years.[10] Velu et al also showed that patients aged > 60 years tended to have more sleep disturbances using the PSQI and ESS scales.[18] However, this result is not consistent with those of other studies. Lufiyani's study showed that age was not associated with insomnia.[12] Lufiyani's study results were also shared by other authors such as Alkhuwaiter and Rai.[16,19] This inconsistency could be explained by some reasons concluding differences in the diagnostic instruments, place of study, sample size, and other factors associated with insomnia.

The results in Table 3 show that the duration of end-stage kidney disease and hemodialysis in the group with insomnia were significantly longer than those in the group without insomnia (p=0.01 and 0.02, respectively). Rahmad et al conducted a study of 57 dialysis patients in Indonesia and found that HD duration was positively correlated with sleep

quality (p=0.006, r=0.41).[20] Studies by other authors also showed that duration of hemodialysis was related to sleep disorders.[16,21] Rai et al found that prevalence of insomnia among patients with duration of hemodialysis more than 1 year was significantly higher than those with duration of hemodialysis of 1 year or less (84.6% and 46.5%, respectively, p=0.003).[16] This result was also confirmed in the Hamzi's study.[21] Hamzi conducted a multicenter study from Morocco in 128 patients on hemodialysis and found that a long duration of hemodialysis was one of two risk factors of insomnia in their study.[21] The long duration of chronic kidney disease and hemodialysis may be associated with complications, co-morbid diseases, tiredness, and bone pain, leading to insomnia.

The association between laboratory test results and sleep disorders varies widely among studies. In our study, laboratory factors, including plasma urea, creatinine, hemoglobin, hematocrit, and GFR, were not associated with insomnia in the study subjects (Table 3). The results of this study are similar to those of several previous studies in patients on hemodialysis.[21–24] Liu et al found a correlation between creatinine, blood urea nitrogen, and alanine transaminase (ALT) levels and sleep disorders (p<0.001),[25] Hashem et al showed that plasma creatinine levels were different in good sleep and poor sleep groups among patients on hemodialysis (p<0.05).[26] Koch et al studied 112 patients undergoing hemodialysis and demonstrated that an elevated level of urea was an independent variable associated with sleep disorders and hemoglobin levels between 10 and 12 g/dl were associated with better sleep quality.[27] Velu et al studied 148 patients on hemodialysis and indicated that lower hemoglobin levels were associated with PSQI and ESS scores.[18]

The results in Table 3 reveal that BMI, anemia, and the number of hemodialysis sessions per week were not associated with insomnia. Hamzi et al also found that BMI is not associated with insomnia.[19] Sabbatini et al showed that BMI and hemoglobin concentration did not differ between insomnia and control group.[15]

Our findings indicated that among comorbid diseases, only diabetes was associated with insomnia in the participants (Table 4), which continued to be an independent variable associated with insomnia in the multivariable regression analysis (Table 6). Diabetes is also associated with depression, peripheral neuropathy, and neuropathic pain. These factors may contribute to insomnia in patients undergoing hemodialysis for diabetes. Diabetes can cause insomnia and, in turn, change the patient's mood, causing fatigue and poor blood glucose control, thereby creating a vicious cycle and possibly leading to more severe kidney failure. Therefore, these results suggest clinicians in hemodialysis settings should focus on insomnia symptoms and associated factors and consider collaboration with psychiatrists and internal medicine in other specialties to explore effective treatment strategies. Han et al studied eighty-two diabetes patients on hemodialysis for more six months from 12 hospitals found that the prevalence of insomnia in these patients was 68.2%, and depression, age, and nutrition were factors associated with insomnia among diabetic hemolysis patients.[28]

In addition to pathological factors, environmental factors, sleep habits, and psychological factors have been associated with insomnia. Our results showed that patients with daytime naps had a significantly higher rate of insomnia than those without daytime naps (Table 5 and 6, p<0.05). Daytime sleepiness and insomnia are bidirectional, with insomnia leading to daytime sleepiness; conversely, daytime naps lead to insomnia or poor sleep quality at night. This association is not only observed in hemodialysis patients but also in the general population, especially in the elderly. Literature and data from previous studies in hemodialysis patients suggest that daytime napping disrupts nocturnal sleep.[29,30] Ancoli et al in their review study indicated that elderly people who complained insomnia also reported more frequent daytime napping.[28] Al – Jahdali et al reported that daytime sleepiness was one of the factors associated with insomnia in 227 patients undergoing hemodialysis at two centers in Saudi Arabia.[30] The results in Table 5 and 6 show that sleep was also affected by exposure with excessive bright and noisy environments. These factors were not specific to hemodialysis patients but were associated with insomnia in the general population. Literature and data have confirmed that sleep hygiene education, by decreasing exposure to light or noise in the environment, could promote healthy sleep habits.[31,32] Tao et al conducted an intervention program on 105 hemodialysis patients aged 45 years and older with poor sleep quality assessed by the PSQI scale using sleep hygiene education that emphasized reducing exposure to light and noise along with relaxation techniques, and found significant improvement in sleep quality after 12 weeks.[31] Abdelkader et al revealed that environmental factors, including excessive light, noise at home, and relative movement, are associated with sleep disorders in hemodialysis patients.[32]

Our study identified diabetes mellitus, duration of hemodialysis, daytime napping, and exposure to excessive noisy/light bedrooms as significant factors associated with insomnia among patients with end-stage kidney disease on hemodialysis. Diabetes mellitus was independently associated with insomnia (OR=0.331 for no diabetes, 95% CI: 0.148–0.738, p<0.01), potentially due to its contribution to peripheral neuropathy and neuropathic pain, which disrupt sleep initiation and maintenance through heightened sensory discomfort.[28] Longer duration of hemodialysis (p=0.02 in univariate analysis) may exacerbate insomnia through cumulative uraemic toxin exposure and physical fatigue, which increase central nervous system irritability and sleep fragmentation.[19] Daytime napping (OR=2.122, 95% CI: 1.159–3.885, p=0.02) was strongly associated with insomnia, likely because it disrupts the circadian rhythm, reducing nocturnal sleep drive, a mechanism well documented in hemodialysis populations and the elderly.[28] Similarly, excessive noisy or light bedrooms (OR=0.251 for no exposure, 95% CI: 0.074–0.854, p=0.03) likely impair sleep by increasing arousal and disrupting sleep consolidation, consistent with findings that environmental factors exacerbate sleep disturbances in hemodialysis patients.[31] These results align with global studies but highlight a higher insomnia prevalence (48.1%) in our Vietnamese cohort compared to some Western studies,[15] possibly due to limited access to sleep hygiene education or mental health support in Vietnam, emphasizing the need for culturally tailored interventions.

Our results demonstrated that health behaviors and other factors, including smoking, alcohol consumption, use of electronic devices before bedtime, and stressful events/conflicts in the last three months, were not associated with insomnia. Several previous studies have reported similar results to ours.[15,25,30]

The strengths of our study were that first, we used the DSM 5 clinical criteria to diagnose insomnia, and the diagnoses were made by psychiatrists who were not involved in the study, second, the comprehensive and exhaustive collection of variable data. The inclusion of a wide range of clinical, behavioral, and laboratory factors enables a more comprehensive analysis of potential contributors to insomnia, thereby strengthening the validity of the multivariate findings.

However, our study has some limitations: first, it was a cross-sectional study, so it is difficult to determine the causal relationship of factors with insomnia; second, our study is not a multicenter study, which limits the generalizability of the findings to broader or more diverse hemodialysis populations. Third, convenience sampling may introduce selection bias, as recruited patients may not represent the broader hemodialysis population. Besides, there are some factors that may be related to insomnia but were not examined in our study such as the medications used by the patient, serum phosphate level. Restless leg syndrome, previously reported to contribute to poor sleep quality in hemodialysis patients,[22] was not assessed in this study but is an important direction for future research.

## Conclusion

The prevalence of insomnia was high (48.1%) among Vietnamese patients with chronic kidney diseases on hemodialysis, consistent with global estimates of 30–80%. Multivariate logistic regression analysis revealed several factors associated with insomnia, including a history of diabetes mellitus, naps during the day, and exposure to excessive light or noise bedrooms.

Given the high prevalence of insomnia among patients undergoing hemodialysis, awareness of insomnia among these patients should be raised among nephrologists and internal medicine doctors. Screening patients on hemodialysis for comorbid insomnia with using standardized tools like The Pittsburgh Sleep Quality Index (PSQI), Insomnia Severity Index (ISI) and its risk factors and consider collaboration with psychiatrists to explore treatment strategies is also recommended. To improve this study's limitations, I suggested that future studies should employ objective sleep measures, explore medication effects, serum phosphate level and investigate interventions targeting identified factors.

## Data Sharing Statement

The data supporting the findings of this study are available upon request from the corresponding author.

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## Disclosure

The authors have no conflict of interest to declare in this work.

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