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Original research article

Sleep and delirium in hospitalized patients: a four-day multicenter cross-sectional study in general wards

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Abstract
Introduction: Poor sleep quality is a risk factor for delirium in hospitalized patients.
Objective: To assess the association between subjective sleep quality and delirium, and to analyze pharmacotherapy during hospitalization.
Methods: A multicenter cross sectional study was conducted from June 2023 to March 2024 in seven general wards in the Czech Republic. The sample included 254 patients. Delirium was assessed daily using the Confusion Assessment Method short form. Sleep quality was evaluated on days 2 to 4 using the Richards–Campbell Sleep Questionnaire.
Results: Patients with delirium had longer hospital stays (8.25 vs 7.12 days), higher alcohol consumption ($p < 0.001$; tau = 0.242), and were more often admitted to medical wards (55.1%; $p < 0.001$; tau = 0.223). Total sleep scores were significantly lower in delirium patients, with the largest difference on night one (60.3 ± 26.2 vs 30.5 ± 23.9; $p < 0.001$). The total score showed the best discriminative ability (Youden index 0.369 and 0.279), whereas individual items were insufficient. Patients with delirium used more medications ($p < 0.001$), mainly antipsychotics and neuroleptics; benzodiazepines were not associated except clonazepam.
Conclusion: Delirium was associated with poorer sleep quality and higher antipsychotic use. Individual Richards–Campbell Sleep Questionnaire items showed limited ability to reliably distinguish sleep quality, particularly among delirium patients.

Keywords: Cross-Sectional Studies; Delirium; Hospitalization; Sleep; Surveys and Questionnaires

Introduction

Delirium is a common and serious condition in hospitalized patients, characterized by sudden, usually reversible impairments in attention, cognition, and consciousness, often with a fluctuating course (Huang, 2025). It predominantly affects older adults, with at least 10% of patients over 65 experiencing delirium during hospitalization (Inouye et al., 2014). Postoperative delirium occurs in 15–50% of older surgical patients and is more frequent after major surgery or in intensive care units (ICUs), affecting up to 80% of mechanically ventilated patients (Fenta et al., 2025; Liu et al., 2024). Delirium is associated with prolonged hospital stays, increased mortality, and risk of long-term cognitive impairment (Brennan et al., 2023). Sleep disturbance is both a risk factor and a consequence of delirium. Poor sleep can disrupt neurotransmitter balance, particularly acetylcholine and dopamine, contributing to delirium development (Farasat et al., 2020). Objective and subjective measures indicate that short or fragmented sleep and low self-rated sleep quality increase delirium risk, while delirium itself disrupts the sleep-wake cycle (Jaiswal et al., 2021; Maldonado, 2018; Nameth et al., 2024; Zheng et al., 2023). For nursing practice, assessing subjective sleep quality is essential for early identification of at-risk patients. Nurses play a key role in monitoring sleep, implementing sleep-promoting interventions, and observing cognitive changes, which can help prevent delirium and improve patient outcomes (Szewczak et al., 2025).

The primary objective of the present study was to investigate the relationship between subjective sleep quality and the presence of delirium. The second objective was to determine the discriminative ability of the Richards–Campbell Sleep Questionnaire items with respect to subjectively perceived

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sleep quality and the presence or absence of delirium. Finally, we aimed to analyze medications used to treat delirium in hospitalized patients.

Materials and methods

Design
A multicenter cross-sectional study.

Sample size estimation
To determine the required sample size, the following formula suitable for cross-sectional studies was used: $(Z\alpha/2)^2 \times p \times (1-p)/d^2$. Assuming a 95% confidence interval (Z = 1.96), an estimated prevalence of the phenomenon of interest (delirium) of 20% ($p = 0.2$), and a maximum allowable relative estimation error of 6.2% (d = 0.062), the minimum required sample size is 160 participants. This is based on the recommendations for sample size calculation in medical research (Charan and Biswas, 2013). Due to the time period specified (10 months of data collection), the sample size was exceeded.

Sample
The study was conducted between June 2023 and March 2024 and included 254 patients from general medical, surgical, and neurological wards in seven hospitals in the Czech Republic. Inclusion criteria were age ≥18 years and hospital stay >96 hours. Patients were excluded if they had a Glasgow Coma Scale (GCS) score <12, terminal illness, pre-existing or treated sleep disorder, dementia, or a hospital stay shorter than 96 hours.

Measurement and data collection
Patient demographics and clinical data were recorded on admission and during hospitalization, including age, sex, prior hospitalization, ward type, admission type, surgery, main diagnosis, alcohol use, smoking. Finally, the patient's total length of stay on the ward was added to the record.

Confusion Assessment Method (CAM) Short Form. An individual record was kept for each patient that contained the study day number and patient identification data. Additionally, GCS scores and VAS pain scores were recorded at a specific time of day (7 a.m. to 9 a.m.) starting from admission. The form also contained information on the use of physical restraints (initiation and termination dates) and on medication to treat delirium, if administered.

Four features typical of delirium were assessed by trained nurses: (1) acute change or fluctuation in mental status, (2) attentional impairment, (3) alteration in the level of thinking, (4) alteration of consciousness – the presence of somnolence, stupor, or coma. The original CAM questionnaire (Inouye et al., 1990) has been validated in the Czech Republic (Topinková and Neuwirth, 1995).

Sleep quality was assessed using the Richards–Campbell Sleep Questionnaire (RCSQ), a validated tool consisting of five items scored 0–100 (higher scores indicate better sleep). Patients completed the RCSQ each morning between 7 a.m. and 9 a.m. on Days 2–4; for patients with delirium, assessments were performed by night shift nurses (Lochihová et al., 2019). Permission to use the tool was obtained from the author (Richards et al., 2000).

Ethical aspects
The study was conducted in accordance with the Declaration of Helsinki and was approved by the Ethics Committee of the Faculty of Medicine of the University of Ostrava (No. R2/2021), the Ethics Committee of the University Hospital Ostrava (No. 524/21), and the Ethics Committee of the General University Hospital in Prague (No. 54/21; grant project AVZ VES 2022 VFN). The study is registered in the ClinialTrials.gov database (ID: NCT05402280).

Data analysis
Descriptive statistics (mean, frequencies, percentages) were used to evaluate the data and characterize the study sample. Relationships between the study periods and metric or dichotomous variables, as well as the association between the presence of delirium and sleep quality on each study day, were analyzed using robust Kendall's tau correlations. The analyses were performed using NCSS statistical software, version 12.0.18 (NCSS, LLC, Kaysville, UT, USA). The diagnostic power of the tests (binary discriminative power) was determined by calculating the area under the ROC curve (AUC) using the Youden index, with the level of statistical significance set at $p < 0.05$. This statistical analysis was performed using Statgraphics Centurion XV software, version 12.2.06 (Statpoint Technologies, Inc., Warrenton, VA, USA).

Results

Patients with delirium had longer hospital stays (8.25 vs. 7.12 days; $p < 0.001$), higher alcohol consumption ($p < 0.001$; $\tau = 0.242$), and slightly higher pain levels ($p < 0.001$; $\tau = 0.11$). Delirium was more frequent in medical wards (55.1%; $p < 0.001$), while age, sex, smoking, surgery, and main diagnoses did not differ significantly between groups (Table 1).

Across all three nights, patients without delirium consistently had higher RCSQ scores than those with delirium, indicating better sleep quality. The largest differences were observed on the first night, with total scores of 60.3 ± 26.2 versus 30.5 ± 23.9 ($p < 0.001$). Differences persisted on the second (65.3 ± 25.3 vs. 43.7 ± 25; $p < 0.001$) and third nights, albeit less pronounced (e.g., sleep quality 69.2 ± 27.7 vs. 57.7 ± 24.9; $p < 0.001$). Kendall's tau correlations confirmed moderately strong negative associations between delirium and sleep quality, and perceived noise levels were higher in delirium patients across all nights (Table 2).

The discriminative ability of individual RCSQ items was generally low in both groups. In patients without delirium, cut-off values and Youden indices were higher, with the total score (cut-off ≥ 54.0; Youden index = 0.348) showing the greatest discriminative ability (Table 3). In delirium patients, discriminative ability was lower, with Youden indices ranging from 0.217 to 0.279; the total score (cut-off ≥ 42.6; Youden index = 0.279; AUC = 0.672) remained the most informative (Table 4).

Overall medication use was significantly higher in delirium patients ($p < 0.001$) and showed an upward trend over the study period (Day 1: 93.3%; Day 4: 103.1%). Antipsychotics and neuroleptics, particularly tiapride, risperidone, and quetiapine, were administered more frequently to delirium patients ($p < 0.001$), as were some hypnotics (e.g., melperone, clomethiazole). Benzodiazepines were generally not associated with delirium, except for clonazepam (Day 1: $p = 0.018$; Day 4: $p = 0.005$). Antidepressant use did not differ between groups ($p > 0.05$) (Table 5).

Table 1. Characteristics of patients with and without delirium on Day 1 of their hospital stay

Characteristics	Total (n = 254)	Non-delirium (n = 165)	Delirium (n = 89)	p-value	Kendall's tau
Age (years), mean ± SD	63.0 ± 15.9	61.7 ± 15.1	65.4 ± 17	0.077	0.0918 (0.0101, 0.172)
Length of hospital stay (days), mean ± SD	7.52 ± 2.64	7.12 ± 2.67	8.25 ± 2.41	**<0.001**	–0.272 (–0.346, –0.194)
Alcohol use, mean ± SD	1.01 ± 0.61	0.852 ± 0.481	1.130 ± 0.773	**<0.001**	0.242 (0.1612, 0.221)
Consciousness (GCS), mean ± SD	14.65 ± 1.35	15.00 ± 1.15	14 ± 1.45	**0.05**	–0.961 (–0.967, –0.954)
Pain (VAS), mean ± SD	1.92 ± 1.81	1.78 ± 1.81	2.17 ± 1.78	**<0.001**	0.11 (0.0284, 0.19)
Sex					
Male, n (%)	129 (50.8)	76 (46.1)	53 (59.6)	0.392	0.0539 (–0.028, 0.135)
Female, n (%)	125 (49.2)	89 (53.9)	36 (40.4)		
Ward					
Medical, n (%)	102 (40.2)	53 (32.1)	49 (55.1)	**<0.001**	0.223 (0.144, 0.3)
Surgical, n (%)	127 (50.0)	91 (55.2)	36 (40.4)	0.026	–0.14 (–0.22, –0.0592)
Neurological, n (%)	25 (9.8)	21 (12.7)	4 (4.5)	0.036	–0.132 (–0.211, –0.0506)
Surgery, n (%)	103 (40.6)	71 (43.0)	32 (36.0)	0.275	–0.0687 (–0.15, –0.0131)
Previous hospitalization, n (%)	181 (71.3)	111 (67.3)	70 (78.7)	**<0.001**	–0.429 (–0.494, –0.36)
Acute admission, n (%)	180 (70.9)	114 (69.1)	66 (74.2)	0.398	–0.0532 (–0.134, 0.0287)
Smoking, n (%)	124 (48.8)	76 (46.1)	48 (53.9)	0.233	0.0751 (–0.0067, 0.156)
Restraints, n (%)	42 (16.5)	0 (0)	42 (47.2)	**<0.001**	0.606 (0.552, 0.655)
ICD-10 diagnoses					
A, B – infectious and parasitic diseases, n (%)	0 (0)	0 (0)	0 (0)	–	–
C – neoplasms, n (%)	16 (6.3)	11 (6.7)	5 (5.6)	0.745	–0.0206 (–0.102, 0.0613)
D – diseases of the blood, n (%)	5 (1.9)	3 (1.8)	2 (2.2)	0.818	0.0147 (–0.0671, 0.0964)
E – endocrine diseases, n (%)	8 (3.1)	4 (2.4)	4 (4.5)	0.37	0.0565 (–0.0253, 0.138)
F – mental disorders, n (%)	2 (0.8)	0 (0)	2 (2.2)	0.054	0.121 (0.0399, 0.201)
G – diseases of the nervous system, n (%)	18 (7.1)	15 (9.1)	3 (3.4)	0.091	–0.106 (–0.187, –0.0248)
H – diseases of the eye and ear, n (%)	0 (0)	0 (0)	0 (0)	–	–
I – diseases of the circulatory system, n (%)	77 (30.1)	45 (27.9)	32 (36.0)	0.184	0.0835 (0.0018, 0.164)
J – diseases of the respiratory system, n (%)	58 (23.2)	41 (25.5)	17 (19.1)	0.254	–0.01718 (–0.153, 0.01)
K – diseases of the digestive system, n (%)	29 (11.4)	14 (8.5)	15 (16.9)	0.046	0.126 (0.0442, 0.205)
L – diseases of the skin, n (%)	0 (0)	0 (0)	0 (0)	–	–
M – diseases of the musculoskeletal system and connective tissue, n (%)	17 (6.7)	15 (9.1)	2 (2.2)	0.038	–0.131 (–0.21, –0.0494)
N – diseases of the genitourinary system, n (%)	5 (1.9)	5 (3.0)	0 (0)	0.099	–0.104 (–0.184, –0.0225)
R – abnormal clinical findings, n (%)	3 (1.2)	2 (1.2)	1 (1.1)	0.954	–0.0039 (–0.0856, 0.0779)
S – injuries, accidents, n (%)	16 (6.3)	11 (6.7)	5 (5.6)	0.745	–0.0206 (–0.102, 0.0613)

Note: SD – Standard Deviation; VAS – Visual Analogue Scale

Table 2. RCSQ scores on the nights studied with regard to delirium

Characteristics	Total	Non-delirium	Delirium	p-value	Kendall's tau
Night 1	n = 254	n = 165	n = 89		
Sleep depth, mean ± SD	43.00 ± 26.04	55.7 ± 28.1	30.3 ± 23.8	**<0.001**	–0.364 (–0.433, –0.291)
Sleep latency, mean ± SD	45.75 ± 26.95	63.2 ± 29.2	28.3 ± 24.7	**<0.001**	–0.437 (–0.501, –0.369)
Awakenings, mean ± SD	42.50 ± 25.95	59.8 ± 26.5	30.6 ± 25.4	**<0.001**	–0.407 (–0.473, –0.336)
Return to sleep, mean ± SD	46.65 ± 28.55	62.2 ± 30.6	31.1 ± 26.5	**<0.001**	–0.381 (–0.449, –0.309)
Sleep quality, mean ± SD	46.60 ± 28.20	60.9 ± 29.5	32.3 ± 26.9	**<0.001**	–0.365 (–0.434, –0.292)
RCSQ Total, mean ± SD	45.40 ± 25.05	60.3 ± 26.2	30.5 ± 23.9	**<0.001**	–0.41 (–0.476, –0.34)
Noise, mean ± SD	70.55 ± 27.75	78.0 ± 26.1	63.1 ± 29.4	**<0.001**	–0.237 (–0.313, –0.159)
Night 2	n = 254	n = 150	n = 104		
Sleep depth, mean ± SD	52.30 ± 27.25	63.2 ± 28.4	41.4 ± 26.3	**<0.001**	–0.308 (–0.38, –0.232)
Sleep latency, mean ± SD	53.25 ± 27.58	65.7 ± 28.9	40.8 ± 26.2	**<0.001**	–0.341 (–0.411, –0.266)
Awakenings, mean ± SD	54.15 ± 25.95	64.2 ± 25.8	44.1 ± 26.1	**<0.001**	–0.302 (–0.375, –0.226)

Table 2. (*continued*)					
Characteristics	Total	Non-delirium	Delirium	*p*-value	Kendall's tau
	n = 254	*n* = 150	*n* = 104		
Return to sleep, mean ± SD	56.50 ± 28.70	67.4 ± 28.7	45.6 ± 28.7	**<0.001**	−0.294 (−0.367, −0.217)
Sleep quality, mean ± SD	56.20 ± 28.00	66.0 ± 28.2	46.4 ± 27.8	**<0.001**	−0.276 (−0.35, −0.199)
RCSQ Total, mean ± SD	54.50 ± 25.15	65.3 ± 25.3	43.7 ± 25.0	**<0.001**	−0.324 (−0.395, −0.249)
Noise, mean ± SD	75.95 ± 24.77	81.9 ± 22.9	70.0 ± 26.5	**<0.001**	−0.235 (−0.31, −0.156)
Night 3	*n* = 254	*n* = 178	*n* = 76		
Sleep depth, mean ± SD	59.65 ± 25.01	64.8 ± 25.8	54.5 ± 24.2	0.002	−0.168 (−0.246, −0.0872)
Sleep latency, mean ± SD	58.20 ± 26.00	64.8 ± 25.8	51.6 ± 26.2	**<0.001**	−0.222 (−0.299, −0.143)
Awakenings, mean ± SD	60.70 ± 25.65	66.8 ± 25.8	54.6 ± 25.5	**<0.001**	−0.19 (−0.268, −0.11)
Return to sleep, mean ± SD	62.35 ± 27.06	67.0 ± 27.9	57.7 ± 26.2	0.006	−0.145 (−0.224, −0.0638)
Sleep quality, mean ± SD	63.45 ± 26.34	69.2 ± 27.7	57.7 ± 24.9	**<0.001**	−0.192 (−0.269, −0.112)
RCSQ Total, mean ± SD	64.10 ± 18.16	73.0 ± 10.8	55.2 ± 23.3	**<0.001**	−0.194 (−0.272, −0.114)
Noise, mean ± SD	78.85 ± 24.10	81.9 ± 23.7	75.8 ± 24.5	0.002	−0.165 (−0.243, −0.084)

Note: SD – Standard Deviation; RCSQ – Richards–Campbell Sleep Questionnaire

Table 3. Discriminative ability of RCSQ items in patients without delirium – ROC analysis results

RCSQ items	mean ± SD	Cut-off value	Youden index	AUC (SE)	*p*-value	Sensitivity	Specificity
Sleep depth	61.2 ± 4.9	≥52.00	0.305	0.701 ± 0.0180	<0.001	0.737 (0.703, 0.769)	0.769 (0.568, 0.510)
Sleep latency	64.6 ± 1.3	≥47.00	0.348	0.732 ± 0.0174	<0.001	0.775 (0.742, 0.805)	0.805 (0.595, 0.537)
Awakenings	63.6 ± 3.5	≥53.00	0.334	0.709 ± 0.0181	<0.001	0.766 (0.734, 0.797)	0.797 (0.568, 0.510)
Return to sleep	65.5 ± 2.9	≥60.00	0.323	0.694 ± 0.0181	<0.001	0.666 (0.630, 0.700)	0.700 (0.658, 0.601)
Sleep quality	65.4 ± 4.2	≥53.00	0.321	0.694 ± 0.0181	<0.001	0.697 (0.661, 0.730)	0.730 (0.625, 0.567)
RCSQ Total	66.2 ± 6.4	≥54.00	0.369	0.720 ± 0.0179	<0.001	0.704 (0.669, 0.737)	0.737 (0.645, 0.588)
Noise	80.6 ± 2.3	≥86.00	0.231	0.638 ± 0.0186	<0.001	0.576 (0.539, 0.613)	0.613 (0.655, 0.598)

Note: ROC – Receiver Operating Characteristic; RCSQ – Richards–Campbell Sleep Questionnaire

Table 4. Discriminative ability of RCSQ items in patients with delirium – ROC analysis results

RCSQ items	mean ± SD	Cut-off value	Youden index	AUC (SE)	*p*-value	Sensitivity	Specificity
Sleep depth	42.1 ± 12.1	≥38.00	0.242	0.638 ± 0.0185	<0.001	0.509 (0.480, 0.712)	0.537 (0.660, 0.712)
Sleep latency	40.2 ± 11.7	≥33.00	0.261	0.647 ± 0.0199	<0.001	0.644 (0.569, 0.662)	0.682 (0.618, 0.561)
Awakenings	43.1 ± 12.0	≥38.00	0.238	0.663 ± 0.0199	<0.001	0.531 (0.479, 0.513)	0.583 (0.770, 0.676)
Return to sleep	44.8 ± 13.3	37.00	0.217	0.637 ± 0.0207	<0.001	0.783 (0.733, 0.822)	0.819 (0.439, 0.386)
Sleep quality	45.5 ± 12.7	≥40.00	0.246	0.661 ± 0.0199	<0.001	0.691 (0.657, 0.724)	0.737 (0.561, 0.526)
RCSQ Total	43.1 ± 12.4	≥42.60	0.279	0.672 ± 0.1200	<0.001	0.714 (0.662, 0.741)	0.701 (0.658, 0.744)
Noise	69.6 ± 6.4	≥73.00	0.219	0.644 ± 0.0189	<0.001	0.689 (0.657, 0.729)	0.731 (0.521, 0.461)

Note: ROC – Receiver Operating Characteristic; RCSQ – Richards–Campbell Sleep Questionnaire

Table 5. Delirium treatment-related medications used during the study period

Characteristics	Total	Non-delirium	Delirium	*p*-value	Kendall's tau
Day 1	*n* = 254	*n* = 165	*n* = 89		
Overall medication use	124 (48.8)	41 (24.8)	83 (93.3)	<0.001	0.545 (0.432, 0.666)
Benzodiazepines – all, *n* (%)	33 (13.0)	23 (13.9)	10 (11.2)	0.834	–0.013 (–0.0711, 0.0968)
Non-benzodiazepine hypnotics – zolpidem, *n* (%)	8 (3.1)	7 (4.2)	1 (1.1)	0.176	–0.0852 (–0.166, –0.0035)
Other hypnotics – melperone, *n* (%)	12 (4.7)	0 (0)	12 (13.5)	<0.001	0.303 (0.227, 0.376)
Psychopharmaceuticals – clomethiazole, *n* (%)	11 (4.3)	1 (0.6)	10 (11.2)	<0.001	0.249 (0.171, 0.324)
Antidepressants – all, *n* (%)	12 (4.7)	6 (3.6)	6 (6.7)	0.353	–0.025 (–0.0821, 0.0678)
Antipsychotics – quetiapine, *n* (%)	8 (3.1)	1 (0.6)	7 (7.9)	0.002	0.198 (0.119, 0.276)
Neuroleptics – all, *n (%)*	*38 (15.0)*	*2 (1.2)*	*36 (40.4)*	<0.001	0.557 (0.443, 0.729
Antihistamines – all, *n* (%)	2 (0.8)	1 (0.6)	1 (1.1)	0.468	–0.0462 (–0.128, 0.0357)
Day 2	*n* = 254	*n* = 150	*n* = 104		
Overall medication use	152 (59.8)	39 (26.0)	113 (108.6)	<0.001	0.604 (0.549, 0.653)
Benzodiazepines – all, *n* (%)	36 (14.2)	22 (14.7)	14 (13.5)	0.166	0.0871 (0.0054, 0.168)
Non-benzodiazepine hypnotics – zolpidem, *n* (%)	7 (2.6)	6 (4.0)	1 (1.0)	0.147	–0.0913 (–0.172, –0.0096)
Other hypnotics – melperone, *n* (%)	16(6.3)	2 (1.3)	14 (13.5)	<0.001	0.246 (0.167, 0.321)
Psychopharmaceuticals – clomethiazole, *n* (%)	13 (5.1)	0 (0)	13 (12.5)	<0.001	0.279 (0.202, 0.353)
Antidepressants – all, *n* (%)	12 (4.7)	6 (4.0)	6 (5.8)	0.516	0.041 (–0.0409, 0.122)
Antipsychotics – quetiapine, *n* (%)	13 (5.1)	0 (0)	13 (12.5)	<0.001	0.649 (0.599, 0.694)
Neuroleptics – all, *n* (%)	54 (21.2)	3 (2.0)	51 (49.0)	<0.001	0.246 (0.167, 0.321)
Antihistamines – all, *n* (%)	1 (0.4)	0 (0)	1 (1.0)	0.233	0.0755 (–0.0063, 0.156)
Day 3	*n* = 254	*n* = 178	*n* = 76		
Overall medication use	161 (63.4)	72 (40.4)	89 (117.1)	<0.001	0.666 (0.618, 0.709)
Benzodiazepines – all, *n* (%)	38 (14.9)	27 (15.2)	11 (14.5)	0.389	0.0542 (–0.0277, 0.135)
Non-benzodiazepine hypnotics – zolpidem, *n* (%)	8 (3.1)	8 (4.5)	0 (0)	0.061	–0.118 (–0.198, –0.0364)
Other hypnotics – melperone, *n* (%)	18 (7.1)	5 (2.8)	13 (17.1)	<0.001	0.255 (0.177, 0.33)
Psychopharmaceuticals – clomethiazole, *n* (%)	13 (5.1)	3 (1.7)	10 (13.2)	<0.001	0.238 (0.16, 0.314)
Antidepressants – all, *n* (%)	14 (5.5)	8 (4.5)	6 (7.9)	0.279	0.0682 (–0.0136, 0.149)
Antipsychotics – quetiapine, *n* (%)	16 (6.3)	4 (2.2)	12 (15.8)	<0.001	0.574 (0.516, 0.626)
Neuroleptics – all, *n* (%)	52 (20.5)	15 (8.4)	37 (48.7)	<0.001	0.255 (0.177, 0.33)
Antihistamines – all, *n* (%)	2 (0.8)	2 (1.1)	0 (0)	0.358	–0.0582 (–0.139, 0.0237)
Day 4	*n* = 254	*n* = 222	*n* = 32		
Overall medication use	141 (55.5)	108 (48.6)	33 (103.1)	<0.001	0.29 (0.213, 0.363)
Benzodiazepines – all, *n* (%)	41 (16.1)	31 (14.0)	10 (3.2)	0.084	0.109 (0.0271, 0.189)
Non-benzodiazepine hypnotics – zolpidem, *n* (%)	7 (2.8)	7 (3.2)	0 (0)	0.312	–0.0639 (–0.145, 0.0179)
Other hypnotics – melperone, *n* (%)	12 (4.7)	10 (4.5)	2 (6.3)	0.667	0.0273 (–0.0546, 0.109)
Psychopharmaceuticals – clomethiazole, *n* (%)	10 (3.9)	8 (3.6)	2 (6.3)	0.475	0.0452 (–0.0367, 0.127)
Antidepressants – all, *n* (%)	14 (5.5)	13 (5.6)	1 (3.1)	0.530	–0.0397 (–0.121, 0.0422)
Antipsychotics – quetiapine, *n* (%)	13 (5.1)	8 (3.6)	5 (15.6)	0.004	0.181 (0.101, 0.259)
Neuroleptics – all, *n* (%)	42 (16.6)	29 (13.1)	13 (40.1)	0.667	0.0273 (–0.0546, 0.109)
Antihistamines – all, *n* (%)	2 (0.8)	2 (0.9)	0 (0)	0.596	–0.0338 (–0.115, 0.0481)

Discussion

The main finding of our study is that patients with delirium had significantly poorer sleep quality than those without delirium, and this difference persisted throughout hospitalization. The RCSQ items demonstrated only moderate discriminative ability, which was further reduced in patients with delirium. Delirium was also associated with a higher overall pharmacological burden. Antipsychotics and neuroleptics were most commonly used, while benzodiazepines as a class showed no clear association with delirium, except for clonazepam, which was administered more frequently in delirium patients.

Available evidence from observational and interventional studies indicates a complex, bidirectional relationship between sleep disturbances and delirium in hospitalized patients (Jaiswal et al., 2021; Zheng et al., 2023). In our study, patients with delirium consistently reported poorer sleep quality throughout hospitalization, supporting the assumption that delirium and sleep disruption mutually reinforce each other. It should be noted that in delirious patients, sleep was assessed by night-shift nurses, which may have influenced comparability with self-reported data.

Our findings are consistent with data from a large prospective cohort (UK Biobank; n > 320,000), demonstrating that higher sleep burden – defined by short or prolonged sleep duration, insomnia, daytime sleepiness, and chronotype – is independently associated with an increased risk of delirium during hospitalization (Ulsa et al., 2022). Moderate and severe sleep burden increased delirium risk by 18% and 57%, respectively, even after excluding patients with dementia and in analyses limited to postoperative delirium. Similarly, a recent meta-analysis confirmed that both preoperative and postoperative sleep disturbances significantly increase the risk of postoperative delirium across surgical populations (He et al., 2022).These findings align with current pathophysiological models suggesting that sleep disruption contributes to neuroinflammation, circadian rhythm dysregulation, and neurotransmitter imbalance, all of which are central mechanisms in delirium development (Farasat et al., 2020; Maldonado, 2018).

Although the literature offers different approaches to determining a cut-off RCSQ score for sleep quality assessment, it should be noted that the identified studies were primarily conducted in ICUs. This means that these psychometric parameters are largely lacking for general wards. In our study, the discriminative ability of individual RCSQ items was limited, particularly in patients with delirium, where sleep assessment relied on night-shift nurses' observations. The total RCSQ score performed somewhat better, but overall predictive accuracy remained modest. In patients without delirium, discrimination was slightly higher, yet still lower than levels reported in ICU studies. Previous research conducted in ICUs has generally reported higher discriminative ability for the RCSQ (Elliott et al., 2013; Rollo et al., 2022; Rood et al., 2019). This difference is likely due to the more controlled ICU environment, where patients are more closely monitored, less heterogeneous, and often under continuous observation, allowing for more accurate and consistent assessment of sleep. On general wards, in contrast, patient conditions are more variable, monitoring is less intensive, and nurses' assessments are often based on brief observations during night shifts.

The presence of delirium negatively affects patient care, as it is associated with social withdrawal, overall deconditioning, non-cooperation with nursing and treatment, and agitation that may necessitate chemical or physical restraints (Kaushik et al., 2024). Non-pharmacological interventions remain the first-line treatment for delirium and associated sleep-wake disturbances, though their effectiveness is often limited (Devlin et al., 2018). Pharmacologically, antipsychotics – particularly tiapride, risperidone, and quetiapine – are commonly used to manage hyperactive or agitated delirium, reflecting both symptom control and the patients' complex clinical status (Grover and Avasthi, 2018). Benzodiazepines, as a class, were not significantly associated with delirium, consistent with guidelines recommending their use mainly for alcohol withdrawal delirium (Siddiqi et al., 2016); clonazepam was an exception, administered in cases of agitation unresponsive to antipsychotics.

Evidence on sleep-targeted pharmacotherapy in hospitalized patients is limited, as few studies report pre-existing sleep disorders, making it difficult to distinguish new-onset from chronic insomnia, and the role of hospital admission as a precipitating versus perpetuating factor remains unclear, with orexin rather than GABA pathways potentially involved (Bottignole et al., 2026). Hypnotics reduce sleep latency but do not consistently improve subjective sleep quality. Benzodiazepines appear relatively safe and may be more effective than Z-drugs, while melatonin shows modest benefits. All compounds were generally well tolerated. These findings underscore both the potential and limitations of pharmacological management of sleep disturbances, particularly in patients with delirium.

Implications for nursing practice

- *Routinely assess sleep quality:* use the Richards–Campbell Sleep Questionnaire to identify patients at risk of delirium, especially during the first nights of hospitalization.
- *Implement sleep-promoting measures:* reduce noise and light, cluster care, and support orientation to improve sleep and potentially lower delirium risk.
- *Combine sleep and delirium screening:* interpret nurse-rated sleep cautiously in delirious patients and use structured tools such as the Confusion Assessment Method alongside clinical judgment.
- *Review medication use regularly:* monitor antipsychotic and sedative treatment daily and prioritize non-pharmacological strategies whenever possible.
- *Strengthen staff education and protocols:* support nurse training and interdisciplinary collaboration to enhance early detection and management of delirium.

Limitations of the study

Delirium assessment using the CAM by trained nurses may be influenced by subjectivity and morning time constraints. Sleep in delirium patients was nurse-assessed, which may affect comparability with self-reported data. The heterogeneous sample, including patients from different wards, may limit generalizability.

Conclusion

Patients admitted to standard wards with confirmed delirium experienced significantly poorer sleep quality than those without delirium, consistently across all study days. Analysis using the Richards–Campbell Sleep Questionnaire showed that individual items had limited discriminative ability across assessed domains, particularly in patients with delirium. Delirium was also associated with a higher pharmacological burden, especially increased use of antipsychotics and neuroleptics, reflecting common clinical management strategies. These findings highlight the importance of systematic sleep assessment, early recognition of cognitive changes, and prioritization of non–pharmacological interventions in nursing practice to improve patient outcomes and potentially reduce delirium–related complications.

Author contributions

H. Lochová: conceptualization, methodology, data curation, formal analysis, writing – review and editing, project administration. *K. Šrámková:* formal analysis, visualization, writing – review & editing. *J. Slonková:* formal analysis, investigation, funding acquisition, writing – review & editing, supervision. *R. Zoubková:* data curation, formal analysis, writing – original draft, visualization. *K. Maternová:* formal analysis, visualization, writing – the original draft. *D. Jarošová:* conceptualization, methodology, data curation, formal analysis, funding acquisition, writing – review & editing, supervision.

Clinical trials registration

The study is registered in the ClinialTrials.gov database ID: NCT05402280.

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Conflict of interest

The authors have no conflict of interest to declare.

References

1. Bottignole D, Balella G, Minetti M, Gambolò L, Rausa F, Ughetti G, et al. (2026). Insomnia among hospitalized inpatients: A systematic review and network meta-analysis. Sleep Med Rev 85: 102210. DOI: 10.1016/j.smrv.2025.102210.
2. Brennan K, Sanchez D, Hedges S, Lynch J, Hou YC, Al Sayfe M, et al. (2023). A nurse-led intervention to reduce the incidence and duration of delirium among adults admitted to intensive care: A stepped-wedge cluster randomised trial. Aust Crit Care 36(4): 441–448. DOI: 10.1016/j.aucc.2022.08.005.
3. Charan J, Biswas T (2013). How to calculate sample size for different study designs in medical research? Indian J Psychol Med 35(2): 121–126. DOI: 10.4103/0253-7176.116232.
4. Devlin JW, Skrobik Y, Gélinas C, Needham DM, Slooter AJC, Pandharipande PP, et al. (2018). Clinical practice guidelines for the prevention and management of pain, agitation/sedation, delirium, immobility, and sleep disruption in adult patients in the ICU. Crit Care Med 46(9): e825–e873. DOI: 10.1097/CCM.0000000000003299.
5. Elliott R, McKinley S, Cistulli P, Fien M (2013). Characterisation of sleep in intensive care using 24–hour polysomnography: An observational study. Crit Care 17(2): R46. DOI: 10.1186/cc12565.
6. Farasat S, Dorsch JJ, Pearce AK, Moore AA, Martin JL, Malhotra A, Kamdar BB (2020). Sleep and delirium in older adults. Curr Sleep Med Rep 6(3): 136–148. DOI: 10.1007/s40675-020-00174-y.
7. Fenta E, Teshome D, Kibret S, Hunie M, Tiruneh A, Belete A, et al. (2025). Incidence and risk factors of postoperative delirium in elderly surgical patients. Sci Rep 15(1): 1400. DOI: 10.1038/s41598-024-84554-2.
8. Grover S, Avasthi A (2018). Clinical practice guidelines for management of delirium in elderly. Indian J Psychiatry 60(Suppl 3): S329–S340. DOI: 10.4103/0019-5545.224473.
9. He E, Dong Y, Jia H, Yu L (2022). Relationship of sleep disturbance and postoperative delirium: A systematic review and meta-analysis. Gland Surg 11(7): 1192–1203. DOI: 10.21037/gs-22-312.
10. Huang J (2025). Delirium. MSD Manual. [online] [cit. 20206-01-22]. Available from: https://www.msdmanuals.com/professional/neurologic-disorders/delirium-and-dementia/delirium
11. Inouye SK, van Dyck CH, Alessi CA, Balkin S, Siegal AP, Horwitz RI (1990). Clarifying confusion: The confusion assessment method. A new method for detection of delirium. Ann Intern Med 113(12): 941–948. DOI: 10.7326/0003-4819-113-12-941.
12. Inouye SK, Westendorp RGJ, Saczynski JS (2014). Delirium in elderly people. Lancet 383(9920): 911–922. DOI: 10.1016/S0140-6736(13)60688-1.
13. Jaiswal SJ, Kang DY, Wineinger NE, Owens RL (2021). Objectively measured sleep fragmentation is associated with incident delirium in older hospitalized patients: Analysis of data collected from an randomized controlled trial. J Sleep Res 30(3): e13205. DOI: 10.1111/jsr.13205.
14. Kaushik R, McAvay GJ, Murphy TE, Acampora D, Araujo K, Charpentier P, et al. (2024). In-hospital delirium and disability and cognitive impairment after COVID-19 hospitalization. JAMA Netw Open 7(7): e2419640. DOI: 10.1001/jamanetworkopen.2024.19640.
15. Liu SB, Wu HY, Duan ML, Yang RL, Ji CH, Liu JJ, Zhao H (2024). Delirium in the ICU: How much do we know? A narrative review. Ann Med 56(1): 2405072. DOI: 10.1080/07853890.2024.2405072.
16. Lochová H, Žiaková K, Šerková D, Černochová S, Rajtrová N, Pončíková V (2019). Reliabilita české verze Richards–Campbell Sleep dotazníku. Kontakt 21(2): 128–134. DOI: 10.32725/kont.2019.001.
17. Maldonado JR (2018). Delirium pathophysiology: An updated hypothesis of the etiology of acute brain failure. Int J Geriatr Psychiatry 33(11): 1428–1457. DOI: 10.1002/gps.4823.
18. Nameth K, Sugg E, Cai R, Haghayegh S, Gao C, Li P, et al. (2024). 1017 Healthy sleep, healthy mind: Examining the relationship between objective sleep measures and delirium development. Sleep 47(Suppl_1): A437. DOI: 10.1093/sleep/zsae067.01017.
19. Richards KC, O'Sullivan PS, Phillips RL (2000). Measurement of sleep in critically ill patients. J Nurs Meas 8(2): 131–144. DOI: 10.1891/1061-3749.8.2.131.
20. Rollo E, Della Marca G, Scala I, Buccarella C, Rozera T, Vollono C, et al. (2022). Validation study of the Richards–Campbell Sleep Questionnaire in patients with acute stroke. J Pers Med 12(9): 1473. DOI: 10.3390/jpm12091473.
21. Rood P, Frenzel T, Verhage R, Bonn M, van der Hoeven H, Pickkers P, van den Boogaard M (2019). Development and daily use of a numeric rating score to assess sleep quality in ICU patients. J Crit Care 52: 68–74. DOI: 10.1016/j.jcrc.2019.04.009.
22. Siddiqi N, Harrison JK, Clegg A, Teale EA, Young J, Taylor J, Simpkins SA (2016). Interventions for preventing delirium in hospitalised non-ICU patients. Cochrane Database Syst Rev 3(3): CD005563. DOI: 10.1002/14651858.CD005563.pub3.
23. Szewczak A, Siwicka D, Klukow J, Czerwik-Marcinkowska J, Zmorzynski S (2025). Clinical nursing management of adult patients with delirium in a hospital setting – A systematic review. J Clin Med 14(22): 8113. DOI: 10.3390/jcm14228113.
24. Topinková E, Neuwirth J (1995). Geriatrie pro praktického lékaře [Geriatrics for the general practitioner]. Praha: Grada, 299 p.
25. Ulsa MC, Xi Z, Li P, Gaba A, Wong PM, Saxena R, et al. (2022). Association of poor sleep burden in middle age and older adults with risk for delirium during hospitalization. J Gerontol A Biol Sci Med Sci 77(3): 507–516. DOI: 10.1093/gerona/glab272.
26. Zheng J, Wang L, Wang W, Zhang H, Yao F, Chen J, Wang Q (2023). Association and prediction of subjective sleep quality and postoperative delirium during major non-cardiac surgery: A prospective observational study. BMC Anesthesiol 23(1): 306. DOI: 10.1186/s12871-023-02267-x.