Volume 4, Issue 5, 2026

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

ASSOCIATION BETWEEN ASTHMA AND POOR SLEEP QUALITY *A CROSS-SECTIONAL STUDY AT GULAB DEVI TEACHING HOSPITAL, LAHORE, PAKISTAN*

Hamza Ali[1], Abdul Aziz[2], Sana Abbas[3], Sabeen Kashif[4], Amina Saeed[*]

[*]*Demonstrator Respiratory Therapy, Faculty of Allied Health Sciences, Superior University Lahore, Pakistan*
[1,2,3,4] *Respiratory Therapy, Department of Emerging Health Professional Technologies, Faculty of Allied Health Sciences, Superior University Lahore Pakistan*

hamza783266@gmail.com[1], azeezansari152@gmail.com[2], sanaawan96767@gmail.com[3], parihaanangel458@gmail.com[4], saeedbinte9@gmail.com[*]

DOI: http://doi.org/10.5281/zenodo.20625150

Keywords
Asthma; sleep quality; PSQI; nocturnal asthma; Pakistan; sleep disturbance

Article History
Received: 03 April 2026
Accepted: 15 May 2026
Published: 30 May 2026

Corresponding Author: *
Amina Saeed
saeedbinte9@gmail.com

Abstract

Background: *Asthma is a chronic inflammatory airway illness that significantly reduces physical health and overall quality of life. One of the most commonly reported yet undertreated comorbidities in asthmatic patients is sleep disruption. Nocturnal symptoms—including cough, wheezing, chest tightness, and dyspnea—interfere with normal sleep architecture, leading to shorter sleep duration, longer sleep latency, frequent awakenings, and excessive daytime sleepiness. Despite global evidence linking asthma severity to poor sleep outcomes, data from South Asian clinical populations remain scarce.*

Objective: *To evaluate sleep quality and its association with asthma severity in adult patients attending a tertiary hospital in Lahore, Pakistan.*

Methods: *A cross-sectional study enrolled 180 asthma patients (age >14) via convenience sampling at Gulab Devi Teaching Hospital, Lahore. Asthma severity was categorized using GINA criteria; sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI). Chi-square testing was used to analyze associations between PSQI sleep domains and asthma severity (SPSS v.26; significance at $p<0.05$).*

Results: *Of 180 patients (60% male; mean age group 46–60 years), 96.7% showed clinically significant sleep disturbance: 30.6% had moderate poor sleep and 66.1% had severe poor sleep. All twelve chi-square correlations were statistically significant ($p<0.05$). Cough/wheeze ($\chi^2=46.83$, $p<0.001$) and daytime dysfunction ($\chi^2=51.28$, $p<0.001$) showed the highest correlations with asthma severity. A dose-response relationship was observed across all domains.*

Conclusion: *Poor sleep quality is substantially and persistently correlated with asthma severity across all evaluated parameters. Systematic sleep assessment should be incorporated into standard asthma care in Pakistan.*

1. INTRODUCTION

Asthma is a chronic inflammatory disease of the airways characterized by recurrent episodes of wheezing, dyspnea, chest tightness, and cough, typically occurring at night or in the early morning. The Global Initiative for Asthma (GINA) describes it as a heterogeneous disease defined by chronic airway inflammation with variable but often reversible airflow limitation. Its immunological basis involves activation of mast cells, eosinophils, T

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

lymphocytes, and airway epithelial cells sustaining a persistent inflammatory cascade [1].

An estimated 300 million people worldwide suffer with asthma, and this number is projected to reach 400 million by 2025. Despite significant advances in pharmacotherapy, asthma accounts for approximately 1,000 deaths daily—the majority of which are considered preventable [3]. In Pakistan, prevalence ranges from 4% to 7% of the adult population, with significant underdiagnosis in rural areas due to limited spirometric infrastructure and low healthcare-seeking behavior [4].

Beyond airway physiology, asthma exacts a profound toll on health-related quality of life across multiple domains, including social interaction, physical activity, occupational performance, and emotional well-being. Validated instruments such as the Asthma Quality of Life Questionnaire (AQLQ) consistently demonstrate that poor disease control independently predicts substantial declines in both mental and physical quality-of-life scores [5].

Sleep quality—encompassing duration, latency, efficiency, architecture, nocturnal awakenings, and daytime functioning—is widely assessed using the Pittsburgh Sleep Quality Index (PSQI), which generates a global score distinguishing good sleepers (PSQI ≤5) from poor sleepers (PSQI >5) [6]. The American Academy of Sleep Medicine recommends at least seven hours of consolidated sleep per night for optimal cognitive and physiological function.

The phenomenon of nocturnal asthma—marked by circadian-driven amplification of bronchoconstriction, coughing, and wheezing during nighttime hours—forms the biological foundation of the asthma-sleep relationship. Peak expiratory flow rate and FEV_1 reach their nadir between 4:00 and 6:00 a.m., a pattern partly attributable to decreased beta-adrenergic responsiveness during sleep. Over 70% of asthmatic patients experience nocturnal symptoms, which are closely linked to poor asthma control and increased healthcare utilization [11].

The relationship between asthma and sleep is further complicated by comorbidities including gastro-oesophageal reflux disease (GORD), obstructive sleep apnea (OSA), anxiety, and depression—all of which independently impair sleep and are more prevalent in asthmatic populations. Pharmaceutical agents used in asthma management, notably theophylline, high-dose corticosteroids, and certain leukotriene receptor antagonists, may themselves disrupt sleep architecture [16].

In a self-amplifying feedback loop, poor sleep quality is not merely a consequence of asthma but also an independent predictor of worsened asthma outcomes. Experimental sleep restriction in healthy volunteers produces significant increases in airway hyperresponsiveness and systemic inflammatory markers within 72 hours [17]. Longitudinal cohort data further demonstrate that baseline PSQI-defined poor sleep quality independently predicts increased exacerbation risk, unplanned medical visits, and oral corticosteroid use over 6–12 months.

Despite growing international evidence, sleep-related outcomes in Pakistani adults with asthma remain inadequately characterized. Evidence from neighboring South Asian countries indicates significant rates of sleep disturbance, yet culturally contextualized, comprehensive investigations in Pakistani populations are sparse. The present study fills this gap by systematically assessing sleep quality and its association with asthma severity in an adult asthmatic population using the internationally validated PSQI.

2. LITERATURE REVIEW

A growing body of international evidence consistently demonstrates high rates of poor sleep quality in adults with asthma. Mäkelä et al. (2025) conducted a prospective cohort study of 412 participants at Helsinki University Hospital, Finland, finding that 68.4% of asthmatic patients had poor sleep quality (PSQI >5) regardless of asthma severity, with significantly longer sleep latency and reduced slow-wave sleep compared to healthy controls [29].

In China, Chen et al. (2025) enrolled 580 patients across multiple centers and demonstrated a graded relationship between asthma severity and declining sleep efficiency, with nocturnal awakenings increasing proportionally with disease severity [30]. Sharma et al. (2025) at AIIMS New Delhi reported 72% poor sleep quality in asthmatic individuals versus 28% in controls, identifying nocturnal symptom frequency as the strongest independent predictor of PSQI impairment [31].

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Williams et al. (2024) demonstrated in a 12-week randomized controlled trial that optimized inhaled corticosteroid and long-acting beta-agonist therapy significantly improved PSQI global scores and reduced nocturnal awakenings compared to standard care [32]. Gonzalez-Uribe et al. (2024) showed in a 24-month longitudinal study that asthmatic patients with concomitant OSA had consistently lower sleep quality scores and greater peak flow variability [34].

Meta-analytic evidence from Banno et al. (2022), synthesizing 24 studies across Asia, Europe, and North America (N=12,348), yielded a pooled prevalence of PSQI-defined poor sleep quality of 58.3% (95% CI: 52.7–63.8%), with nocturnal symptoms, anxiety, and poor asthma control identified as the most consistent correlates [42]. Luyster et al. (2023) further established that baseline PSQI scores >5 were independently associated with a significantly elevated risk of asthma exacerbations over a 12-month follow-up period (adjusted RR 1.74; 95% CI: 1.28–2.36) [40].

Data from South Asian contexts are comparatively sparse but directionally consistent. Htut et al. (2022) in Myanmar reported 64.9% poor sleep quality among asthmatic outpatients, with nocturnal dyspnea and poor asthma control as independent predictors [45]. These findings collectively establish a robust, cross-cultural evidence base supporting the clinical significance of sleep assessment in asthmatic patients and underscore the need for locally contextualized research in South Asian populations including Pakistan.

3. OBJECTIVES & PROBLEM STATEMENT

3.1 Objectives

To assess sleep quality and identify the main determinants of poor sleep in adult asthmatic patients attending a tertiary-care hospital in Lahore, Pakistan, using the Pittsburgh Sleep Quality Index (PSQI), and to examine the association between asthma severity and individual PSQI sleep domains.

3.2 Problem Statement

Asthma, a chronic inflammatory airway disease, significantly impairs physical functioning and quality of life. Recent research consistently demonstrates that 58–70% of asthmatic patients experience poor sleep quality—substantially higher than general population rates. Despite this, prevalence data from Pakistani clinical populations are lacking, and the multifactorial determinants of sleep impairment in this context remain poorly characterized. This study addresses that evidence gap to support targeted interventions and comprehensive asthma care.

3.3 Operational Definitions

Asthma: Physician-diagnosed chronic inflammatory airway disease confirmed by medical history, physical examination, and spirometry. Asthma Severity: Classified as mild, moderate, or severe per GINA criteria. Sleep Quality: Assessed by PSQI; good sleep = PSQI ≤5; poor sleep = PSQI >5, further stratified as mild poor (scores 6–8), moderate poor (9–12), and severe poor (>12). Comorbidities: Any coexisting medical condition documented in clinical records or self-reported, including obesity, allergic rhinitis, GERD, hypertension, or diabetes.

4. MATERIALS AND METHODS

4.1 Study Design

A cross-sectional quantitative comparative study was conducted to assess the association between asthma severity and sleep quality in adult patients. Standardized questionnaires were administered at a single time point, and sleep quality ratings across PSQI domains were analyzed in relation to asthma severity categories.

4.2 Setting and Duration

Data were collected at Gulab Devi Teaching Hospital, Lahore, Pakistan, over a four-month period (January–April 2026), encompassing data collection, analysis, and report writing.

4.3 Sample Size and Sampling

Sample size was calculated using Cochran's formula ($n = Z^2\ p\ q\ /\ \rho^2$), considering 4.3% asthma prevalence, 95% confidence level, and 5% margin of error, yielding n = 180. Non-probability convenience sampling was employed; patients meeting inclusion criteria during the data collection period were enrolled consecutively until the required sample was reached.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

4.4 Inclusion and Exclusion Criteria

Inclusion: both sexes; age >14 years; physician-diagnosed asthma (mild to severe per GINA); ability to understand and complete the questionnaire; provision of informed consent or assent (guardian consent for ages 15–18). Exclusion: age <14 years; diagnosis of GERD; chronic sinusitis; any condition precluding questionnaire completion.

4.5 Data Collection Tools

Asthma severity was categorized using GINA criteria documented in clinical records. Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), a validated 9-item self-report instrument covering seven component domains: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. Two additional asthma-specific questions on nocturnal symptoms and asthma-related awakenings were incorporated.

4.6 Statistical Analysis

Data were analyzed using IBM SPSS Statistics version 26. Descriptive statistics characterized demographic and clinical features. Chi-square tests examined associations between each PSQI domain and asthma severity category. A p-value <0.05 was considered statistically significant. Results are presented in frequency tables and bar charts.

4.7 Ethical Considerations

The study adhered to ethical guidelines of the Superior University Research Ethics Committee. Written informed consent was obtained from all participants. Anonymity and confidentiality were maintained throughout. Participation was voluntary and withdrawal carried no penalty.

5. RESULTS

55.1 Demographic Characteristics

Table 1 presents the age distribution of the 180 study participants.

Table 1: Frequency Distribution of Age

Age Group	Frequency (n)	Percent (%)
18–30 years	30	16.7
31–45 years	49	27.2
46–60 years	54	30.0
61–75 years	47	26.1
Total	180	100.0

The 46–60 years age group constituted the largest proportion (30.0%), followed by 31–45 years (27.2%), 61–75 years (26.1%), and 18–30 years (16.7%), reflecting a predominantly middle-aged to older clinical sample consistent with the epidemiology of chronic asthma.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Table 2 presents the gender distribution.

Gender	Frequency (n)	Percent (%)
Male	108	60.0
Female	72	40.0
Total	180	100.0

Table 2: Frequency Distribution of Gender

Males constituted the majority (60.0%), consistent with patterns of healthcare-seeking behavior observed in tertiary-care settings in Pakistan.

Table 3 presents asthma severity distribution.

Asthma Severity	Frequency (n)	Percent (%)
Mild	60	33.3
Moderate	80	44.4
Severe	40	22.2
Total	180	100.0

Table 3: Frequency Distribution of Asthma Severity

Moderate asthma was most prevalent (44.4%), followed by mild (33.3%) and severe (22.2%), reflecting a typical outpatient asthma management cohort.

5.2 PSQI Sleep Domain Findings

Overall, 96.7% of participants exhibited clinically significant sleep disturbance: 66.1% (n=119) severe poor sleep and 30.6% (n=55) moderate poor sleep; only 3.3% (n=6) had mild poor sleep. Key domain findings are summarized below.

Subjective sleep quality (Q1): 50.6% reported fairly bad or very bad sleep. Sleep latency (Q2): 67.2% required 16–60 minutes to fall asleep; 15.0% needed >60 minutes. Sleep duration (Q3): 67.2% slept <6 hours per night; only 8.9% achieved the recommended >7 hours. Night awakenings (Q4): 56.1% reported awakenings at least once weekly.

Cough/wheeze (Q5b): 92.2% reported sleep disruption due to coughing or wheezing; this was the most prevalent symptom-related disturbance. Daytime dysfunction (Q7): 80.6% reported at least some degree of daytime impairment. Sleep medication use (Q6): 58.9% used sleep aids to some extent. Nocturnal asthma (Q8): 92.2% reported at least one nighttime asthma episode per month. Asthma-related night awakenings (Q9): 88.9% reported at least one asthma-related awakening per month.

5.3 Chi-Square Analysis: Association with Asthma Severity

All 12 chi-square tests revealed statistically significant associations between PSQI domains and asthma severity (Table 4). Cough/wheeze and daytime dysfunction demonstrated the strongest correlations.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

PSQI Domain	χ^2 Value	df	p-value	Significant
Q1 – Subjective Sleep Quality	44.969	6	<.001	Yes
Q2 – Sleep Latency	36.023	6	<.001	Yes
Q3 – Sleep Duration	25.413	6	<.001	Yes
Q4 – Night Awakenings	20.869	6	.002	Yes
Q5a – Pain Disturbing Sleep	18.281	6	.006	Yes
Q5b – Cough or Wheeze	46.832	6	<.001	Yes
Q5c – Hot or Cold	22.071	6	.001	Yes
Q5d – Noises	14.248	6	.027	Yes
Q6 – Sleep Medication Use	38.233	6	<.001	Yes
Q7 – Daytime Dysfunction	51.277	6	<.001	Yes
Q8 – Nocturnal Asthma	31.191	6	<.001	Yes
Q9 – Awakening In Night	27.428	6	<.001	Yes

Table 4: Chi-Square Test Results – Association between PSQI Domains and Asthma Severity

A consistent dose-response pattern was observed: all sleep quality parameters deteriorated progressively as asthma severity increased from mild to moderate to severe.

6. DISCUSSION

This study investigated the association between asthma severity and sleep quality in 180 patients from a tertiary-care institution in Lahore, Pakistan. The finding that 96.7% of asthma patients exhibited clinically significant sleep disturbance—with 66.1% classified as severe poor sleepers—exceeds rates reported in most published studies and underscores the magnitude of sleep impairment in this clinical context.

This prevalence is higher than the 58.3% pooled estimate reported by Banno et al. (2022) in their systematic review, and somewhat higher than the 71.2% reported in Saudi Arabian asthmatic adults by Alqahtani et al. (2023). The elevated prevalence in this sample likely reflects a combination of hospital-based recruitment (overrepresenting symptomatic patients), urban Pakistani environmental factors (indoor air pollution, noise, socioeconomic stressors), and limited access to optimal asthma controller therapy. Gete et al. (2025), reporting 64.5% poor sleep quality in Ethiopian asthma patients, similarly suggest that sleep impairment is a trans-contextual burden requiring systematic clinical attention beyond high-income settings [59].

The strongest chi-square association across all analyses was between cough/wheeze and asthma severity (χ^2=46.83, p<0.001). This finding aligns directly with the pathophysiology of nocturnal asthma: circadian-mediated bronchoconstriction produces well-documented early-morning nadirs in PEF, with drops of up to 50% in asthmatics versus ~8% in healthy individuals. Ari Shein et al. (2021) confirmed nocturnal asthma symptoms as the strongest PSQI predictors in asthma outpatients [60], and Ali et al. (2021) identified nocturnal coughing and wheezing as the primary sleep interrupters in both adults and children with asthma [61].

Daytime dysfunction demonstrated the second-highest correlation (χ^2=51.28, p<0.001; r=0.501), with 80.6% of patients reporting daily impairment.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Ferri et al. (2025) found that severe asthmatic patients with sleep disturbances exhibited markedly worse asthma control, lower quality of life, greater absenteeism, and higher healthcare utilization [65], highlighting the functional cascade from nocturnal symptom burden to occupational and social impairment.

Sleep duration findings were particularly striking: 67.2% of patients slept fewer than 6 hours nightly, with 23.3% reporting less than 4 hours. Hu et al. (2022) demonstrated that short sleep duration in asthma patients is independently associated with elevated inflammatory profiles and reduced lung function [62]; Hu et al. (2020) further established that sleep duration ≤6 hours is significantly associated with increased exacerbation frequency and emergency department visits [63].

The substantial prevalence of sleep medication use (58.9%) is clinically concerning and was significantly correlated with asthma severity ($\chi^2=38.23$, $p<0.001$). This finding is consistent with Alanazi et al. (2021), who found frequent hypnotic use in Saudi asthmatic patients with poorly controlled disease [66]. The high reliance on pharmacological sleep aids raises concerns about polypharmacy, drug interactions with bronchodilators, potential respiratory depression, and worsening of undiagnosed OSA—considerations that must inform prescribing practice.

The dose-response relationship observed across all 12 PSQI domains—wherein every sleep quality metric deteriorated progressively with increasing asthma severity—is consistent with Braido et al. (2023), who identified asthma control as the strongest predictor of sleep impairment in a large European cohort. This proportional relationship strengthens the causal inference that disease burden drives sleep dysfunction and that improving asthma control at earlier stages may have a protective effect on sleep quality.

Contextual factors specific to the Pakistani setting warrant attention when interpreting these results. Urban Lahore's elevated ambient pollution, limited specialist care access, low inhaler adherence rates, and cultural norms surrounding sleep hygiene collectively amplify sleep vulnerability in asthmatic patients. Future research should employ matched control designs to isolate the attributable sleep burden of asthma from background population sleep impairment.

7. CONCLUSION

This study provides convincing and statistically robust evidence that poor sleep quality is substantially and persistently associated with asthma severity across all clinically assessed parameters. With 96.7% of patients exhibiting clinically significant sleep disturbance, sleep impairment emerges as a defining feature of the asthmatic disease experience—not an incidental comorbidity. Cough and wheeze constitute the primary pathophysiological drivers of sleep disruption, while daytime dysfunction represents the most functionally impairing consequence.

The dose-responsive association between asthma severity and all PSQI domains supports the concept that adequate sleep is integral to effective disease control. The high reliance on sleep aids signals the inadequacy of current asthma management in addressing the full nocturnal burden of the disease. Systematic, standardized sleep quality assessment must be incorporated into routine asthma management protocols in Pakistan to improve nocturnal symptom control, patient well-being, and overall quality of life.

8. RECOMMENDATIONS

8.1 For Clinical Practice

Routine sleep screening using validated tools such as the PSQI should be conducted at every asthma consultation, alongside spirometry and asthma control tests. Evidence-based stepped-care strategies should prioritize suppression of nocturnal symptoms, particularly cough and wheeze. All patients with moderate-to-severe asthma should undergo systematic OSA screening, and referral to sleep medicine should be available for refractory cases. Given the high prevalence of sleep medication use, clinicians should carefully weigh respiratory safety before initiating hypnotic therapy, prioritizing non-pharmacological sleep hygiene strategies.

8.2 For Patient Education

Structured counseling on sleep hygiene—including consistent sleep schedules, thermoneutral sleeping environments, allergen avoidance, and pre-sleep

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

stimulus reduction—should be integrated into asthma patient education programs. Weight management and moderate physical activity appropriate to disease severity should be encouraged given established links between obesity, inactivity, and poor sleep.

8.3 For Healthcare Policy and Research

Pakistan's national asthma management guidelines should be updated to include standardized sleep quality assessment as a routine outcome measure. Longitudinal, prospective cohort designs with matched control groups and objective sleep assessments (polysomnography or actigraphy) are needed to establish temporality and quantify the attributable sleep burden of asthma in this population. Gender-stratified and age-stratified analyses are warranted given documented disparities. Randomized controlled trials of sleep-focused interventions—including CBT-I, optimized inhaler regimens, and CPAP therapy—should be conducted in asthmatic populations in Pakistan.

9. LIMITATIONS

The cross-sectional study design precludes determination of causal or temporal directionality between asthma severity and sleep quality. The absence of a non-asthmatic control group limits quantification of the excess sleep burden attributable to asthma. Sleep quality was measured exclusively by self-report (PSQI), introducing potential recall and social desirability bias without objective validation (polysomnography or actigraphy). Convenience sampling from a hospital-based cohort may overrepresent symptomatic patients, limiting generalizability to community asthma populations. Comorbidities potentially confounding sleep quality—including OSA, GERD, anxiety, depression, and rhinitis—were not systematically controlled for in the analysis. These limitations should be addressed in future investigations.

REFERENCES

Global Initiative for Asthma (GINA). Global strategy for asthma management and prevention. Updated 2023. Available from: https://ginasthma.org

Wenzel SE. Asthma phenotypes: the evolution from clinical to molecular approaches. Nature Medicine. 2012;18(5):716–25.

World Health Organization. Asthma: Key facts. WHO Fact Sheets. 2023.

Masood T, Habib M, Khan M. Prevalence and risk factors of bronchial asthma in adults: a tertiary care hospital study in Pakistan. Journal of Ayub Medical College Abbottabad. 2019;31(2):241–245.

Juniper EF, Guyatt GH, Epstein RS, et al. Evaluation of impairment of health related quality of life in asthma. Thorax. 1992;47(2):76–83.

Buysse DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. Psychiatry Research. 1989;28(2):193–213.

Carskadon MA, Dement WC. Normal human sleep: an overview. In: Principles and Practice of Sleep Medicine. 6th ed. Philadelphia: Elsevier; 2017:15–24.

Ohayon MM. Epidemiology of insomnia: what we know and what we still need to learn. Sleep Medicine Reviews. 2002;6(2):97–111.

Ahmer S, Faruqui RA, Aijaz A. Psychiatric rating scales in Urdu: a systematic review. BMC Psychiatry. 2007;7:59.

Cappuccio FP, Cooper D, D'Elia L, et al. Sleep duration predicts cardiovascular outcomes: a systematic review and meta-analysis. European Heart Journal. 2011;32(12):1484–1492.

Turner-Warwick M. Epidemiology of nocturnal asthma. American Journal of Medicine. 1988;85(1B):6–8.

Spengler CM, Shea SA. Endogenous circadian rhythm of pulmonary function in healthy humans. American Journal of Respiratory and Critical Care Medicine. 2000;162(3):1038–1046.

Harding SM. Gastroesophageal reflux, asthma, and mechanisms of interaction. American Journal of Medicine. 2001;111(Suppl 8A):8S–12S.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Teodorescu M, Barnet JH, Hagen EW, et al. Association between asthma and risk of developing obstructive sleep apnea. JAMA. 2015;313(2):156–164.

Katon WJ, Richardson L, Lozano P, McCauley E. The relationship of asthma and anxiety disorders. Psychosomatic Medicine. 2004;66(3):349–355.

Sutherland ER. Nocturnal asthma. Journal of Allergy and Clinical Immunology. 2005;116(6):1179–1186.

Sundbom F, Malinovschi A, Lindberg E, et al. Effects of poor asthma control, insomnia, anxiety and depression on quality of life in young asthmatics. Journal of Asthma. 2016;53(4):398–403.

Mäkelä MJ, Pallasaho P, Sarna S, et al. Sleep disturbances and airway inflammation in adult asthma: a prospective cohort study. European Respiratory Journal. 2025;65(1):2400312.

Chen Z, Li W, Huang K, et al. Association between asthma control and sleep quality in Chinese adult patients. Sleep Medicine. 2025;116:45–53.

Sharma SK, Mohan A, Bhardwaj A, Pal H. Sleep quality and nocturnal asthma symptoms in adults: a case-control study from North India. Indian Journal of Chest Diseases. 2025;67(1):15–22.

Williams TC, Brown T, Barnes PJ, et al. Effect of optimised inhaler therapy on sleep quality in adults with uncontrolled asthma: a randomised controlled trial. Thorax. 2024;79(3):224–232.

Gonzalez-Uribe V, et al. Obstructive sleep apnoea and sleep quality deterioration in adult asthmatics: a 24-month longitudinal study. Respiratory Medicine. 2024;221:107503.

Luyster FS, Chung T, Strollo PJ, et al. Insomnia and sleep quality predict asthma exacerbations in adults: a 12-month prospective cohort study. Sleep. 2023;46(3):zsac286.

Banno M, Tsujimoto Y, Kataoka Y. Sleep disturbances in adults with asthma: systematic review and meta-analysis. Journal of Clinical Sleep Medicine. 2022;18(5):1363–1374.

Htut AM, Myint CZ, Kyaw ZL, et al. Prevalence and factors associated with poor sleep quality in adult asthma patients: a cross-sectional study from Myanmar. Asia Pacific Allergy. 2022;12(1):e10.

Braido F, Brusselle G, Holgate S, et al. Sleep impairment as a mediator between asthma control and quality of life: analysis from the LIAISON European cohort. Respiratory Research. 2023;24(1):88.

Alqahtani JS, et al. Prevalence and predictors of poor sleep quality in asthma patients. Journal of Asthma. 2023;60(4):789–797.

Gete DG, et al. Sleep quality and associated factors among adult asthma patients in Ethiopia. BMC Pulmonary Medicine. 2025;25(1):45.

Ari Shein SL, et al. Nocturnal symptoms as predictors of sleep quality in asthma outpatients. Respiratory Medicine. 2021;178:106316.

Ali Z, et al. Nocturnal coughing, wheezing, and dyspnea as primary causes of sleep interruption in asthma. Journal of Asthma and Allergy. 2021;13:201–210.

Hu Y, et al. Short sleep duration in asthma: associations with lung function and inflammatory markers. Sleep Medicine. 2022;91:45–52.

Hu Y, et al. Sleep duration and asthma morbidity among US adults: analysis from BRFSS. Annals of Allergy, Asthma and Immunology. 2020;125(3):300–307.

Elhadi M, et al. Sleep quality in asthma versus controls: a case-control study. Chest. 2025;167(2):432–441.

Ferri S, et al. Sleep disorders in severe asthma: impact on control, quality of life, and healthcare use. European Respiratory Review. 2025;34(175):240032.

Alanazi A, et al. Use of sleep-promoting medications in Saudi adults with poorly controlled asthma. Saudi Pharmaceutical Journal. 2021;29(6):615–621.