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ORIGINAL PAPER

Factors influencing sleep disturbances in patients staying in general departments

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Abstract

Aim: The main objective was to determine how hospitalized patients subjectively perceive sleep disturbances. The study also assessed the influence of selected factors (physiological, physical, environmental, and psychological) and clinical and demographic variables on sleep disruption. *Design:* A multicenter descriptive study. *Methods:* Conducted in seven Czech hospitals from February to May 2023, the study included 397 patients in general wards. Data were collected using a modified questionnaire on sleep disturbances, and the results were analyzed using non-parametric statistical tests. *Results:* The sample comprised 193 males (48.6 %) and 204 females (51.4%). Females reported more sleep disturbances than males ($p = 0.023$). Psychological and physical factors had a greater impact on females. Younger patients reported poorer sleep quality ($p = 0.015$). Pain was the strongest clinical factor that negatively affected sleep ($Ra = 0.730$). Environmental factors were the leading cause of sleep disturbance in patients ($Ra = 0.836$). The variability associated with all the factors studied (environmental, psychological, physiological, and physical) accounted for 97.6% of the total variability in sleep disturbance. *Conclusion:* Females and younger patients experienced more sleep disturbance. Pain and environmental factors were the primary causes of disrupted sleep. Differences were noted in the factors affecting sleep between genders.

Keywords: factors, general department, patients, sleep disturbance.

Introduction

Sleep is a fundamental physiological process in all animals, including humans. Current evidence suggests that good quality sleep is an important independent factor contributing to successful treatment in hospitalized individuals recovering from a variety of health issues (Burger et al., 2022). The most common short-term consequences of inadequate sleep are daytime sleepiness, reduced alertness (Binte Arman et al., 2022), poor emotional adjustment (Goldstein & Walker, 2014), increased pain perception (Raymond et al., 2001), memory loss, and impaired decision making (Rasch & Born, 2013). There is also an increased risk of falls (Knechel & Chang, 2022) and delirium (Kuhlmann et al., 2023). Long-term health consequences of sleep disorders include anxiety and depression (Alvaro et al., 2013), cardiovascular diseases (Miller & Howarth, 2023) including hypertension (Grandner et al., 2018), obesity, dyslipidemia (Chaput et al., 2023), and type 2 diabetes (Antza et al., 2021).

Sleep assessment studies employ both objective and subjective methods. As the currently considered gold standard for objective sleep measurement in healthy individuals, polysomnography provides key information on sleep architecture (Rundo & Downey, 2019). However, the method is difficult to use in hospitalized patients for a number of reasons including poor tolerance of electrodes, time demands, and the need for trained personnel (Knauert et al., 2023). Therefore, other, more feasible methods, such as actigraphy or the bispectral index, are increasingly being used to assess sleep in hospitalized patients (Elías, 2021). Even with these methods, however, the reliability of the data obtained remains an important limitation. The aforementioned methods are usually not used on their own, but often serve as supportive tools, for example, to complement

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subjective assessments or to evaluate the effects of clinical interventions (Schwab et al., 2018).

Subjective sleep assessment is of paramount importance in clinical practice since hospitalized patients are often dissatisfied with sleep duration and / or quality (Kulpatcharapong et al., 2020). To identify these issues, various questionnaires have been developed that focus on both sleep quality and factors that may interfere with it (Jeffs & Darbyshire, 2019; Knauert et al., 2023)

The hospital environment is not optimal for good quality sleep, which is often disrupted by various factors that occur during hospitalization. These factors are physiological (e.g., illness, its severity, pain), environmental (e.g., lighting, noise made by staff or alarms), physical (e.g., limited mobility, positioning, nursing interventions), and psychological (e.g., anxiety, stress, lack of privacy) (D'souza et al., 2019; Wesselius et al., 2018).

While previous studies assessing sleep in hospitals have mostly focused on patients in intensive care units, the sleep of patients on regular wards has been less well investigated.

Aim

The objective of the study was to determine how patients admitted to regular wards subjectively perceive sleep disturbances. The study also aimed to assess the influence of selected factors (physiological, physical, environmental, and psychological) and clinical and demographic variables that may impact on sleep disturbance.

Methods

Design

A multicenter cross-sectional study.

Sample

The study was conducted between February and May 2023. The sample included 397 patients staying on regular wards in seven hospitals in the Czech Republic. The inclusion criteria were age over 18 years, length of stay exceeding 96 hours, ability to respond to questions and complete a questionnaire, and informed consent to participate in the study. The exclusion criteria included a history of sleep disorder, long-term use of hypnotics, a diagnosis of dementia and / or delirium, and terminal stage of illness.

Data collection

Trained nurses administered the questionnaires to patients in the hospital ward on the day of their discharge, ensuring that only those who had signed the informed consent form participated. On the same day, trained nurses collected sociodemographic and clinical data such as age, gender, prior hospitalizations, length of stay, ward type, reason for admission, surgical procedures during hospitalization, and reported pain levels – directly from the medical records. Participation in the study was both voluntary and anonymous.

Translation process

The original version of the questionnaire as obtained from the author was translated and adapted using the standard approach (Wild et al., 2005). The translation process consisted of several steps: (1) forward translation (two independent professional translators translated the questionnaire from English into Czech and produced a single Czech version); (2) reverse translation (the Czech version was translated back into English and any differences between the original and translated versions were identified and corrected); (3) expert review (experts agreed on the final Czech version); and (4) pilot testing on 15 patients not included in the sample.

Diagnostic instruments

Data were collected on the last day of hospital stay using the modified Questionnaire on Factors Influencing Sleep During Hospitalization (D'souza et al., 2019). The questionnaire contains 23 items divided into four domains according to factors (physical, physiological, environmental, and psychological). Each item is rated using a five-point Likert scale (0 – not at all, 1 – rarely, 2 – sometimes, 3 – often, 4 – always). Although the items cover all the domains, they do not form coherent blocks and contribute unevenly to the total score: physical factors – three items (13%; numbers 2, 6, 21); physiological factors – three items (13%; numbers 7, 19, 20); environmental – eleven items (48%; numbers 1, 3, 4, 5, 11, 12, 13, 14, 15, 18, 23); and psychological – six items (26%; numbers 8, 9, 10, 16, 17, 22). The maximum total score for all items is 92. Based on the total score, sleep disturbance is classified as mild (0–30), moderate (31–60), or severe (61–92).

Data analysis

For categorical variables, absolute and relative frequencies were determined. For quantitative variables, the mean, standard deviation, median, and minimum and maximum values were calculated. Subgroup results were statistically compared using

parametric (Welch's t-test) and non-parametric (Mann–Whitney test) tests. The Chi-squared test of independence was used to determine relationships, and their strength was assessed parametrically (Pearson's correlation coefficient) and non-parametrically (Spearman's coefficient). Calculations were performed using TIBCO Statistica software at a 5% significance level. Relationships between questionnaire items and sleep quality were assessed using the multivariate regression method (OPLS). SIMCA-P+ version 12.0 software (Umetrics AB) was used for OPLS statistical analysis.

Results

The entire sample included 397 patients, of whom 193 were male (48.6%) and 204 were female (51.4%). A statistically significant difference ($p < 0.05$) between the sexes was observed regarding ward type, with males more likely to be admitted to surgical wards (80 males [40.7%] vs. 57 females [27.4%]) and to undergo surgery (86 [45.0%] vs. 58 [28.0%]) during their hospitalization. The other parameters assessed (age, pain perception, length of stay, education, previous hospitalization, and type of admission) did not indicate significant differences (Table 1).

When subjectively assessing sleep disturbances, females showed a significantly higher ($p = 0.023$) proportion of moderate (99 females [50.0%] vs 76 males [38.8%]) and severe sleep disturbances (4 [0.8%] vs. 1 [0.2%]), see Table 2. Furthermore, there were significant differences ($p = 0.020$) between males and females in total sleep disturbance

Table 1 Summary statistic and statistical testing of sample (n = 397)

	All		Men		Women		Difference	
Variable	n (%)	mean ± SD	n (%)	mean ± SD	n (%)	mean ± SD	p-value	test
Gender			193 (48.6)		204 (51.4)		0.752	MWt
Age		59.9 ± 14.5		59.8 ± 13.2		60.0 ± 15.7	0.865	W
Visual analog scale (VAS)		2.8 ± 2.7		2.6 ± 2.6		3.0 ± 2.8	0.293	MWt
Length of hospitalization		7.3 ± 5.8		7.8 ± 7.0		6.8 ± 4.2	0.547	MWt
Primary school	68 (17.1)		31 (15.2)		37 (18.3)			
Secondary school	242 (61.0)		121 (63.2)		121 (58.4)		0.905	Chí-2
Higher professional education	35 (8.8)		17 (9.2)		18 (9.2)			
University degree	52 (13.1)		24 (12.4)		28 (14.1)			
Internal department	260 (65.5)		113 (59.3)		147 (72.6)		0.005	Chí-2
Surgical department	137 (34.5)		80 (40.7)		57 (27.4)			
Operation	144 (36.3)		86 (45.0)		58 (28.0)		0.001	Chí-2
Previous experience	319 (80.4)		150 (78.1)		169 (83.2)		0.199	Chí-2
Acute admission	196 (49.4)		88 (46.5)		108 (52.8)			
Planned admission	201 (50.6)		105 (53.5)		96 (47.2)		0.143	Chí-2

MWt – Mann Whitney test; Chí-2 – chi-squared test; W – Welch's t-test; SD – standard deviation

Table 2 Comparison of sleep disturbance and factor scores between men and women (n = 397)

	All		Men (n = 193)		Women (n = 204)		Difference	
Variable	n (%)	mean ± SD	n (%)	mean ± SD	n (%)	mean ± SD	p-value	test
Mild disturbance (0–30)	217 (54.7)		117 (61.0)		100 (49.2)			
Moderate disturbance (31–60)	175 (44.1)		76 (38.8)		99 (50.0)		0.023	Chí-2
Severe disturbance (61–92)	5 (1.3)		1 (0.2)		4 (0.8)			
Physical factors (items 2, 6, 21)		4.0 ± 2.2		3.7 ± 2.1		4.3 ± 2.3	0.011	W
Physiological factors (items 7, 19, 20)		4.1 ± 2.8		3.8 ± 2.8		4.3 ± 2.8	0.103	W
Environmental factors (items 1, 3, 4, 5, 11, 12, 13, 14,15, 18, 23)		18.4 ± 5.7		18.4 ± 5.5		18.4 ± 5.9	0.982	W
Psychological factors (items 8, 9, 10, 16, 17, 22)		4.0 ± 3.8		3.4 ± 3.4		4.6 ± 4.1	0.002	W
Total score (sum of items)		30.5 ± 9.6		29.3 ± 9.0		31.5 ± 10	0.020	W

Chí-2 – chi-squared test; W – Welch's t-test; SD – standard deviation

scores (29.3 ± 9.0 vs. 31.5 ± 10). There were also significant differences in scores for selected factors: physical (4.3 ± 2.3 vs. 3.7 ± 2.1, p = 0.011) and psychological (4.6 ± 4.1 vs. 3.4 ± 3.4, p = 0.002), with females scoring significantly higher than males. Females also scored slightly higher for other factors (physiological and environmental), but these differences were not statistically significant (p > 0.05).

An association was found between sleep disturbance and the participants' age. There were significantly (p = 0.015) more mild sleep disturbances in older patients (217; 59.4 ± 15) and significantly more moderate (175; 40.4 ± 14.0) and severe disturbances (5; 41.3 ± 13.7) in younger patients (Table 3).

Table 3 Relationship between patient age and sleep disturbance (n = 397)

Sleep disturbance	n	mean	SD	p-value*
Mild (0–30)	217	59.4	15.0	
Moderate (31–60)	175	40.4	14.0	0.015
Severe (61–92)	5	41.3	13.7	

**Welch's t-test*

With regard to the strength of the relationship between age and sleep-disrupting factors, a significant weak negative correlation was found for psychological factors (r = -0.38). The other factors were not statistically significant and showed very weak correlations (≤ 0.3) (Table 4).

Table 4 Comparison of factor scores by age (n = 397)

Variable	r-value	p-value*
Physical factors	-0.26	0.108
Physiological factors	0.15	0.355
Environmental factors	0.12	0.633
Psychological factors	-0.38	0.066
Total score	0.14	0.136

** Pearson's correlation test*

The relationships between sleep disturbances, clinical and demographic variables, and questionnaire items were examined using multivariate regression analysis. Among the clinical and demographic factors assessed, pain intensity had the strongest negative effect on sleep quality (Ra = 0.730), and this relationship was confirmed with high statistical confidence (t = 22.30). Other factors that negatively impacted sleep were stay in a medical ward (Ra = 0.156) and elective admission (Ra = 0.086). In contrast, the most significant positive effects on sleep were noted for older age (Ra = -0.467), male sex (Ra = -0.228), stay on a surgical ward (Ra = -0.156), and surgery during hospitalization (Ra = -0.103). Environmental factors had the greatest effect (Ra = 0.836) among the four questionnaire factors. The other factors were less significant (in descending order): psychological (Ra = 0.629), physiological (Ra = 0.569), and physical (Ra = 0.549). The variability associated with these factors explained 97.6% of the total variability in sleep disturbance (Table 5).

Table 5 Multivariate regression (OPLS) analysis of the relationship between sleep disturbance and questionnaire data

Questionnaire data / clinical data	Variable importance	Component loading[b]	t-statistics	R[a]	p-value
Males	0.544	-0.188	-15.14	-0.228	**
Visual analog scale	1.715	0.280	22.30	0.730	**
Age	1.075	-0.179	-12.23	-0.467	**
Previous hospitalization	0.362	-0.166	-3.69	-0.173	**
Medical ward	0.454	0.181	3.30	0.156	*
Surgical ward	0.454	-0.181	-3.30	-0.156	*
Surgery	0.327	-0.174	-2.36	-0.103	*
Elective admission	0.276	0.132	2.88	0.086	*
2) I cannot get into a comfortable position in the bed.	0.844	0.143	7.33	0.375	**
6) I cannot sleep because of restrictions caused by tubes, electrodes, etc.	1.158	0.200	12.40	0.521	**
21) I must sleep in an elevated position.	0.482	0.072	6.24	0.188	**
Physical factors	1.305	0.210	10.53	0.549	**
7) I cannot sleep because of pain.	2.054	0.424	20.98	0.846	**
19) I wake up from sleep because of pain.	1.108	0.179	27.92	0.467	**
20) I wake up from sleep because of breathing difficulty.	0.955	0.146	6.94	0.382	**
Physiological factors	1.372	0.218	11.52	0.569	**
1) I cannot sleep with lights on.	1.305	0.210	10.53	0.549	**
3) I wake up from sleep because the room is too hot or too cold.	1.372	0.218	11.52	0.569	**
4) I cannot sleep when there is an unpleasant odor in the room.	1.140	0.190	16.91	0.495	**
5) I cannot sleep because of environmental noise such as telephone ring, machine alarm, etc.	0.911	0.146	4.51	0.382	**
11) I cannot sleep because patients are moaning around me.	1.349	0.219	11.90	0.571	**
12) I wake up from sleep when other patients are treated.	1.067	0.172	9.55	0.450	**
13) I cannot sleep when a patient is dying near me.	1.754	0.280	16.91	0.846	**
14) I cannot sleep because doctors and nurses often wake me up.	1.034	0.164	7.83	0.427	**
15) I cannot sleep when there is a loud voice produced by the personnel.	1.244	0.201	12.07	0.526	**
18) I cannot sleep without a corner bed or extra blanket.	1.007	0.162	10.59	0.423	**
23) I cannot sleep if there are too many visitors.	1.063	0.171	5.57	0.446	**
Environmental factors	2.016	0.324	19.08	0.836	**
8) I cannot sleep because of lack of privacy.	1.428	0.246	17.44	0.642	**
9) I cannot sleep because of concern of more medical expenses.	1.053	0.077	7.50	0.462	**
10) I wake up from sleep because of fear of infectious complications.	0.202	0.042	2.62	0.110	*
16) I cannot sleep because of lack of explanation of the treatment regimen.	1.068	0.060	8.57	0.471	**
17) I cannot sleep because my children are at home.	0.793	0.033	7.66	0.345	**
22) I cannot sleep because of uncertainty regarding the consequences of my illness.	1.087	0.040	4.92	0.455	**
Psychological factors	1.714	0.274	19.27	0.629	**
Sleep disturbances					
Sum of the items		1.000	206.70	0.988	**
Explained variability			97.6%		

*Ra – component loading expressed as a correlation coefficient with a predictive component; *p < 0.05; **p < 0.01*

Discussion

The most significant finding of the study was that sleep quality was perceived as worse in females, younger patients, elective admissions, and patients on medical wards. In contrast, better sleep quality (fewer subjective disturbances) was associated with older age, male sex, surgical ward stay, surgery, and previous hospitalization.

The study confirmed that subjectively perceived sleep disturbances are more common in hospitalized female patients. At the same time, females scored higher than males on both psychological and physical factors. Subjectively perceived poorer sleep quality in female patients may be due to a combination of physiological and psychological factors, including higher levels of anxiety, greater susceptibility to environmental disturbances, and female-specific health problems (Fatima et al., 2016). Differences in key sleep characteristics (sleep quality, duration, architecture, and sleep onset latency) between males and females have been repeatedly demonstrated. These differences may be due to, among other things, different melatonin levels or body temperature, which determine variations in circadian rhythms (Boivin et al., 2016; Lok et al., 2024). Females also appear to be more sensitive to pain, which further disrupts their sleep during hospitalization (Cascais & Cunha, 2024). Sex differences can also be identified in psychological factors negatively affecting sleep. Females have been found to have higher levels of anxiety (Weller et al., 2018), dysfunctional illness perceptions, and emotional distress (Palagini et al., 2023). Although the above factors that disrupt sleep in the hospital setting are common to females, their negative impact may be influenced by individual experience and good adaptive ability.

Another important finding was the strong association between sleep disturbance and pain intensity. The significance of this relationship has been confirmed by other authors (Cascais & Cunha, 2024; Saleem et al., 2024). Although most studies point to the negative impact of pain on sleep quality, some have also documented that improved sleep can be associated with better pain coping, suggesting a bidirectional relationship.

Our study also indicated a relationship between sleep quality and age, with younger patients more likely to report poorer sleep during hospitalization. While younger people tend to be more influenced by psychological and physical factors, older patients are more affected by physiological and environmental factors. Our findings are consistent with a meta-analysis (Burger et al., 2022) which reported that younger patients often experience higher levels of anxiety and stress during hospitalization, which can negatively affect their ability to fall asleep and maintain sleep. At the same time, the literature supports the notion that unfamiliarity with the hospital environment may exacerbate sleep disturbances in younger patients since, unlike older individuals, they have more difficulty adapting to new environments (Alessandrini et al., 2023).

Yet another important finding is that during hospitalization, sleep is mainly disrupted by environmental factors such as noise, light, odor, temperature, and diagnostic or therapeutic interventions. Many studies have identified noise as the most disturbing factor affecting patients' sleep. Its sources vary, but some authors point directly to noise associated with staff conversations and interventions, which account for half of all cases of disturbed sleep (Adams et al., 2024; Hillman et al., 2023). Unnatural lighting, which is responsible for disrupting natural circadian rhythms, has also received attention in the literature (Pamuk & Turan, 2022). Common nocturnal nursing activities that are considered necessary by the professional community but result in significant sleep disruption include monitoring vital signs, administering medications, and positioning the patient (Locihová et al., 2021).

Efforts to comprehensively address all of the above factors require a multidisciplinary approach. Although the implementation of sleep promoting programs for inpatients is encouraged, the use of such programs in routine clinical practice is limited (Affini et al., 2022). The main challenges to their implementation are the lack of regular sleep assessment using standardized tools, the infrequent use of non-pharmacological interventions, and the paucity of evidence in the literature (Acharya et al., 2024; Rinehart et al., 2024).

Recommendations for practice are:

- Routine use of pain assessment and management protocols in hospitals that include regular pain assessments and individualized treatment plans to reduce pain-related sleep disturbances.
- Enhancing of hospital design to mitigate environmental disturbances and creating of protocols to prioritize sleep can improve patient outcomes
- Provision of training for nurses to enable them to recognize and address the diverse factors contributing to sleep disturbances, such as environmental, psychological, physical, and physiological influences. Conducting of regular assessments can support the development of tailored interventions for each patient.

Limitation of the study

Major limitations of the study are the low homogeneity of the sample and the choice of a subjective assessment tool.

Conclusion

The study highlights differences in subjectively perceived sleep disturbance during hospitalization on regular wards. Females reported poorer sleep and were more likely to be negatively affected by psychological and physical factors. In contrast, better sleep quality was observed in males and was associated with older age, stay on a surgical ward, surgery during hospitalization, and previous hospitalization. Younger patients experienced more severe sleep problems than older patients. Sleep disturbance in regular ward patients was closely associated with the presence of pain, stay on a medical ward, and elective admission. Environmental factors were the most important contributors to sleep disturbance.

Ethical aspects and conflict of interest

The study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of the Faculty of Medicine of the University of Ostrava (No. R2/2021). The authors are not aware of any conflict of interest.

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Author contributions

Conception and design (HL), data analysis and interpretation (HL, SP), manuscript draft (HL, SP), critical revision of the manuscript (KA), final approval of the manuscript (HL, SP, KA).

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