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REVIEW ARTICLES

Prevalence and factors associated with insomnia in patients with diabetes mellitus: A scoping review

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Abstract
Insomnia is a significant concern in diabetes management, as it may worsen metabolic outcomes and negatively affect patients' quality of life. Determining the prevalence of insomnia and identifying its associated factors among patients with diabetes are essential. However, evidence syntheses in this area remain limited, with particularly few reviews addressing this topic. Therefore, the scoping review maps the existing literature on insomnia among patients with diabetes mellitus, focusing on its prevalence, associated factors, and potential management strategies. The review followed the five-stage framework proposed by Arksey and O'Malley. Six electronic databases (CINAHL, MEDLINE, EMBASE, PubMed, Scopus, and Web of Science) were searched for studies published between 2002 and 2025. A total of 1,638 records were identified, of which 21 studies met the inclusion criteria and were included in the review. Among patients with diabetes, the prevalence of insomnia ranged from 9.6% to 62%, with the highest prevalence reported in a study conducted in India. Five major categories of factors associated with insomnia were identified. These included: (1) demographic and social factors, such as female sex, older age, living alone, lower educational attainment, and longer diabetes duration; (2) psychological factors, including depression, anxiety, mood disturbances, neuroticism, and maladaptive coping styles; (3) diabetes-related clinical and metabolic factors, such as higher Body Mass Index (BMI) or obesity, poor glycaemic control (indicated by elevated HbA1c and fasting blood glucose levels), insulin resistance, diabetes-related complications, fatigue, gastrointestinal symptoms, and electrolyte imbalances, particularly abnormal magnesium and phosphorus levels; (4) lifestyle and behavioral factors, including low physical activity, lack of regular exercise, smoking, and the use of sleep aids or medication; and (5) comorbid physical conditions, such as bodily pain, other coexisting health conditions, and cardiovascular diseases, including hypertension and coronary artery disease. Future research should focus on gathering qualitative evidence to understand the mechanisms and experiences related to insomnia.

Keywords: Associated factors, diabetes mellitus, insomnia, prevalence, scoping review

Introduction

Diabetes has emerged as a major contributor to the global health burden and is ranked among the ten leading causes of death worldwide (Hossain et al., 2024; Pan et al., 2025). Its prevalence continues to rise across both developed and developing countries, placing increasing pressure on healthcare systems and public health resources (Muharram et al., 2025). According to the International Diabetes Federation Diabetes Atlas, 425 million individuals, or 8.8% of the global adult population, had diabetes mellitus in 2017, increasing to 463 million in 2019 (GBD 2021 Diabetes Collaborators, 2023). The growing number of people living with diabetes reflects demographic changes, population ageing and the increasing prevalence of obesity, physical inactivity, and unhealthy dietary patterns. Apart from its metabolic implications, diabetes is associated with complications, including cardiovascular disease, kidney failure, neuropathy, and visual impairment, which compromise patients' functional capacity (Iwasaki et al., 2025). Furthermore, the long-term management of diabetes requires continuous medical care, sustained lifestyle modifications, and financial resources (Lee et al., 2025; Herges et al., 2021; Ahmad & Joshi, 2023). Therefore, strengthening comprehensive, accessible, and evidence-based diabetes prevention and management strategies remains an urgent global health priority. However, the primary focus of treating diabetes is maintaining blood glucose levels (Nishida & Watada, 2024). In addition to medication, collaborative efforts in treatment, lifestyle changes, and educating patients and their families are

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necessary. Although oral antidiabetic medications are prescribed for diabetes care, their use may also be associated with adverse effects on sleep, including insomnia (Xue et al., 2021; Mansour et al., 2025). Insomnia increases the risk of type 2 diabetes (T2D), whereas diabetes-related symptoms and complications can worsen sleep quality (Yusuf et al., 2022).

Insomnia and diabetes frequently coexist, negatively affecting patients' quality of life and overall health (Darraj, 2023; Chen et al., 2025). Research has presented that patients with T2D often struggle with insomnia (Koopman et al., 2020). Chronic sleep fragmentation triggers hypothalamic-pituitary-adrenal (HPA) axis hyperactivation and inflammation, which impairs insulin sensitivity and exacerbates glycemic variability (Nguyen et al., 2023; Hirotsu et al., 2015). Moreover, persistent insomnia compromises daytime cognitive function and motivation, undermining patient adherence to complex self-care regimens, dietary restrictions, and blood glucose monitoring (Brzecka et al., 2021; Chasens et al., 2013). Although sleep problems are common, diabetes clinics often overlook and under-treat them, prioritizing metabolic control over sleep health. This creates a bidirectional burden where diabetes-related nocturnal symptoms—such as nocturia, neuropathic pain, and hypoglycemia—further disrupt sleep architecture and perpetuate chronic insomnia. Thus, integrating routine sleep assessment into multidisciplinary diabetes management is essential for optimizing long-term therapeutic outcomes and mitigating complications. When nurses screen for sleep disturbances during routine visits, they can identify these barriers to glycemic control much earlier in the disease course (Mohamed et al., 2025). Addressing sleep issues alongside nutrition and physical activity creates a more holistic care that stabilizes daily blood glucose sugar fluctuations. Collaborative referrals to sleep specialists also allow for continuous positive airway pressure therapy or cognitive behavioral therapy for insomnia (Edinger et al., 2016). Over time, improving sleep architecture lowers inflammation and reduces complications. Treating sleep health as a core pillar of diabetes nursing care empowers patients to achieve better metabolic stability.

Although previous studies have explored specific sleep disorders in patients with diabetes, the prevalence of insomnia and its contributing factors have not yet been systematically mapped. The exact prevalence of insomnia across different diabetic populations remains unclear (Núñez-Baila et al., 2025). Furthermore, the specific demographic, clinical, and lifestyle determinants associated with its development are not well understood (Li et al., 2025; Um et al., 2022). In addition, the potential differences in the prevalence of insomnia and their associated factors between developed and developing countries have not been thoroughly examined. Moreover, how diabetes duration, disease severity, and treatment modalities influence insomnia risk remains unclear. In addition, the potential bidirectional causality between insomnia and diabetes-related complications has not yet been systematically explored (Leblanc et al., 2018; Xiuyun et al., 2022). Previous evidence syntheses have examined sleep disturbances in diabetes from different perspectives. Koopman et al. A review regarding insomnia among patient with T2D estimated a pooled prevalence of 39% across heterogeneous studies and reporting associations with glycemic parameters (Koopman et al., 2020). Another review presented multiple sleep disorders and clinical outcomes among patients with T2D (Schipper et al., 2021). More recently, A previous review focused on predictors of overall sleep quality rather than insomnia among patients (Kurnia et al., 2025). Although these syntheses make important contributions, differences in insomnia definitions and instruments, diabetes populations, study designs, and the range of demographic, psychological, clinical, behavioral and comorbid correlates still warrant explicit mapping. The present scoping review therefore charts primary-study evidence on reported insomnia prevalence, assessment approaches, associated factors and management recommendations, and identifies gaps for future diabetes nursing research. Together, these knowledge gaps underscore the need for a scoping review that synthesizes current evidence and highlights priorities for further investigation.

A scoping review is particularly well-suited for investigating the prevalence and factors associated with insomnia in patients with diabetes because the existing literature is broad, fragmented, and methodologically heterogeneous. Consequently, conducting a narrower systematic review or meta-analysis would be premature or overly restrictive. Studies examining insomnia among patients with diabetes originate from varied geographic regions, clinical settings, and diabetes subtypes. Furthermore, these studies rely on diverse diagnostic criteria and assessment instruments, ranging from validated questionnaires like the Insomnia Severity Index (ISI) to self-reported symptoms and clinical diagnoses. Furthermore, the determinants of insomnia in this population are complex and multidimensional, encompassing overlapping demographic, clinical, psychological, and lifestyle factors that have not yet been synthesized. Employing a scoping review methodology can map the extent, range, and nature of the available evidence, clarify how insomnia and its correlates are conceptualized and measured across studies, summarize reported prevalence ranges across different subgroups, and pinpoint critical gaps to guide future research and nursing care. Therefore, the research questions guiding this scoping review were: What is the prevalence of insomnia among individuals with diabetes mellitus? Which

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factors are associated with the development of insomnia in this patient population? What interventions or recommendations have been published to address this issue?

Method

This study employed a scoping review methodology based on the framework proposed by Arksey and O'Malley (2005). Additionally, the reporting of this review was guided by the PRISMA Extension for Scoping Reviews (PRISMA-ScR) checklist. Unlike systematic reviews, scoping reviews are descriptive analyses designed to map key concepts within a specific body of literature. This approach is especially well-suited for broad research questions in fields with diverse evidence, as it prioritizes comprehensive information gathering (Arksey & O'Malley, 2005). In contrast, systematic reviews generally focus on narrowly defined clinical or policy questions using the PICO (Population, Intervention, Comparison, and Outcome) framework (Calderon Martinez et al., 2025). The primary objective of a systematic review is to synthesize high-quality evidence to provide definitive guidance for evidence-based practice (Dagher & Khan, 2025). Additionally, systematic reviews require rigorous critical appraisal of study quality and risk-of-bias assessment to determine the strength of the findings (Shaheen et al., 2023). However, the scoping review was conducted using a structured five-step process: (i) Defining the research question, as discussed in the Introduction; (ii) identifying relevant literature through comprehensive database searches; (iii) selecting studies based on predetermined inclusion and exclusion criteria; (iv) extracting data using a standardized data charting form; and (v) Synthesizing, summarizing, and presenting the findings. In this scoping review, the literature is confined to primary research studies to enrich the exploration of the research questions. The following section details the five stages outlined above.

First step is identifying research questions. As previously mentioned, this scoping review examines the available research findings on the prevalence of insomnia and its associated factors in patients with diabetes. Considering the framework used to define insomnia and its associated factors. This review attempted to provide answers to the questions as follows how common is insomnia among patients with diabetes? What factors are associated with insomnia in patients with diabetes? And what interventions or recommendations exist to address this issue? The second step is identifying relevant literature. The search strategy was carried out using key search words and Boolean logic: ("insomnia" OR "sleep initiation disorder" OR "sleep maintenance insomnia" OR "sleep-onset insomnia") AND ("diabetes mellitus" OR diabetes OR "type 2 diabetes" OR T2DM OR T2D OR "diabetic patient" OR "DM patient") AND (prevalence OR incidence OR epidemiology OR proportion OR frequency OR rate) AND ("risk factor" OR "associated factor" OR correlate OR determinant OR predictor OR influence). The literature databases searched included CINAHL, MEDLINE, EMBASE, Scopus, Web of Science, and PubMed. These searches were limited to articles published between 2002 and 2025, as research on insomnia in patients with diabetes became more common starting in 2002 (Ford et al., 2015).

The third step is selecting relevant studies. The initial search identified 1,638 articles across the searched databases (CINAHL=210, MEDLINE=180, EMBASE=220, Scopus=320, Web of Science=288, PubMed=420). After removing 438 duplicates, 1200 articles were retained based on predefined inclusion criteria. Three authors (DP, RAS, and THP) independently screened the titles and abstracts of the remaining articles, after which 140 peer-reviewed articles were selected for full-text review. After evaluating these articles against the research questions, 21 studies were included in this review. Studies were eligible for inclusion if they met the following criteria: the population comprised adult patients (aged 18 years and older) diagnosed with any type of diabetes mellitus (type 1, type 2, or unspecified); the concept involved reporting the prevalence of insomnia (proportion, incidence, or rates) or examining factors associated with insomnia (risk factors, correlates, predictors, mediators, or moderators) using validated tools such as the ISI or Pittsburgh Sleep Quality Index (PSQI) or others validated tools, or clear diagnostic criteria. Eligible sources encompassed peer-reviewed quantitative studies (cross-sectional, cohort, case-control), mixed-methods studies with extractable quantitative data on prevalence or factors, and published in English from 2002 to 2025, with a minimum sample size of 20 participants. Studies were excluded if they focused on pediatric populations (<18 years), non-diabetic groups, or animals; lacked prevalence data or factor analyses; were qualitative-only; were interventions without baseline prevalence; were editorials, reviews, case reports. Gray literature was excluded because a substantial volume of peer-reviewed publications is available on this topic. Given the robustness of the existing evidence, the authors limited their searches to the six databases outlined above. EndNote software was used for record management, duplicate removal, and article storage. The results of the search and the study inclusion process are presented in a Preferred Reporting Items for Systematic Reviews and Meta-analyses extension for scoping review (PRISMA-ScR) flow diagram (Tricco et al., 2018) **(Figure 1).**

The fourth step is charting data. To minimize selection bias, each article was reviewed using the JBI Critical Appraisal Checklist. The methodological quality of the included studies was appraised using the JBI critical appraisal

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tools appropriate to each study design (Moola et al., 2020; Munn et al., 2015). Analytical cross-sectional studies were appraised with the JBI Checklist for Analytical Cross-Sectional Studies, which comprises eight items included clearly defined inclusion criteria; detailed description of the study subjects and setting; valid and reliable measurement of the exposure; objective, standard criteria used to measure the condition; identification of confounding factors; strategies to deal with confounding factors; valid and reliable measurement of outcomes; and appropriate statistical analysis. Cohort studies were appraised with the JBI Checklist for Cohort Studies (11 items), which addresses the similarity of groups, measurement of exposure, identification and handling of confounders, absence of the outcome at baseline, outcome measurement, sufficiency and completeness of follow-up, and statistical analysis. Studies reporting prevalence were also appraised with the JBI Checklist for Prevalence Studies (nine items): an appropriate sample frame, appropriate sampling, adequate sample size, detailed description of subjects and setting, sufficient coverage of the identified sample, valid methods for identifying the condition, standard and reliable measurement of the condition for all participants, appropriate statistical analysis, and an adequate response rate. Each item was rated as “yes”, “no”, “unclear”, or “not applicable”. Given the aims of this review, the fundamental criteria were those concerning the measurement of insomnia, namely whether insomnia was identified using valid methods and measured in a standard and reliable way for all participants (e.g., ISI, PSQI, Athens Insomnia Scale, or explicit diagnostic criteria). For studies reporting associated factors, the identification of and adjustment for confounding factors were also considered key, and for prevalence estimates, the adequacy of the sample size and response rate. In line with scoping review methodology (Tricco et al., 2018), the appraisal was used to describe the methodological quality of the evidence rather than to exclude studies.

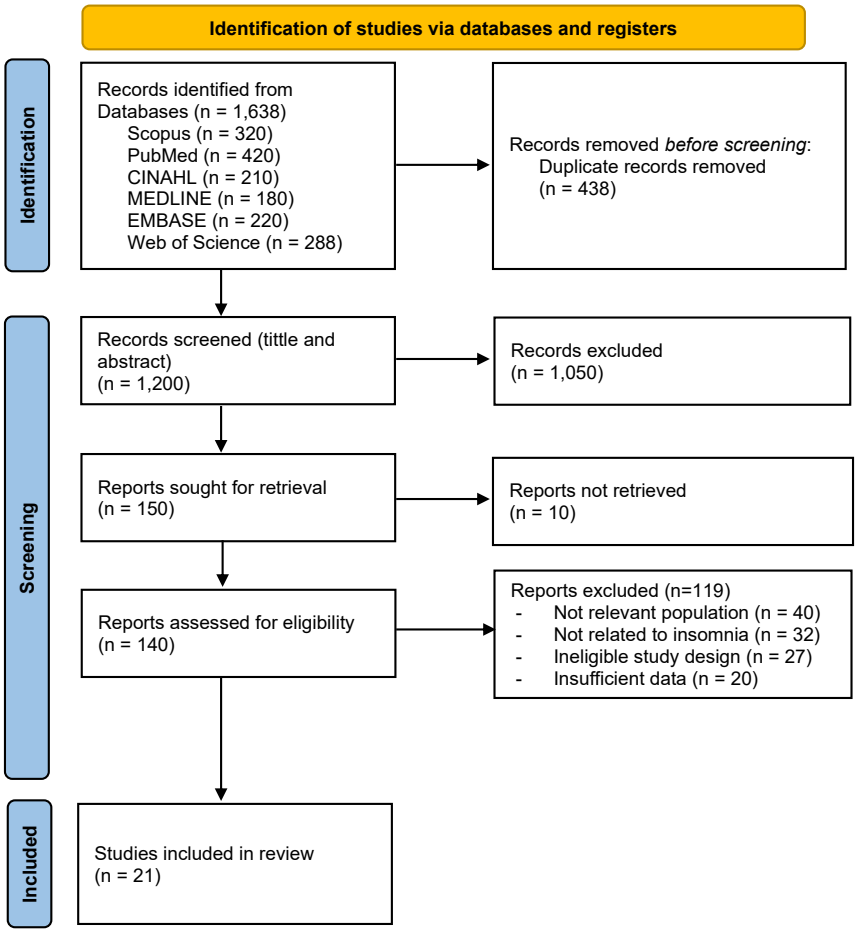


Figure 1. PRISMA flowchart for the study selection process.

Three authors (DP, RAS, and THP) independently identified and selected the studies. Additional consultations with subject matter experts were conducted to strengthen the comprehensiveness of the review. Data were extracted using a standardized template and a predefined Excel form. In cases of discrepancies, the extraction process was repeated to ensure the accuracy of the information. Information about the authors, country of origin, research design, sample size, instrument, prevalence, factors associated with the outcome, and recommendations was recorded in this form. The fifth step is data analysis. Data extracted included authors, country of origin, research design, sample size, instrument, prevalence, factors associated with the outcome, and recommendations. Owing to substantial heterogeneity among the included studies, statistical or meta-analytic analyses were not performed. Instead, a descriptive synthesis was used to summarize key characteristics. Thematic content analysis was conducted on the included studies. Data relevant to the identified themes were manually extracted. The findings were synthesized and summarized, with particular emphasis on the prevalence and associated risk factors of insomnia. As this is a scoping review that does not involve human subjects, ethical clearance from an institutional review board (IRB) or similar body was not required.

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Result

A total of 21 studies were included in this review **(Table 1)**. The sample sizes across the included studies varied substantially, ranging from 50 to 502,540 participants. Most studies employed a cross-sectional design (n=14), while others used cohort-based designs, including prospective (n=2), observational (n=1), population-based (n=2), and registry-based (n=1). In addition, one study used a retrospective design, and another conducted a secondary analysis of randomized controlled trial data. The studies were conducted across a wide range of countries. For instance, Japan contributed the most studies (n=5), followed by the United States (n=3). China, India, and Norway each contributed two studies. The remaining studies were conducted in Saudi Arabia, France, the Netherlands, the United Kingdom, Jordan, Hong Kong, and Spain, each represented by a single study. In this section, the result presents several points as follows instruments used to measure insomnia, prevalence of insomnia among patients with diabetes, factors associated with insomnia, and recommendations for addressing insomnia.

Table 1. Study findings

Code	Authors, title	Participants, Country	Study design, instrument	Prevalence of insomnia	Factors associated with insomnia	Recommendations for addressing insomnia
1	Jain et al., 2017	50 participants, India	Observational cross-sectional study, ISI	62%	Poor glycemic control	N/A
2	Otaka et al., 2019	504 participants, Japan	Observational cross-sectional study, PSQ Index-Japanese version	30.6%	High neuroticism, living alone, female, high BMI	N/A
3	Sugano et al., 2022	755 participants, Japan	Observational cross-sectional study, structured questionnaire	13.9%	Diabetes, smoking	Reducing unhealthy habits such as alcohol consumption, smoking, and psychological stress
4	Narisawa et al., 2017	622 participants, Japan	Observational cross-sectional study, PSQ Index-Japanese version	43.9%	High BMI, living alone, younger age, lack exercise	Developing intervention for sleep disturbance
5	Mirghani, 2027	246 participants, Saudi Arabia	Observational cross-sectional study, structured questionnaire	73.2% (Delayed sleep), 23.8% (Interrupted sleep).	Diabetes, fatigue, and high HbA1c	Promoting good sleep hygiene
6	Duquenne et al., 2024	35,014 participants, France	Large prospective cohort, structured questionnaire	7.5%	Anxiety	N/A
7	Groeneveld et al., 2023	1,272, Netherlands	Prospective cohort, ISI (the Dutch version)	23.0% (mild insomnia),10. 7% (severe insomnia)	Lack physical activity	N/A

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Table 1. Study findings (Continued).

Code	Authors, title	Participants, Country	Study design, instrument	Prevalence of insomnia	Factors associated with insomnia	Recommendations for addressing insomnia
8	Chao et al., 2022	2,829 participants, US	Observational cohort study, The Women's Health Initiative Insomnia Rating Scale	31.5%	Younger age, non-Hispanic White identity, stressful events and depressive symptoms	Psychological resilience improvements
9	Minamida et al., 2024	175 participants, Japan	Observational cross-sectional study, the Athens insomnia scale	38.9%	Gastrointestinal symptoms	Managing gastrointestinal symptoms, improving dietary habits, and controlling blood glucose
10	Jeon et al., 2022	224 participants, US	A secondary analysis study design, ISI	40%	Mood disturbance	N/A
11	Wright et al., 2025	502,540 participants, UK	Cohort study, structured questionnaire	28%	T2D, short/long sleep	N/A
12	Strandberg et al., 2025	55,083 participants, Norway	Cohort study, medical records assessment from Norwegian Prescription Database (NorPD)	39%	Age ≥60 years, lower education level, longer diabetes duration, female	Integrating insomnia care in diabetes management
13	Alshehri et al., 2020	60 participants, US	Observational cross-sectional study, ISI	53.3%	Depression, anxiety, fatigue, and lack physical activity	Interventions combine insomnia care and Diabetes Self-Care Behavior
14	Yoshida et al., 2018	503 participants, Japan	Observational cross-sectional study, PSQ Index-Japanese version	28%	Female, living alone, avoidance and suppression coping style, age, BMI, and depression	Behavioral interventions for insomnia
15	Shannag et al., 2025	390 participants, Jordan	Observational cross-sectional study, ISI Arabic version	33.8%	Duration of diabetes (>5 years), uncontrolled diabetes, Gabapentin use, and younger age lower risk of severe insomnia	N/A

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Table 1. Study findings (Continued).

Code	Authors, title	Participant, Country	Study design, instrument	Prevalence of insomnia	Factor associated with insomnia	Recommendations for addressing insomnia
16	Ding et al., 2019	3,753 participants, Hong Kong	Observational cross-sectional study, ISI	9.6%	Anxiety, depression, glycemic control, fasting plasma glucose, and HbA1c levels	N/A
17	Núñez-Baila et al., 2025	362 participants, Spain	Observational cross-sectional study, Oviedo sleep questionnaire	47.5%	Female, coexisting health conditions, and sleep aid use	Interventions focusing on sleep disturbance
18	Karumanchi et al., 2023	200 participants, India	Observational cross-sectional study, PSQI	52%	Complication of diabetes	Health education in sleep management
19	Mortensen et al., 2024	1,354 participants, Norway	Observational cross-sectional study, structed questionnaire	39%	Adiposity, glucose dysregulation, obesity, and bodily pain	Insomnia management in diabetes care
20	Li et al., 2025	227 participants, China	Observational cross-sectional study, ISI	N/A (all participants had insomnia)	Fasting blood glucose, depression, fatigue, blood magnesium level, and blood phosphorus level	Improve magnesium and phosphorus intake, depression care, and daytime fatigue
21	Hu et al., 2021	354 participants, China	Retrospective study, the WHO Composite International Diagnostic Interview (WMH-CIDI)	36.4%	Decreased insulin reaction, insulin resistance, poor sleep quality, elevated HbA1c, increased sympathetic activity, and higher metabolic rates	N/A

Instruments used to measure insomnia

Various instruments were used to assess insomnia among patients with diabetes. The ISI, including its Dutch and Arabic versions, was the most frequently used tool, appearing in seven studies (Alshehri et al., 2020; Ding et al., 2019; Groeneveld et al., 2023; Jain et al., 2017; Jeon et al., 2022; Li et al., 2025; Shannag et al., 2025). The PSQI and its Japanese version (PSQI-J) were used in four studies (Karumanchi et al., 2023; Narisawa et al., 2017; Otaka et al., 2019; Yoshida et al., 2018). The Athens Insomnia Scale was used in one study (Minamida et al., 2024). Four studies assessed insomnia using self-reported questions on difficulties initiating sleep, maintaining sleep, or early morning awakening, sometimes combined with daytime dysfunction (Mirghani, 2017; Mortensen et al., 2024; Sugano et al., 2022; Wright et al., 2025). One study applied established criteria for chronic insomnia, namely sleep problems on at least three nights per week for at

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least three months with negative daytime consequences (Duquenne et al., 2024). Other instruments included the Women's Health Initiative Insomnia Rating Scale (Chao et al., 2022), the Oviedo Sleep Questionnaire (Núñez-Baila et al., 2025), and the World Mental Health Composite International Diagnostic Interview (WMH-CIDI) (Hu et al., 2021). In addition, one registry-based study indirectly assessed insomnia using prescription records for insomnia medication from the Norwegian Prescription Database (Strandberg et al., 2025). These findings indicate heterogeneity in the measurement of insomnia across studies, ranging from validated psychometric scales to self-reported symptoms and registry-based indicators.

Prevalence of insomnia among patients with diabetes

Reported insomnia prevalence varies across studies, reflecting differences in study populations, assessment methods, and diagnostic criteria. Overall, the reported prevalence ranged from 9.6% to 62%. The highest prevalence was reported in a study conducted in India, where 62% of patients with T2D experienced insomnia symptoms (Jain et al., 2017). Similarly, another study from India reported a 52% prevalence (Karumanchi et al., 2023). In contrast, the lowest prevalence was reported in Hong Kong, where 9.6% of patients with T2D met the criteria for insomnia (Ding et al., 2019). Studies conducted in Japan demonstrated variability in prevalence estimates, ranging from 13.9% (Sugano et al., 2022) to 43.9% (Narisawa et al., 2017), with other studies reporting 30.6% (Otaka et al., 2019) and 28% (Yoshida et al., 2018). In the United States, the prevalence of insomnia ranged from 31.5% to 40% (Chao et al., 2022; Jeon et al., 2022). Comparable estimates were also reported in other countries, including 33.8% in Jordan (Shannag et al., 2025), 36.4% in China (Hu et al., 2021), and 39% in Norway (Strandberg et al., 2025). Additionally, a cohort study in the Netherlands reported 23.0% mild insomnia and 10.7% severe insomnia among patients with T2D (Groeneveld et al., 2023). Overall, most studies reported insomnia prevalence within the moderate range of approximately 25–40%, suggesting that sleep disturbances are a common comorbidity.

Factors associated with insomnia

Factors were identified as associated with insomnia, suggesting that sleep disturbances in this population result from a complex interaction of demographic, psychological, metabolic, and lifestyle determinants. Among demographic characteristics, female was reported as a significant correlate of insomnia symptoms (Núñez-Baila et al., 2025; Otaka et al., 2019; Strandberg et al., 2025; Yoshida et al., 2018). Findings regarding age were inconsistent, with some studies reporting higher insomnia prevalence among younger individuals (Chao et al., 2022; Narisawa et al., 2017) and others identifying older age as a risk factor (Shannag et al., 2025; Strandberg et al., 2025; Yoshida et al., 2018). Social determinants, such as living alone and lower educational attainment, as well as a longer duration of diabetes, were also associated with risk of insomnia (Narisawa et al., 2017; Otaka et al., 2019; Shannag et al., 2025; Strandberg et al., 2025; Yoshida et al., 2018). Psychological factors were also significant correlates of insomnia, including depression (Alshehri et al., 2020; Chao et al., 2022; Ding et al., 2019; Li et al., 2025; Yoshida et al., 2018), anxiety (Alshehri et al., 2020; Ding et al., 2019; Duquenne et al., 2024), and mood disturbance or psychological distress (Chao et al., 2022; Jeon et al., 2022). Personality traits and coping styles also influenced sleep outcomes, with higher neuroticism and maladaptive coping strategies, such as avoidance and suppression, linked to increased insomnia symptoms (Otaka et al., 2019; Yoshida et al., 2018). Clinical and metabolic factors specific to diabetes were also associated with insomnia, including poor glycaemic control, as indicated by elevated HbA1c, uncontrolled diabetes, or glucose dysregulation (Ding et al., 2019; Hu et al., 2021; Jain et al., 2017; Mirghani, 2017; Mortensen et al., 2024; Shannag et al., 2025), higher fasting blood glucose (Ding et al., 2019; Li et al., 2025), higher BMI or obesity (Mortensen et al., 2024; Narisawa et al., 2017; Otaka et al., 2019; Yoshida et al., 2018), fatigue (Alshehri et al., 2020; Li et al., 2025; Mirghani, 2017), diabetes complications (Karumanchi et al., 2023), gastrointestinal symptoms (Minamida et al., 2024), abnormal magnesium and phosphorus levels (Li et al., 2025), and metabolic dysregulation such as insulin resistance and increased sympathetic activity (Hu et al., 2021). Comorbid physical conditions, including coexisting health conditions, bodily pain, hypertension, and coronary artery disease, were also associated with insomnia (Hu et al., 2021; Mortensen et al., 2024; Núñez-Baila et al., 2025). Lifestyle and behavioural factors included low physical activity and the absence of regular exercise (Alshehri et al., 2020; Groeneveld et al., 2023; Narisawa et al., 2017), smoking (Sugano et al., 2022), and the use of sleep aids or medication such as gabapentin (Núñez-Baila et al., 2025; Shannag et al., 2025) **(Table 2)**.

Recommendations for addressing insomnia

Studies recommend routine sleep screening in diabetes management to enable early detection and treatment (Alshehri et al., 2020; Karumanchi et al., 2023; Mortensen et al., 2024; Strandberg et al., 2025). Some studies emphasized

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psychological aspects, such as strengthening psychological resilience and addressing pre-existing psychological conditions (Chao et al., 2022) and managing depression and daytime fatigue (Li et al., 2025). Other recommendations focused on lifestyle and behavioural interventions, including promoting good sleep hygiene (Mirghani, 2017), lifestyle changes and treatment adherence (Karumanchi et al., 2023), facilitating physical activity (Mortensen et al., 2024), and considering lifestyle factors such as BMI and smoking (Narisawa et al., 2017). Reducing smoking and alcohol consumption and addressing occupational stressors were also suggested as approaches for improving sleep outcomes (Sugano et al., 2022). Moreover, managing gastrointestinal symptoms, improving dietary habits, and controlling blood glucose levels were proposed as strategies for reducing insomnia symptoms (Minamida et al., 2024), and improving sleep hygiene was suggested as a way to support glycaemic control (Mirghani, 2017). Additionally, attention to magnesium and phosphorus intake has been suggested as a potential target for intervention in patients with insomnia and metabolic dysregulation (Li et al., 2025).

Discussion

This scoping review revealed heterogeneity across sample sizes, measurement instruments, study designs, and geographic regions. However, it noted that all included studies employed quantitative research, predominantly using a cross-sectional design. Although the method allows for easy comparison of data, it falls short in addressing the crucial "why" and "how" questions that explain the experiences of patients with diabetes afflicted by insomnia. Without underestimating the value of quantitative research, this review proposes incorporating qualitative studies to gain much-needed insights into how patients manage insomnia. Such approaches can uncover deeper dimensions of the condition, including personal coping strategies, health-seeking behaviors, and mental health challenges. The review found that different instruments had been used to measure insomnia. However, the ISI and PSQI were most often used. The ISI and PSQI differ in their theoretical foundations and conceptual approaches to assessing sleep issues (Morin et al., 2011). The ISI is rooted in the clinical conceptualization of insomnia, basing its framework on diagnostic criteria defined in manuals such as the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (Morin et al., 2011). It explicitly targets insomnia's core symptoms and consequences, focusing on their nature, severity, and impact on daily functioning. This approach aligns closely with clinical diagnostic criteria for insomnia and demonstrates high partial invariance before and after treatment, supporting its use as an outcome measure for insomnia interventions (Krystal et al., 2019). In contrast, the PSQI assesses a construct of sleep health, adopting a multidimensional approach that transcends standalone insomnia complaints. Assessing multiple domains of sleep behavior and disruption allows it to generate a more thorough profile of overall sleep quality (Fabbri et al., 2021; Mollayeva et al., 2016). The review recommends using the ISI over the PSQI, although the latter has been translated into 51 languages, suggesting broader international applicability (Arumugam et al., 2024). While the number of translations alone does not necessarily indicate superiority, both instruments demonstrate good internal consistency, with the ISI showing slightly greater reliability (Cronbach's alpha=0.90–0.91) than the PSQ (Cronbach's alpha=0.875) (Morin et al., 2011). In addition, the ISI offers distinct psychometric advantages over the PSQI by maintaining superior construct stability and high partial invariance across pre- and post-treatment assessments. In contrast, the PSQI's factorial structure tends to shift following treatment, which can compromise its validity as a longitudinal outcome measure (Manzar et al., 2016; Morin, 2003).

The reviewed studies identified 25 factors as being associated with insomnia in patients with diabetes. These factors can be broadly categorized into five main groups: demographic and social factors (female sex, age, living alone, lower educational level, and longer duration of diabetes); psychological factors (depression, anxiety, mood disturbances, neuroticism, and maladaptive coping styles); diabetes-related clinical and metabolic factors (high BMI or obesity, poor glycaemic control as indicated by higher HbA1c levels, elevated fasting blood glucose, insulin resistance, diabetes complications, fatigue, gastrointestinal symptoms, and electrolyte imbalances such as abnormal magnesium and phosphorus levels); lifestyle and behavioural factors (low physical activity, lack of habitual exercise, smoking, and other unhealthy behaviours); and comorbid physical conditions (bodily pain, coexisting health conditions, and cardiovascular diseases including hypertension and coronary artery disease). The scoping review found that demographic factors (female gender and age), especially female gender, were most frequently associated with insomnia. This observation mirrors wider patterns in sleep medicine and underscores pronounced sex-based differences in insomnia rates among individuals with diabetes (Boer et al., 2023). Multiple sex-specific mechanisms likely underlie this pattern, including fluctuations in estrogen and progesterone levels that are known to disrupt sleep quality (Morssinkhof et al., 2023). Furthermore, female patients with diabetes are disproportionately affected by comorbidities including depression, anxiety, and restless legs syndrome, all of which compound insomnia symptoms (Meisinger et al., 2005; Phillips et al., 2008). Sociocultural factors, including marital status and caregiving responsibilities, may also play a role

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in the higher prevalence of insomnia among females with diabetes (Forsbom et al., 2025). However, even though men with diabetes typically present with higher BMI and greater rates of metabolic dysfunction, women remain more susceptible to sleep disturbances. This contrast suggests that the underlying mechanisms linking diabetes and insomnia differ substantially between sexes (Chasens et al., 2016).

Table 2. Factors associated with insomnia.

Category	Factors associated with insomnia	Code	Studies in total
Demographic and social factors	Female	2, 12, 14, 17	4
	Age (younger or older age groups)	4, 8, 12, 14, 15	5
	Living alone	2, 4, 14	3
	Longer duration of diabetes	12, 15	2
	Lower education level	12	1
Psychological and emotional factors	Depression	8, 13, 14, 16, 20	5
	Anxiety	6, 13, 16	3
	Mood disturbance / psychological distress	8, 10	2
	Neuroticism	2	1
	Maladaptive coping style	14	1
Diabetes-related clinical and metabolic factors	Poor glycemic control / high HbA1c	1, 5, 15, 16, 19, 21	6
	Fatigue	5, 13, 20	3
	High Body Mass Index (BMI) / obesity / adiposity	2, 4, 14, 19	4
	Elevated fasting blood glucose	16, 20	2
	Insulin resistance / decreased insulin reaction	21	1
	Diabetes complications	18	1
	Gastrointestinal symptoms	9	1
	Electrolyte imbalance (magnesium, phosphorus)	20	1
Lifestyle and behavioral factors	Low physical activity	7, 13	2
	Lack of regular exercise	4	1
	Smoking	3	1
	Sleep aids or medication (e.g., gabapentin)	15, 17	2
Comorbidities and physical health conditions	Bodily pain	19	1
	Coexisting health conditions	17	1
	Hypertension, coronary artery disease	21	1

Other demographic factors, especially age and being elderly, were also found to be associated with insomnia. This finding is consistent with the understanding of sleep patterns across the lifespan and highlights the complex interplay between aging, diabetes, and sleep disturbances (Yao et al., 2022). As individuals age, they often experience changes in sleep structure, including reduced sleep efficiency and increased sleep fragmentation (Strandberg et al., 2025). Various factors may exacerbate these age-related sleep changes, such as increased nocturia, chronic pain, and comorbid conditions that are more common in older adults (Miner et al., 2023). Additionally, alterations in circadian rhythms, decreased melatonin production, and aging-associated changes in lifestyle factors (e.g., reduced physical activity and social engagement) may further contribute to the higher prevalence of insomnia in older patients with diabetes (Seixas et al., 2019). The use of multiple medications among older adults with diabetes can also interfere with sleep patterns. In addition to demographic factors, this review found that psychological factors such as depression and anxiety contribute to insomnia. Depression and anxiety are known to be more common in patients with diabetes than in the general population as it contributes to sleep disturbances (Oh et al., 2019). Various physiological and psychological mechanisms mediate the bidirectional relationship between mental health and insomnia (Xiuyun et al., 2022). Conversely, poor sleep quality can exacerbate depression, anxiety and create a vicious cycle (Bastos et al., 2023). Some studies suggested that insomnia can be a precursor to mental health problems rather than a consequence (Drake et al., 2003; Pigeon et al., 2017). However, the relationship between mental health and insomnia is not strictly bidirectional. While depression and

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anxiety can trigger heightened arousal, rumination, and worry that disrupt sleep onset and maintenance, the reverse is not always true. In some cases, poor sleep quality may not directly worsen psychological distress; rather, this association is often mediated by broader factors such as disease management, lifestyle behaviors, and social support (Rutten et al., 2017).

The diabetes-related clinical and metabolic category emerges as the most significant contributor to insomnia in patients with diabetes mellitus, encompassing 8 of the 25 factors identified in our scoping review. Among them, Poor glycaemic control (higher HbA1c levels) were the most frequently mentioned factors associated with insomnia. The relationship between HbA1c levels and insomnia in patients with diabetes has been debated among researchers, with some studies supporting an association while others do not (Chen et al., 2025). Research has shown that poor sleep quality and insomnia symptoms are associated with higher HbA1c levels in patients with T2D. For example, one study involving 585 patients with T2D found that HbA1c levels correlated significantly with insomnia symptoms, as measured using the PSQI (Keskin et al., 2015). Additionally, patients with high HbA1c levels (>6.5%) were found to have a greater risk of poor sleep quality than those with normal HbA1c levels (Tan & Benedict, 2020). These findings suggest that elevated HbA1c levels may contribute to the development or exacerbation of insomnia in patients with diabetes mellitus. The pathophysiology of diabetes contributes to insomnia through multiple interrelated neuroendocrine and metabolic pathways that disrupt normal sleep wake regulation. Chronic hyperglycaemia and insulin resistance activate the hypothalamic–pituitary–adrenal (HPA) axis, leading to elevated evening corticotropin and cortisol levels that counteract the typical circadian decline of cortisol before sleep (Bezerra et al., 2022). This altered cortisol rhythm impairs slow wave sleep generation, increases nocturnal arousals, and reduces total sleep time. Additionally, diabetic autonomic neuropathy and recurrent episodes of hyperglycaemia and hypoglycaemia enhance sympathetic outflow and catecholamine release (norepinephrine, epinephrine), sustaining physiological hyperarousal, elevating nocturnal heart rate and blood pressure, and disrupting sleep initiation and continuity (Basta et al., 2022). Nocturnal polyuria due to osmotic diuresis, neuropathic pain such as burning feet, and pruritus further provoke repeated awakenings, perpetuating hyperarousal and conditioning the brain to associate nighttime with somatic discomfort rather than restorative sleep (Papworth et al., 2022).

At the central nervous system level, diabetes alters neurotransmitter and neuropeptide systems that regulate the sleep–wake cycle. As a result, insulin resistance and fluctuating glucose concentrations impair hypothalamic regulation of orexin (hypocretin) neurons, which are critical for promoting wakefulness (Sakurai, 2005). The present scoping review identifies several lifestyle factors associated with insomnia in patients with diabetes, with low physical activity emerging as the most frequently cited factor, reported in five of the included studies (Alshehri et al., 2020; Groeneveld et al., 2023; Narisawa et al., 2017). This observation is consistent with extensive epidemiological evidence linking sedentary behaviour to adverse sleep outcomes in metabolic populations. For example, cross-sectional analyses from the US National Health and Nutrition Examination Survey (NHANES) indicate that adults with T2D who engage in less than 150 minutes of moderate-to-vigorous physical activity per week have significantly higher odds of experiencing short sleep duration and difficulty maintaining sleep (Dong et al., 2022). Additionally, the Look AHEAD study found that lower baseline fitness predicts incident insomnia over a four-year follow-up in overweight individuals with T2D (Spira et al., 2023). The biological plausibility of this association is supported by the role of physical activity in promoting sleep. Physical activity facilitates thermoregulatory vasodilation, which lowers core body temperature at sleep onset, down-regulates sympathetic nervous system activity to reduce nocturnal hyperarousal, and modulates serotonin and melatonin pathways (Schwimmer et al., 2010). In contrast, physical inactivity in individuals with diabetes exacerbates insulin resistance, nocturnal hyperglycemia, osmotic diuresis, and frequent awakenings (Mao, 2024). The findings of this review underscore the need for a comprehensive approach to managing insomnia, incorporating clinical assessment, psychological evaluation, and lifestyle modifications. A study has identified routine screening and assessment of sleep disturbances as essential elements of diabetes management (Smyth et al., 2020). The literature also emphasizes the importance of addressing psychological comorbidities, given the established association between insomnia and psychological distress (Groeneveld et al., 2024). These findings align with theoretical frameworks describing the bidirectional relationship between metabolic disorders and mental health (Sousa et al., 2025). The current evidence advances previous understanding by positioning psychological assessment as a core diagnostic and therapeutic component. The principal contribution of this synthesis is the demonstration that effective management of insomnia necessitates integrated screening protocols that evaluate sleep quality, psychological resilience, and symptoms of depression and anxiety (Kassem et al., 2025).

The practical implications of these findings reveal several key avenues for intervention. Lifestyle and behavioral changes are well-established foundational strategies supported by evidence across diverse populations. Key examples

include increasing physical activity, practicing good sleep hygiene, and reducing smoking and alcohol use (González-Devesa et al., 2025). These approaches should be supplemented by optimizing glycemic control and addressing gastrointestinal symptoms and diabetes-related complications. Recent evidence on nutritional factors and electrolyte balance offers new insights into the biochemical mechanisms underlying insomnia in the context of metabolic dysregulation (Seow et al., 2022). These findings suggest that insomnia in diabetes is a multifactorial condition requiring coordinated clinical attention across metabolic, psychological, and behavioral domains. Future research should elucidate the mechanisms by which glycemic control influences sleep quality and identify patient subpopulations. Given the high prevalence of insomnia and its associated factors, nurses serve as essential frontline providers in sleep health management. Through comprehensive assessment, nurses can conduct routine screening using validated instruments such as the ISI or the PSQI during diabetes consultations (Nagy et al., 2024). In addition, nurses are positioned to deliver individualized non-pharmacological interventions, including sleep hygiene education, adapted cognitive behavioral therapy for insomnia (CBT-I), and diabetes self-management counseling that addresses modifiable factors such as circadian rhythm disruption or nocturnal hypoglycemia (Cho & Kim, 2021). Our scoping review has several limitations. Firstly, the evolving understanding of insomnia as a distinct issue among patients with diabetes, separate from other sleep disorders, may have affected the comprehensiveness of our search strategy. Secondly, the search terms may not have fully captured all relevant contemporary and historical terminology used to describe insomnia in this population, potentially leading to the exclusion of some relevant studies. Thirdly, our scoping review was restricted to articles available in English and those accessible through databases available at Tanjungpura University, which may have limited the inclusion of some relevant studies. Fourthly, publication bias also poses a concern, as studies with significant findings are more likely to be selected for publication and included in our scoping review.

Conclusion

Addressing insomnia in patients with diabetes is vital, as it impacts diabetes management. The review enhances understanding of the prevalence of insomnia in patients with diabetes mellitus, the factors contributing to its development, and potential strategies for intervention. The identified factors contributing to insomnia were categorized into five main groups: demographic and social factors, psychological factors, diabetes-related clinical and metabolic factors, lifestyle and behavioural factors, and comorbid physical conditions. The recommendations emphasize incorporating clinical assessment, psychological evaluation, and lifestyle modifications approaches to improve sleep quality and, thus, diabetes outcomes. Future research should aim to expand qualitative evidence, exploring the underlying mechanisms and patient experiences to provide deeper insights into effective interventions.

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Author's declaration

All authors have made substantial contributions to complete research.

Availability of data and materials

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

Competing interests

The author declares no conflict of interest.

Ethical clearance

Ethical approval was not applicable for this study, as it involved only the review and analysis of previously published literature without human or animal subjects.

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Authors' insight

Key points

- Insomnia is a underrecognized problem among patients with diabetes mellitus with variation in prevalence across studies and populations.
- Insomnia is associated with a combination of demographic, psychological, metabolic, behavioural, and comorbid health factors, highlighting the complex relationship between sleep disturbances and diabetes management.
- Identifying patients at risk of insomnia and addressing its contributing factors may support diabetes management, improve sleep health, and enhance quality of life.

Emerging nursing avenues

- How prevalent is insomnia among patients with diabetes mellitus, and how does its prevalence vary across different populations and geographical settings?
- What demographic, psychological, clinical, metabolic, and lifestyle-related factors are associated with insomnia among patients with diabetes mellitus?
- What are the current approaches and potential strategies for preventing and managing insomnia in patients with diabetes mellitus, and what gaps remain in the existing evidence?

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