Nature and Science of Sleep

Elevate Series

Open Access Full Text Article

ORIGINAL RESEARCH

Sleep Quality of Patients on a General Department During the First Days of Hospitalization

Hana Locihová[1,2], Darja Jarošová[2], Karolína Šrámková[3], Jana Slonkova[3,4], Renáta Zoubková[1,5], Klára Maternová[6], Karel Sonka[7]

[1]Department of Anesthesiology, Resuscitation and Intensive Care Medicine, Faculty of Medicine, University of Ostrava, Ostrava, Czech Republic; [2]Department of Nursing and Midwifery, Faculty of Medicine, University of Ostrava, Ostrava, Czech Republic; [3]Department of Neurology, University Hospital Ostrava, Ostrava, Czech Republic; [4]Department of Clinical Neurosciences, Faculty of Medicine, University of Ostrava, Ostrava, Czech Republic; [5]Department of Anesthesiology, Resuscitation and Intensive Care Medicine, University Hospital Ostrava, Ostrava, Czech Republic; [6]2nd Department of Surgery – Department of Cardiovascular Surgery, First Faculty of Medicine, Charles University and General University Hospital, Prague, Czech Republic; [7]Department of Neurology and Center of Clinical Neuroscience, First Faculty of Medicine, Charles University and General University Hospital, Prague, Czech Republic

Correspondence: Hana Locihová, Department of Anesthesiology, Resuscitation and Intensive Care Medicine, Faculty of Medicine, University of Ostrava, Ostrava, Czech Republic, Tel +00420739026151, Email h.reichelova@seznam.cz

Purpose: The main aim of the study was to record subjective assessment of sleep quality between men and woman in hospitalised patients over 3 nights and look for associations with other basic hospitalisation data (age, type of department, surgery, pain, type of admission, previous hospitalisation, sleep-inducing medication). The secondary aim was to determine whether the *Ford Insomnia Response to Stress Test* (FIRST) questionnaire is an appropriate tool for identifying hospitalised individuals prone to situational sleep disturbance.

Methods: A multicentre descriptive cross-sectional study was conducted in regular surgical and medical departments of seven selected hospitals in the Czech Republic. On the first day of hospitalization, patients completed the FIRST screening questionnaire. Their subjectively perceived sleep quality for the previous night was assessed from the second to the fourth day of hospitalization using the *Richards-Campbell Sleep Questionnaire* (RCSQ).

Results: The study included 340 patients (172 females and 168 males; mean age 58.9 ± 14.9 years and 57.3 ± 15.0 years, respectively). No significant differences in RCSQ scores were observed between men and women or across the three nights of hospitalization. Moderate correlations were identified between hospitalization data and RCSQ scores, with the strongest positive correlation for alprazolam use (Ra = 0.604). Other positive correlations included surgical department hospitalization, sleep-inducing medications, surgery, male sex, and age. The strongest negative correlation was with pain (Ra = −0.498), while other negative correlations included elective admission, medical department hospitalization, and previous hospitalization. The studied factors explained 18% of the RCSQ variability. The association between FIRST scores and RCSQ was statistically significant ($p < 0.001$) but weak (Spearman's −0.1734, Kendall's tau −0.1234).

Conclusion: Subjective sleep quality during hospitalization is related to the type of department, care provided, and pain, age, and sex. There were no significant changes in subjective sleep quality ratings during the first three days of hospitalization. The FIRST questionnaire is not a suitable screening tool for identifying individuals with situational sleep disturbance in hospital.

Keywords: sleep quality, hospitalized patients, general department, Richards-Campbell Sleep Questionnaire, RCSQ, Ford Insomnia Response to Stress Test, FIRST

Introduction

Adequate sleep duration and structure are essential to a person's health and well-being. Sleep problems are common and include deficits in both quantity and quality. Sleep and sleep deprivation affect virtually every system level of an individual.[1]

Unfortunately, hospital rooms are not optimal environments for sleep. Hospitalized patients suffer from sleep disturbances caused by symptoms of the underlying disease (eg, pain, discomfort, comorbidities, and medications), the environment (eg, nursing and medical interventions, noise, and light), psychological factors (eg, anxiety), and social influences (eg, loss of autonomy or bedtime routines).[2]

Received: 30 October 2024
Accepted: 5 March 2025
Published: 28 March 2025

Growing evidence of the importance of sleep for physical and mental health and recovery, including those of inpatients, has prompted research on this topic, including the search for appropriate techniques to assess sleep quality in a hospital setting. Sleep is commonly assessed using subjective tools such as questionnaires and scales, and objective measures such as polysomnography, actigraphy, the electroencephalogram-derived bispectral index, or endocrinological and biochemical biomarkers (eg 6-sulfatoxymelatonin, cortisol). Each method has advantages and disadvantages or shortcomings, but they are often complementary.[3,4] So far, there has been no perfect tool for nurses to use in the assessment of sleep in hospitalized patients, even though sleep is an independent factor in successful treatment.[5]

For most people, hospitalization is associated with stress, one of the factors affecting sleep. The most important general determinants of sleep disturbance due to stress are family history of insomnia, female sex, and adverse environmental influences (eg unfamiliar sleep environment).[6] Hospitalization can also be regarded as an adverse environmental factor. Drake et al[7,8] have elaborated on the concept of sleep reactivity, which describes how sleep reacts in response to various factors. Understanding individual sleep reactivity is important for individual optimization of sleep conditions. The most widely used tool for assessing sleep reactivity is the *Ford Insomnia Response to Stress Test* (FIRST).[9] The Ford Insomnia Response to Stress Test (FIRST) was selected as a frequently used screening tool due to evaluate the stress reactivity and its effect on sleep.[7–9] We proposed that patients with higher FIRST scores would be more susceptible to declines in sleep quality during hospitalization and more sensitive to stressors related to the hospital environment.

The primary hypothesis of this study was to assess subjective sleep quality in patients during the first 72 hours of hospitalization and to examine the relationship between perceived sleep quality between men and women and other commonly available hospitalization data, including age, type of department, surgery, previous hospitalization, reason for admission, pain level, and use of medications to induce or maintain sleep.

The secondary hypothesis aimed to determine whether the FIRST questionnaire could identify individuals prone to sleep disturbances during the initial days of hospitalization.

Methods

Design

A multicenter cross-sectional study

Sample

The study was conducted between September 2022 and January 2023. The sample consisted of 340 patients on general medical and surgical departments in seven hospitals in the Czech Republic. The number of beds per room mainly were two – to three. The inclusion criteria were age over 18 years, hospitalization duration of longer than 72 hours, ability to answer questions and complete the questionnaire, and informed consent to participate in the study. The exclusion criteria were a history of significant sleep disorder, chronic hypnotic use, dementia, delirium, and terminal stage of disease. For FIRST testing, patients who had received sleep-inducing medication were excluded, resulting in a final study population of 285 patients.

Sample Size Estimation

To determine the required sample size, the following formula, applicable for cross-sectional studies, was applied: $(Z\alpha/2)2 \times p(1\text{-}p)/d^2$, assuming a 95% confidence interval, prevalence rate (p) of 50%, and error rate (d) of 5%. This calculation indicated that at least 340 participants were needed.

Measurements and Data Collection

Sociodemographic information (age, sex, and previous hospitalization) was recorded together with the following basic hospitalization data from the patients' medical records: type of department (medical, surgical), type of admission (elective, acute), surgery during hospitalization (yes, no), pain (visual analog scale 0–10), and sleep-inducing medication - Timing medication was between 8:00–10:00 p.m. (yes – administered any time throughout the study period, type and dosage; no – medication not administered on any night). Patient recruitment and administration of the questionnaires were carried out by nurses trained in the research project protocol.

Questionnaires Used

The *Richards-Campbell Sleep Questionnaire (RCSQ)* contains five items (sleep depth, falling asleep, awakenings, return to sleep, and sleep quality) and optional sixth item about noise during the previous night (were not included in the analysis in this study). Each item is scored on a visual analog scale ranging from 0 to 100. The RCSQ total is the average of the individual items. A total score of 0 represents the worst sleep and a score of 100 represents the best sleep. The RCSQ has been validated in the Czech Republic.[10] Patients completed the RCSQ from day two to day four of hospitalization, always between 7 am and 9 am, as an assessment of the previous night's sleep.

The *Ford Insomnia Response to Stress Test (FIRST)* assesses sleep disturbance caused by stressful events. It contains a total of nine items (model situations) with Likert scales (1–4), meaning that the total score ranges from nine to 36. The higher the score, the greater the likelihood of sleep disturbance.[7] On the first day of hospitalization, patients completed the questionnaire (some with the help of nurses). The original FIRST questionnaire was requested from the author and translated. The translation of the questionnaire was carried out by the following stages: (1) Forward translation: translation from English into Czech by two independent professional translators, including the creation of a unified Czech version; (2); Backward translation: translation back into English with subsequent identification and correction of differences between the original and the backward translation; (3) Expert evaluation: consensus of an expert group on the final form of the Czech version; and (4) Pilot testing: testing the questionnaire on ten patients in a selected hospital (these patients were not included in the study population).[11]

Ethical Aspects

The study, conducted in accordance with the Declaration of Helsinki, 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 also registered in the ClinialTrials.gov database (ID: NCT05402280). All participants gave their written paper informed consent. The Participants could withdraw from the study at any time without facing any penalties. Every participant in the study was an adult, aged at least eighteen years. Participants did not receive any financial or non-financial incentives.

Data Analysis

Descriptive statistics included absolute frequency (n), relative frequency (%), arithmetic mean (mean), and general deviation (SD). Relationships between pairs of metric or ordinal variables were tested with the Mann–Whitney *U*-test. Relationships between dichotomous variables were assessed using Fisher's exact test. Statistical analysis of the relationships between RCSQ items, sex, and hospital duration was performed using a three-factor analysis of variance model at a significance level of $p < 0.05$. Effect sizes were calculated using Cohen's d to quantify the magnitude of differences between groups. The impact of various variables (sex, age, type of department, surgery, type of admission, previous hospitalization, sleep-inducing medication, and pain) on individual RCSQ items and the total RCSQ score (averaged over three days) was analysed using multivariate regression with dimension reduction via the orthogonal projections to latent structure (OPLS) method. OPLS effectively addresses multicollinearity by isolating predictive components from orthogonal variation, enabling the identification of key predictors and estimating their combined influence on RCSQ scores. Regarding post hoc comparisons, Bonferroni test was employed, and $p < 0.05$ served as the cutoff level for statistical significance. The internal consistency of the FIRST was estimated using Cronbach's alpha (NCSS 2012 software; Kaysville, UT, USA). Statgraphics Centurion XV version 12.2.06 statistical software from Statpoint, Inc. (Warrenton, VA, USA) was used to calculate analysis of variance and statistical tests. SIMCA-P v.12.0 from Umetrics AB (Umeå, Sweden) was used for statistical analysis of OPLS.

Results

The analysis included 340 patients with complete data on sleep and sleep reactivity (Table 1). Participant recruitment, exclusions and reasons for exclusion are shown in Supplementary Figure 1.

Table 1 Characteristics of Patients

Characteristics	Total (n = 340)
Age (years), mean ± SD	58.1 (15.3)
Sex	
Male, n (%)	168 (49.4)
Female, n (%)	172 (50.6)
Type of department	
Surgical department, n (%)	124 (36.5)
Medical department, n (%)	216 (63.5)
Surgery, n (%)	128 (35.3)
Elective surgery, n (%)	55 (43.0)
Acute surgery, n (%)	73 (57.0)
Previous hospitalization, n (%)	269 (79.1)
Acute admission, n (%)	154 (45.4)
Pain (VAS), mean ± SD	3.18 (3.03)
Situational sleep disorder medication, n (%)	55 (16.2)
Benzodiazepines	
Alprazolam, n (%)	41 (74.6)
Diazepam, n (%)	1 (1.8)
Clonazepam, n (%)	2 (3.6)
Oxazepam, n (%)	1 (1.8)
Non-benzodiazepine hypnotics	
Zolpidem, n (%)	5 (9.1)
Antipsychotics	
Melperon, n (%)	5 (9.1)

Abbreviations: VAS, visual analog scale; n, number; SD, standard deviation; FIRST: Ford Insomnia Response to Stress Test.

The sample of 340 participants consisted of 172 females and 168 males. The mean age was 58.9 (± 14.9) for females and 57.3 (± 15.0) for males (p = 0.447). There were no statistically significant differences between males and females with respect to all items in this study except intake of alprazolam which was higher in men (Supplementary Tables 1 and 2).

The average total RCSQ score and individual item scores for the entire sample over three days were higher in males than in females, although not significantly so. This is consistent with the analysis of individual RCSQ items over the three nights studied, for which subjective perception of sleep was slightly better in males on each RCSQ item. For females, RCSQ total was found to increase over the course of their hospitalization, whereas for males, deterioration was noted on the second rated night for the following items: falling asleep, return to sleep, sleep quality, and average RCSQ total (Table 2). In order to assess the internal consistency of the (RCSQ), we calculated Cronbach's alpha for all five items (Q1–Q5) to evaluate how consistently they measure the overall construct of sleep quality. The internal consistency of the RCSQ test (Cronbach's alpha) was 0.93 (excellent) (Table 3). Patients who had undergone surgery scored statistically significantly better on sleep depth, awakenings, subjective sleep quality, and RCSQ total compared to patients who had not undergone surgery (Table 4).

The multivariate regression method was used to analyze the relationships between the selected basic hospitalization data and RCSQ scores. RCSQ scores significantly correlated ($p < 0.05$) with the assessed clinical and demographic parameters (age, sex, department type, surgery performed, previous hospitalization, urgency of hospitalization, pain severity, and sleep-inducing medication administration). When assessing the level of statistical certainty (t-statistic), the following parameters had the strongest positive effect on RCSQ total: male sex ($t = 7.89$) and alprazolam use ($t = 6.51$). The strongest positive effect on RCSQ total was found for alprazolam administration ($R^a = 0.604$). Other clinical and demographic parameters positively affecting RCSQ scores were (in descending order of correlation coefficient R^a): hospitalization in surgical department, sleep-inducing medication (other than alprazolam) administration, surgery during hospitalization,

Table 2 Changes in individual RCSQ items during the first three days of hospitalization

RCSQ	Sex	Night 1 Mean (SD)	Night 2 Mean (SD)	Night 3 Mean (SD)
RCSQ Q1	Male	58.97 (0.34)	60.24 (0.34)	62.81 (0.34)
RCSQ Q1	Female	53.37 (0.34)	58.09 (0.34)	61.79 (0.34)
		F = 1.2; p = 0.305, ηp2 = 0.00351		
RCSQ Q2	Male	65.13 (0.33)	61.90 (0.33)	66.36 (0.33)
RCSQ Q2	Female	58.35 (0.33)	60.20 (0.33)	64.21 (0.33)
		F = 1.4; p = 0.238, ηp2 = 0.00423		
RCSQ Q3	Male	61.11 (0.32)	61.95 (0.32)	65.96 (0.32)
RCSQ Q3	Female	57.83 (0.32)	61.90(0.32)	65.01 (0.32)
		F = 2.6; p = 0.074, ηp2 = 0.00769		
RCSQ Q4	Male	64.38 (0.32)	61.91 (0.32)	66.91 (0.32)
RCSQ Q4	Female	57.83 (0.32)	61.90 (0.32)	65.00 (0.32)
		F = 1.3; p = 0.264, ηp2 = 0.00393		
RCSQ Q5	Male	67.41 (0.33)	65.54 (0.33)	69.81 (0.33)
RCSQ Q5	Female	60.42 (0.33)	64.42 (0.33)	66.24 (0.33)
		F = 1.4; p = 0.246, ηp2 = 0.00414		
RCSQ total	Male	65.05 (0.28)	62.74 (0.28)	67.02 (0.28)
RCSQ total	Female	57.86 (0.28)	61.45 (0.28)	64.09 (0.28)
		F = 2.4; p = 0.089, ηp2 = 0.00712		

Abbreviations: RCSQ, Richards-Campbell Sleep Questionnaire; RCSQ Q1, sleep depth; RCSQ Q2, falling asleep; RCSQ Q3, awakenings; RCSQ Q4, return to sleep; RCSQ Q5, sleep quality, RCSQ total = (Q1 – Q5) / 5; *F*-ratio, ratio of two estimates of variance; p, p value; ηp2, partial eta squared.

Table 3 Reliability of the Richards-Campbell Sleep Questionnaire (RCSQ)

	Mean	Standard Deviation	Total Mean	Total SD	Coef. Alpha	Corr. Total	Other Items
Sleep depth	53.49706	28.83444	443.5933	157.2237	0.9216	0.7930	0.6327
Falling asleep	58.84118	31.83713	438.2492	154.9401	0.9231	0.7826	0.6086
Awakenings	58.42647	27.72990	438.6639	156.6123	0.9167	0.8571	0.7457
Return to sleep	61.54118	30.88137	435.5492	154.1962	0.9178	0.8412	0.7353
Sleep quality	60.79118	31.95813	436.2992	152.0395	0.9142	0.8854	0.7972
RCSQ total	58.61941	26.83274	438.4710	154.3740	0.9070	0.9886	30.9902
Total			497.0904	180.9449	0.9326		
			Cronbach's alpha 0.932562				

Abbreviations: RCSQ, Richards-Campbell Sleep Questionnaire; SD, standard deviation; coef. Alpha, coefficient alpha; corr. Total, correlation total.

male sex, and age. Pain had the strongest negative effect on RCSQ total ($R^a = -0.378$); other parameters decreasing RCSQ total were (in descending order): elective admission, hospitalization in medical department, and history of previous hospitalization. The variability associated with the factors studied accounted for 18% of the RCSQ variability (Table 5).

Table 4 Mean RCSQ Scores for All Three Nights Combined, Surgery Vs Non-Surgery Patients

	Surgery (n=128)	No surgery (n=212)	P-value	Cohen's d
RCSQ Q1 mean (SD)	59.5 (24.0)	56.4 (25.8)	0.012*	0.12
RCSQ Q2 mean (SD)	62.8 (31.2)	61.6 (30.6)	0.303	0.04
RCSQ Q3 mean (SD)	64.9 (26.5)	60.1 (27.6)	<0.001*	0.18
RCSQ Q4 mean (SD)	65.8 (27.2)	64.5 (25.1)	0.257	0.05
RCSQ Q5 mean (SD)	65.7 (29.4)	64.5 (29.1)	0.047*	0.04
RCSQ total mean (SD)	65.5 (24.4)	63.6 (25.0)	0.003*	0.08

Note: *: p<0.05.
Abbreviations: RCSQ, Richards-Campbell Sleep Questionnaire; RCSQ Q1, sleep depth; RCSQ Q2, falling asleep; RCSQ Q3, awakenings; RCSQ Q4, return to sleep; RCSQ Q5, sleep quality; RCSQ total = (Q1, Q5) / 5; SD, standard deviation; n, number.

Table 5 Relationships Between Subjective Sleep Quality (Expressed as Mean RCSQ Scores) and Clinical and Demographic Parameters Assessed by Multivariate Regression

		OPLS, Predictive Component			
		Component Loading	t-statistics	R^a	P-value
Clinical and demographic parameters	Male sex	0.223	7.89	0.372	**
	Age	0.133	3.02	0.223	**
	Surgical ward	0.312	6.36	0.521	**
	Medical ward	−0.298	−5.57	−0.398	**
	Surgery	0.293	5.75	0.489	**
	Previous hospitalization	−0.145	−1.86	−0.242	*
	Elective admission	−0.249	−4.68	−0.416	**
	Pain (VAS)	−0.378	−6.47	−0.498	**
	Sleep-inducing medication (other than alprazolam)	0.305	5.41	0.510	**
	Alprazolam use	0.362	6.51	0.604	**
RCSQ scores	RCSQ Q1	0.353	4.42	0.382	**
	RCSQ Q2	0.346	4.83	0.372	*
	RCSQ Q3	0.366	4.75	0.367	**
	RCSQ Q4	0.360	4.35	0.339	**
	RCSQ Q5	0.374	4.74	0.350	**
	RCSQ total	0.406	4.81	0.408	**
	Explained variability	18%			

Notes: R^a predictive component loading expressed as a correlation coefficient of variables with a predictive component, *P - value < 0.05, **P - value < 0.01.
Abbreviations: OPLS, orthogonal projections to latent structure RCSQ, Richards-Campbell Sleep Questionnaire; RCSQ Q1, sleep depth; RCSQ Q2, falling asleep; RCSQ Q3, awakenings; RCSQ Q4, return to sleep; RCSQ Q5, sleep quality; RCSQ total = (Q1, Q5) / 5; VAS, visual analog scale.

The mean FIRST score was 20.2 (± 6.3). When evaluating individual FIRST items, the least stressful situation likely to disturb sleep was watching a frightening movie, whereas the most stressful was receiving bad news during the day (Table 6). A sub-analysis comparing males and females confirmed significantly lower scores for males: 17.8 (± 5.5) vs 22.5 (± 6.1), respectively ($p < 0.001$). The FIRST achieved a Cronbach's alpha of 0.85 (Supplementary Table 3). The dependence of sleep reactivity (FIRST score) on subjective RCSQ total was assessed using two correlation tests: Spearman's coefficient (−0.1734;

Table 6 Ford Insomnia Response to Stress Test FIRST

FIRST items	Not likely n (%)	Somewhat likely n (%)	Moderately likely n (%)	Very likely n (%)
Before an important meeting the next day	71 (24.9)	85 (29.8)	81 (28.5)	48 (16.8)
After a stressful experience during the day	74 (26.0)	98 (34.4)	77 (27.0)	36 (12.6)
After a stressful experience in the evening	45 (15.8)	80 (28.0)	82 (28.7)	78 (27.4)
After getting bad news during the day	49 (17.2)	71 (24.9)	77 (27.0)	88 (30.8)
After watching a frightening movie or TV show	194 (68.0)	59 (20.7)	17 (6.0)	15 (5.3)
After having a bad day at work	108 (37.9)	107 (37.5)	50 (17.5)	20 (7.0)
After an argument	80 (28.0)	85 (29.9)	66 (23.2)	54 (18.9)
Before having to speak in public	98 (34.4)	72 (25.3)	59 (20.7)	56 (19.6)
Before going on vacation, the next day	138 (48.4)	67 (23.5)	46 (16.2)	34 (11.9)

Abbreviations: n, number; TV, television.

CI −0.2846, −0.0575) and Kendall's tau (−0.1234; CI −0.1987, −0.0467). Although both tests confirmed a statistically significant relationship ($p < 0.001$), these negative correlations were deemed very weak (less than 0.3).

Discussion

The present study showed that, according to the RCSQ, the perception of good sleep quality during the first three days of a stay in a room on a hospital department was associated with several factors. These included the intake of medication inducing and maintaining sleep, hospitalization in a surgical department, undergoing surgery during hospitalization, and older age of the patient. Conversely, pain level, hospitalization in a medical department, elective hospitalization, and previous hospitalization were associated with a perception of poor sleep. The factors assessed were chosen because they are readily available during stays in all types of departments and hospitals, but their variability appeared to account for only 18% of the variability in subjective sleep ratings. Another important finding of the study was that there were no significant changes in subjective sleep quality scores between gender over the first three days when the entire sample was assessed together, although there was considerable inter-individual variability in the results for individual nights and the overall trend. Finally, the study found that the FIRST instrument was not suitable for screening inpatients at risk of poor sleep at the beginning of their hospital stay.

The findings suggested that sleep quality remained poor and consistent, with no significant improvement over the first three days. The third day subjective assessment showed only a non-significant improvement in sleep quality, although patients might be expected to be familiar with and partially adapted to the hospital environment so that their sleep would improve. In practice, therefore, it is reasonable to assume that patients' perceptions of sleep remain the same during the first few days of their hospital stay and that a poor rating of sleep quality on the first night indicates that sleep will be similar on subsequent nights. However, our results are based on average ratings of a heterogeneous group of consecutive patients with different reasons for hospitalization. Therefore, trends in sleep perception might have been observed if more precisely defined groups of inpatients were followed.

Patients who had undergone surgery gave better ratings to the questionnaire items over three whole days (sleep depth, awakenings, and subjective and overall sleep quality – RCSQ total) than patients without surgery, but at the same time, hospitalization for elective surgery seemed to be factor that worsened sleep. Thus, we can speculate that patients with acute surgery found relief, including relief from the anxiety that is very likely to accompany a condition requiring acute surgery, whereas elective surgery led to prolonged and persistent anxiety, which did not immediately improve. Sleep and overall condition depend on the type and extent of surgery, which could not be considered in this extensive study. The sleep improvement in surgery patients may be explained by the usual administration of an anxiolytic or hypnotic the night before surgery and the postoperative use of analgesics, some of which have sedative effects. It is also reasonable to assume that, in some cases, surgery removed the problem causing pain or discomfort, resulting in improved sleep.

In our study, males gave non-significantly higher sleep ratings than females. In epidemiological studies, females generally rate their sleep quality as worse than males, independent of differences in sociodemographic and/or lifestyle

https://doi.org/10.2147/NSS.S501743

factors.[12,13] There are probably several reasons for this, one of which is that females are approximately twice as likely to develop anxiety disorders, which are associated with poorer sleep quality.[14] In addition, females are more likely to report more problems, including depressive experiences. At the same time, they tend to report more or more intense physical symptoms, even though these may not be objectively present.[15] This is consistent with a study that found no significant difference in sleep quality between males and females when analyzing subjective data.[16]

The RCSQ was developed primarily for, and is used in, intensive care units (ICUs),[17,18] but has also been employed to assess sleep in non-ICU hospital environments.[19] Despite the lack of normative values for general hospital departments, we followed these examples due to several advantages. In the present study, the internal consistency of the RCSQ test achieved very good reliability for the studied population of patients on general departments. Therefore, we consider the results to be reliable and the use of the RCSQ on general departments to be feasible. Not surprisingly, the RCSQ scores in our study were higher than those in ICU patients, including slightly lower scores for females. The present study can only be compared with a small study of 25 patients on regular departments that assessed sleep quality during the first three days, using the RCSQ and actigraphy, which also found no significant differences between day scores for any of the questionnaire items. The RCSQ total in this study was very similar to our results (63.0 ± 5.4).[19] Higher RCSQ scores and generally better sleep of patients on regular departments compared to ICU patients are anticipated and may be explained to the more stable and less disruptive environment of general departments compared to the ICU, where noise, bright lighting, frequent interventions, and sedatives disrupt sleep. In general departments, patients experience fewer disturbances, better circadian rhythm regulation, less severe condition and lower stress, leading to improved sleep quality. Additionally, more realistic rest expectations in general departments may contribute to better perceived sleep quality. According to a review of 36 studies (with a total of 2522 patients), the mean RCSQ score during an ICU stay was 49.1 (95% CI 45.6, 52.5). Cut-off values of RCSQ total for adequate sleep in ICUs were reported to range from 50.0 to 63.4.[17]

In the present study, the use of sleep-inducing medication was most significantly positively correlated with subjective positive assessment of nighttime sleep from the hospitalization data analyzed. The most frequently used drugs were benzodiazepines, with alprazolam being the single most frequently used drug. A retrospective study of sleep-inducing medications administered to 642 patients in four regular departments over a two-month period showed that 168 patients (26.2%) received sleep drugs during their hospital stay. Patients were most commonly treated with trazodone (30.4%), lorazepam (24.4%), and zolpidem (17.9%).[20] Benzodiazepines, which were used significantly more frequently than other medications in our study, play a role in comprehensive hospital care for both their hypnotic and anxiolytic effects, alleviating the usual problems with new environments, including hospital, as well as anxiety regarding illness or elective surgery.[21,22] In the hospital setting, benzodiazepines reduce sleep latency and generally have a beneficial effect on sleep architecture[23] as has been documented with other conditions and environments in subjects with insomnia. Sleep-inducing medication is necessary and beneficial when indicated, but requires ongoing assessment of reactions and adverse effects, followed by monitoring to ensure that it is reduced and discontinued at the appropriate time. It is important to note that in some patients, newly prescribed benzodiazepines during hospitalization have resulted in ongoing use after discharge, regardless of the severity of their insomnia.[20]

Pain intensity was found to be the most significant predictor of poor sleep in our study. This aligns with findings from a similar study by Ritmala-Castren et al[16] which also identified a correlation between pain levels and sleep ratings in ICU patients. Sleep and pain interact, with pain disrupting sleep and sleep deprivation amplifying perception of pain.[24,25]

Unexpectedly, the present study found a positive association between sleep quality and age. Aging is typically associated with a reduced ability to maintain uninterrupted sleep, shorter total sleep duration at night, and a decrease in the proportion of deep sleep.[26] However, some studies based on subjective ratings reveal surprisingly different trends in sleep quality across age groups.[13,27] This suggests that while aging brings notable changes in sleep patterns, it does not necessarily lead to complaints about sleep quality. Many healthy older individuals may adjust their perception of what constitutes "acceptable" sleep as they age. It is also likely that younger individuals are more aware of their environment and the experiences associated with hospitalization and have greater demands for comfort and privacy.

The 18% explained variability in sleep quality, as indicated by the multivariate regression model, suggests that the clinical and demographic parameters included in the analysis account for a modest but significant portion of the variance in subjective sleep quality scores (RCSQ) However, a substantial 82% of the variability remains unexplained. Despite their significance, the predictors in the model only capture a fraction of the complexity of sleep. Data used in our study suggests that sleep is

influenced by factors beyond those that can be included, such as psychological factors (eg, anxiety, depression), environmental influences (eg, noise, lighting, staff activity), and intrinsic patient characteristics (eg, circadian preferences).

Hospitalization is a stressful situation that can affect sleep quality. To improve the quality of care, it is beneficial to identify patients at risk of sleep problems as early as admission to hospital. We hypothesized that patients with higher FIRST scores would be more susceptible to declines in sleep quality during hospitalization and more sensitive to stressors related to the hospital environment. However, the FIRST questionnaire did not prove useful for this purpose since it contains items related to everyday life that cannot be matched to the stressful circumstances of hospitalization and illness. Failure to include patients indicated for sleep-inducing medication at the very beginning of their hospital stay may have weakened the correlation between subjective sleep quality and FIRST scores by excluding the potentially most vulnerable individuals.

Limitations of the Study

One key limitation of our study was the low homogeneity of the sample, which was necessary to ensure that the study objectives were met, but may have impacted the generalizability of the findings. While we analyzed a large number of patients across various departments in one country, the high exclusion rate due to short hospital stays, acute conditions, or other factors may have introduced biases, as excluded patients may differ systematically from those included. Additionally, the study did not account for several potential confounding variables, such as psychological factors (eg, anxiety, depression), environmental influences (eg, noise, lighting, temperature), and intrinsic patient characteristics (eg, circadian rhythm preferences, baseline sleep habits), which could have further influenced sleep quality. The inclusion of medications not officially classified as hypnotics, though reflective of actual patient care practices, also introduced a potential bias.

Conclusion

Drugs inducing and maintaining sleep, hospitalization in a surgical department, surgery during hospitalization, male sex, and older age are factors associated with a better assessment of the subjective perception of sleep quality at the beginning of hospitalization in a regular department. Conversely, factors associated with worse sleep quality are pain, hospitalization in a medical department, elective admission, and previous hospitalization. Among the factors examined, alprazolam intake was recognized as the most influential on sleep. However, these factors accounted for only 18% of the variability in perceived sleep quality during the first days of hospitalization on a regular department. During the first three days of hospitalization, there was no significant change between men and woman in subjective ratings of sleep quality. The FIRST questionnaire does not appear to be a suitable screening tool for identifying individuals with situational sleep disturbance on general hospital departments.

Data Sharing Statement

Data supporting the results reported in this manuscript will be made available by the corresponding author upon reasonable request.

Acknowledgments

I want to thank Pavel Kurfürst for translating the manuscript and Tomáš Zdražil, Martin Hill for statistical analysis.

Author Contributions

Hana Locihová: Conceptualization, methodology, data curation, formal analysis, writing – review and editing, project administration.

Darja Jarošová: Conceptualization, methodology, data curation, formal analysis, funding acquisition, writing – review & editing, supervision.*Karolína Šrámková*: formal analysis, visualisation, writing – review & editing.*Jana Slonkova*: formal analysis, investigation, funding acquisition, writing – review & editing, supervision.

Renáta Zoubková: data curation, formal analysis, writing - original draft, visualisation.

Klára Maternová: formal analysis, visualisation, writing - the original draft.

Karel Sonka: funding acquisition, writing – review & editing, supervision.

All authors give final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Funding

The study was supported by the Ministry of Health of the Czech Republic (AZV MZCR grant no. NU22-09-00457). The funding parties played no role in any part of the study design, data collection, analysis, or writing of this paper.

Disclosure

The authors are not aware of any conflict of interest.

References

1. Wesselius HM, van den Ende ES, Alsma J, et al. Quality and quantity of sleep and factors associated with sleep disturbance in hospitalized patients. *JAMA Intern Med*. 2018;178(9):1201–1208. doi:10.1001/jamainternmed.2018.2669
2. Burger P, Van den Ende ES, Lukman W, et al. Sleep in hospitalized pediatric and adult patients – a systematic review and meta-analysis. *Sleep Med X*. 2022;4:100059. doi:10.1016/j.sleepx.2022.100059
3. Hoey LM, Fulbrook P, Douglas JA. Sleep assessment of hospitalised patients: a literature review. *Int J Nurs Stud*. 2014;51(9):1281–1288. doi:10.1016/j.ijnurstu.2014.02.001
4. Knauert MP, Ayas NT, Bosma KJ, et al. Causes, consequences, and treatments of sleep and circadian disruption in the ICU: an official American Thoracic Society research statement. *Am J Respir Crit Care Med*. 2023;207(7):e49–e68. doi:10.1164/rccm.202301-0184ST
5. Hillman DR. Sleep loss in the hospitalized patient and its influence on recovery from illness and operation. *Anesth Analg*. 2021;132(5):1314–1320. doi:10.1213/ANE.0000000000005323
6. Bonnet MH, Arand DL. Situational insomnia: consistency, predictors, and outcomes. *Sleep*. 2003;26(8):1029–1036. doi:10.1093/sleep/26.8.1029
7. Drake CL, Pillai V, Roth T. Stress and sleep reactivity: a prospective investigation of the stress-diathesis model of insomnia. *Sleep*. 2014;37 (8):1295–1304. doi:10.5665/sleep.3916
8. Drake C, Richardson G, Roehrs T, Scofield H, Roth T. Vulnerability to stress-related sleep disturbance and hyperarousal. *Sleep*. 2004;27 (2):285–291. doi:10.1093/sleep/27.2.285
9. Walker JL, Vargas I, Drake CL, Ellis JG, Muench A, Perlis ML. The natural history of insomnia: high sleep reactivity interacts with greater life stress to predict the onset of acute insomnia. *Sleep*. 2022;45(9):zsac149. doi:10.1093/sleep/zsac149
10. Locihová H, Žiaková K, Šerková D, Černochová S, Rajtrová N, Pončíková V. Reliabilita české verze Richards-Campbell Sleep dotazníku [The reliability of the Czech version of the Richards-Campbell Sleep Questionnaire]. *Kontakt*. 2019;21(2):128–134. Czech . doi:10.32725/kont.2019.001
11. Wild D, Grove A, Martin M, et al. Principles of good practice for the translation and cultural adaptation process for Patient-Reported Outcomes (PRO) measures: report of the ISPOR task force for translation and cultural adaptation. *Value Health*. 2005;8(2):94–104. doi:10.1111/j.1524-4733.2005.04054.x
12. Fatima Y, Doi SAR, Najman JM, Mamun AA. Exploring gender difference in sleep quality of young adults: findings from a large population study. *Clin Med Res*. 2016;14(3–4):138–144. doi:10.3121/cmr.2016.1338
13. Vitiello MV, Larsen LH, Moe KE. Age-related sleep change: gender and estrogen effects on the subjective–objective sleep quality relationships of healthy, noncomplaining older men and women. *J Psychos Res*. 2004;56(5):503–510. doi:10.1016/S0022-3999(04)00023-6
14. Bandelow B, Michaelis S. Epidemiology of anxiety disorders in the 21st century. *Dialogues Clin Neurosci*. 2015;17(3):327–335. doi:10.31887/DCNS.2015.17.3/bbandelow
15. Howren MB, Suls J, Depressive Symptomatology MR, Than Neuroticism R. Predicts inflated physical symptom reports. *Psychosom Med*. 2009;71 (9):951–957. doi:10.1097/PSY.0b013e3181b9b2d7
16. Ritmala-Castren M, Salanterä S, Holm A, Heino M, Lundgrén-Laine H, Koivunen M. Sleep improvement intervention and its effect on patients' sleep on the department. *J Clin Nurs*. 2022;31(1–2):275–282. doi:10.1111/jocn.15906
17. Kakar E, Priester M, Wessels P, Slooter AJC, Louter M, van der Jagt M. Sleep assessment in critically ill adults: a systematic review and meta-analysis. *J Crit Care*. 2022;71:154102. doi:10.1016/j.jcrc.2022.154102
18. Richards KC, yan WY, Jun J, Ye L. A systematic review of sleep measurement in critically Ill patients. *Front Neurol*. 2020;11:11. doi:10.3389/fneur.2020.542529
19. Gellerstedt L, Rydell Karlsson M, Medin J, Kumlin M. Patients' self-assessed sleep as a nursing tool during hospital care: a pilot study. *Nordic J Nurs Res*. 2020;3(40):123–129. doi:10.1177/2057158520913227
20. Gillis CM, Poyant JO, Degrado JR, Ye L, Anger KE, Owens RL. Inpatient pharmacological sleep aid utilization is common at a tertiary medical center. *J Hosp Med*. 2014;9(10):652–657. doi:10.1002/jhm.2246
21. Dubovsky SL, Marshall D. Benzodiazepines remain important therapeutic options in psychiatric practice. *Psychother Psychosom*. 2022;91 (5):307–334. doi:10.1159/000524400
22. Griffin CE, Kaye AM, Bueno FR, Kaye AD. Benzodiazepine pharmacology and central nervous system–mediated effects. *Ochsner J*. 2013;13 (2):214–223.
23. Kanji S, Mera A, Hutton B, et al. Pharmacological interventions to improve sleep in hospitalised adults: a systematic review. *BMJ Open*. 2016;6(7): e012108. doi:10.1136/bmjopen-2016-012108
24. Finan PH, Goodin BR, Smith MT. The association of sleep and pain: an update and a path forward. *J Pain*. 2013;14(12):1539–1552. doi:10.1016/j.jpain.2013.08.007
25. Whibley D, AlKandari N, Kristensen K, et al. Sleep and pain: a systematic review of studies of mediation. *Clin J Pain*. 2019;35(6):544. doi:10.1097/AJP.0000000000000697
26. Li J, Vitiello MV, Gooneratne NS. Sleep in normal aging. *Sleep Med Clin*. 2018;13(1):1–11. doi:10.1016/j.jsmc.2017.09.001
27. Gooneratne NS, Vitiello MV. Sleep in older adults: normative changes, sleep disorders, and treatment options. *Clin Geriatr Med*. 2014;30 (3):591–627. doi:10.1016/j.cger.2014.04.007