

**Sleep quality among orthopaedic patients in Denmark**

**A nationwide cross-sectional study**

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## Title page

### SLEEP QUALITY AMONG ORTHOPAEDIC PATIENTS IN DENMARK

#### – A NATIONWIDE CROSS-SECTIONAL STUDY

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## **ABSTRACT**

**Background:** Hospitalised patients sleep less and have a lower quality of sleep compared to patients who recover in their own home . Poor sleep quality has been associated with complications as increased pain sensation, delirium, reduced rehabilitation capacity and quality of life and in worst case death.

**Purpose:** To investigate patients' self-reported sleep quality and factors related to sleep quality during admission to a department of Orthopaedic Surgery

**Methods:** The Richard-Campbell Sleep Questionnaire was used to assess patients sleep quality, measured using the VAS 0-100 scale, (a higher score indicating good sleep quality). The moderated Pittsburg Sleep Quality Index assessed the most severe and frequent barriers to high sleep quality.

**Results:** A total of 533 patient undergoing orthopaedic surgery participated with an overall mean sleep quality score of 54. The most frequent and severe factors impacting sleep quality were waking during the night, difficulties falling asleep, waking early, waking for toileting or pain. The intensity of the pain was found to be proportional to the quality of sleep.

**Conclusion:** There is room for improvement for enhancing Orthopaedic patients' self-reported sleep quality. Nurses need to focus on sleep-inducing interventions to reduce patients' awakeness and pain during the night.

## **INTRODUCTION**

Sleep is a basic human need and essential in maintaining the body's physical and cognitive stability (Shapiro and Flanigan, 1993). In an acute illness that leads to a hospital admission, sufficient sleep is an important factor to recover health (Shapiro and Flanigan, 1993). Despite the significant effect of sleep, sleep disturbance is common among older adults during their hospital stay due to a variety of environmental, medical, and patient factors (Stewart and Arora, 2018). Parthasarathy and Tobin (2004) reported that 40-50% of critically ill hospitalised patients are often awake during the night with their sleep quality characterised as interrupted and shallow (Parthasarathy and Tobin, 2004). According to Henderson (1987), sleep, breathing, eating and drinking, digestion, and excretion are characterised as the most essential human needs for survival. The increasing demand for evidence-based practices within healthcare emphasises our responsibility as orthopaedic nurses to optimise and ensure the patients healthy sleep environment.

## **BACKGROUND**

The sleep quality of hospitalised patients is characterised as minimal with many interruptions compared to those who sleep at home (Costa and Ceolim, 2013; Wesselius et al., 2018). Loss of sleep during hospitalisation is associated with worse health outcomes, including cardiometabolic complications and increased risk of delirium (Stewart and Arora, 2018). Sleep deprivation and the risk of insomnia is especially critical in patients who have undergone surgery due to the surgically induced stress response (Gögenur, 2010). In addition, anaesthesia may contribute to a disturbance of the vital deep sleep phase that assists in decreasing the stress hormone cortisone, stimulates nerve growth factors, and allows renewal of nerve cells and neurotransmitters (Shapiro and Flanigan, 1993). Pain treatment with opioids interferes with deep sleep characterised as REM (rapid eye movement) sleep, and there is strong evidence that patients who have undergone orthopaedic surgery lack REM sleep, particularly the first two postoperative nights [7–9]. So far, there has been limited research on sleep quality of orthopaedic patients. One observational study included 75 orthopaedic patients and measured pain using a visual analogue score of 0-10, (10 indicated severe pain) and quality of sleep was measured using the Pittsburgh Sleep Quality Index (PSQI) 0-21, (21 indicating poor sleep quality) following the second postoperative night (Buysse et al., 1989). The study assessed their pain with a score of 6.6 and their sleep quality with a score of 9.2 and called for nonpharmacologic interventions to decrease pain and improve sleep quality (Büyükyilmaz et al., 2011).

### ***Factors related to sleep quality***

The factors which influence patients' sleep quality during hospitalisation include noise, light, discomfort, pain, medication, anxiety and stress (Gay, 2010; Honkus, 2003; Missildine et al., 2010a; Young JS et al., 2009). Long et al. reported from a retrospective study of 965 Chinese orthopaedic patients that 31% of patients having primary total knee arthroplasty had depression and anxiety resulting in insomnia (Long et al., 2019). When anxiety is combined with pain and depression the risk of poor sleep quality increases (Roehrs and Roth, 2005; Young et al., 2009). In a qualitative study Gellerstedt et al. reported that surgical and medical patients sleep quality was impacted during hospitalisation by, psychological factors such as bedside manner, patient involvement and influence, and preservation of patient integrity (Gellerstedt et al., 2014). In contrast, a pilot study was conducted in an acute medical care unit to investigate sleep quality among 48 older adults using the Richard-Campbell Sleep Questionnaire (RCSQ)(Richards et al., 2000a) (Missildine et al., 2010b). The study reported no association between the duration of night-time sleep with age, environmental noise and light levels but the study population was underpowered (Missildine et al., 2010b). Many studies report on barriers preventing good patient sleep quality. However, no study has examined the patients sleep quality during admission to an orthopaedic department in a Danish context.

### ***Sleep quality among Danish orthopaedic patients***

In 2015, the Danish Scientific Society of Orthopaedic Nursing (VIDOKS) highlighted sleep disturbance as a significant issue for orthopaedic patients. VIDOKS invited all 21 Danish departments of orthopaedic surgery to undertake a local project exploring factors affecting sleep quality (Mainz H et al., 2017). Fourteen departments participated and reports from these departments describing the minor local projects, each with a different aspect of patient's quality of sleep were collected in an anthology (Specht and Mainz, 2017). The anthology described the need for a more homogeneous and consistent assessment of sleep quality and the factors that influence sleep quality among Danish orthopaedic patients. The anthology also highlighted that there was limited research on the sleep quality of Danish orthopaedic patients using validated tools as the literature describe nurses tends to overestimate the patients quality of sleep (Delaney et al., 2018). Therefore, this study aimed to investigate patients' self-reported sleep quality during admission to a Danish department of orthopaedic surgery and to identify factors related to sleep quality.

## **MATERIALS AND METHODS**

### ***Study design***

This nationwide multicentre study used a prospective, cross-sectional design. The data was collected using an anonymous questionnaire on the 7<sup>th</sup> and 8<sup>th</sup> of November 2018.

### ***Setting and study participants***

The Danish Scientific Society of Orthopaedic Nursing (VIDOKS) initiated the study inviting the 32 departments of Orthopaedic Surgery in Denmark to participate. Three researchers were appointed to conduct the study in collaboration with local clinical nurses selected by the head of the Nursing in each department for each department. All patients admitted to an orthopaedic ward during the study period for a minimum of one night before data collection were eligible for inclusion. Patients were excluded if they were: below 18 years of age, unable to communicate in Danish, diagnosed with dementia, treated for postoperative delirium or assessed as too fragile to participate.

### ***Selection of sleep assessment instrument***

A literature search to select the most appropriate sleep assessment instrument was performed using PubMed and Cinahl in February 2018 and supplemented with a manual reference search. The following prioritised criteria were set for the assessment of validated instruments: 1) developed to assess self-reported sleep quality among hospitalised patients 2) validated for in-hospitalised patients 3) ability to measure sleep quality based on a single night sleep 4) feasible in a clinical setting with only written instructions. The five instruments were identified for assessment were the Insomnia Severity Index (ISI) (Bastien et al., 2001), the Pittsburg Sleep Quality Index (PSQI) (Buysse et al., 1989), the Richard-Campbell Sleep Questionnaire (RCSQ) (Richards et al., 2000a), St. Mary's Hospital Sleep Questionnaire (SMHSQ) (Ellis et al., 1981) and the Verran Snyder-Halpern (VSH) Sleep Scale (Snyder-Halpern and Verran, 1987). Of these five instruments; PSQI and SMHAQ fulfilled none of the criteria, ISI and VSH fulfilled one criterion, whilst RCSQ fulfilled all 5 criteria. RCSQ was selected as the use of a visual scale is well known in the clinical setting; RCSQ has been positively compared to cover the essential sleep dimensions within sleep measurement to detect sleep quality among critically ill patients (Hoey et al., 2014) and has been translated into Danish (Vestergaard et al., 2018).

### ***The Questionnaire***

A questionnaire was created including demographic data, the validated self-reported sleep assessment instrument, questions on barriers affecting sleep quality and the patients' suggestions for improvement of quality of sleep.

The demographic data included age and gender, data on acute or elective admission and the number of nights spent at the hospital. The RCSQ was used to measure patients' self-reported sleep quality on five dimensions; sleep depth, sleep latency, awakenings, returning to sleep and sleep quality (Richards et al., 2000b). Each dimension was linked to one question (light to deep sleep, never could fall asleep to slept immediately, awake all night to very little, couldn't go back to sleep or slept immediately, bad night to good night sleep) and evaluated with using a visual analogue (VAS) between 0-100. Zero indicated the most reduced quality of sleep and 100 indicated the best sleep quality. A total score was calculated as a mean of the five items. An additional item in the RCSQ questionnaire was included using the same score as RCSQ to identify a patient experience of noise during the night as a potential barrier for sleep quality. To explore other factors that influenced sleep quality, all ten questions from section five of the Pittsburg Sleep Quality Index (PSQI) (Buysse et al., 1989) were included. The PSQI has been validated to measure regular sleep habits over time (Mollayeva et al., 2016) and so the questions were modified to measure the last night of sleep and the response was altered to a yes/no answer. To explore the patients' pain intensity from no pain to severe pain one additional question was included. To measure the factors related to the local context, an additional four questions were included addressing the difficulty sleeping in a new environment, feeling of being worried, noise from fellow patients and disturbance due to light. Finally, questions related to the use of sleep medication, disturbance from television, and numbers of patients in the room were also included with a yes/no response. At the end of the questionnaire, a free text section was included for the patients' comments and suggestions. The results of the qualitative data will be published elsewhere.

The layout and content of the questionnaire was tested using cognitive interviewing from the Think aloud test (Willis GB., 1994) and revised twice to improve the clarity of the questions. The written instruction related to the data collection procedure was evaluated by a selection of clinical nurses before the data collection and altered accordingly to ensure clarity and comprehensibility.

### ***Data collection procedure***

Before the data collection, one to two clinical nurses for each ward was selected to conduct the data collection. The clinical nurses received the questionnaire, the patient information sheet and written instructions with examples on how to inform the patients and collect the data. Each department collected over a 2-day period: 1) the total number of patients who had spent the night at the ward; 2) the number of patients eligible for the study according to the inclusion criteria; 3) the numbers of patients not eligible for the study according to the exclusion criteria and; 4) the number of patients who declined to participate.

Patients eligible for inclusion were asked to participate after receiving oral and written information about the study. The patients could guide the nurses in filling out the questionnaire if they required assistance. All material was scanned and e-mailed before being sent by mail to the first author for data management.

### ***Analysis***

Using Epidata, the data was entered twice to ensure accuracy. The demographics of the study population were described using simple descriptive statistics to estimate means and percentages. A t-test was used to determine statistically significant differences in the sleep quality score according to the dichotomised demographic factors and barriers from the modified PSQI questionnaire. The association between pain and sleep quality, the mean sleep quality score for patients with no pain, mild pain, moderate pain and severe pain were compared with a One way ANOVA analyses.

A diagram was created to graphically illustrate the frequency and severity of the problems according to the patients' sleep quality. The severity of the sleeping problems was estimated as the difference in the sleep quality score between patients who experienced the problem and patients who did not experience the problem (x-value in the diagram). The frequency was the prevalence of patients who experienced the problem (y-value in the diagram). Dividing the severity into *Severe* and *Less severe*, and frequency into *Frequent* and *Less frequent* by the median, four categories emerged: 1. Frequent and severe barriers for sleep quality, 2. Less frequent but severe barriers for sleep quality, 3. Frequent but less severe barriers for sleep quality, and 4. Less frequent and less severe barriers to sleep quality. All analyses were performed using Stata version 19.1 and based on a statistical significance level of 5% and power of 80%.

### ***Ethical considerations***

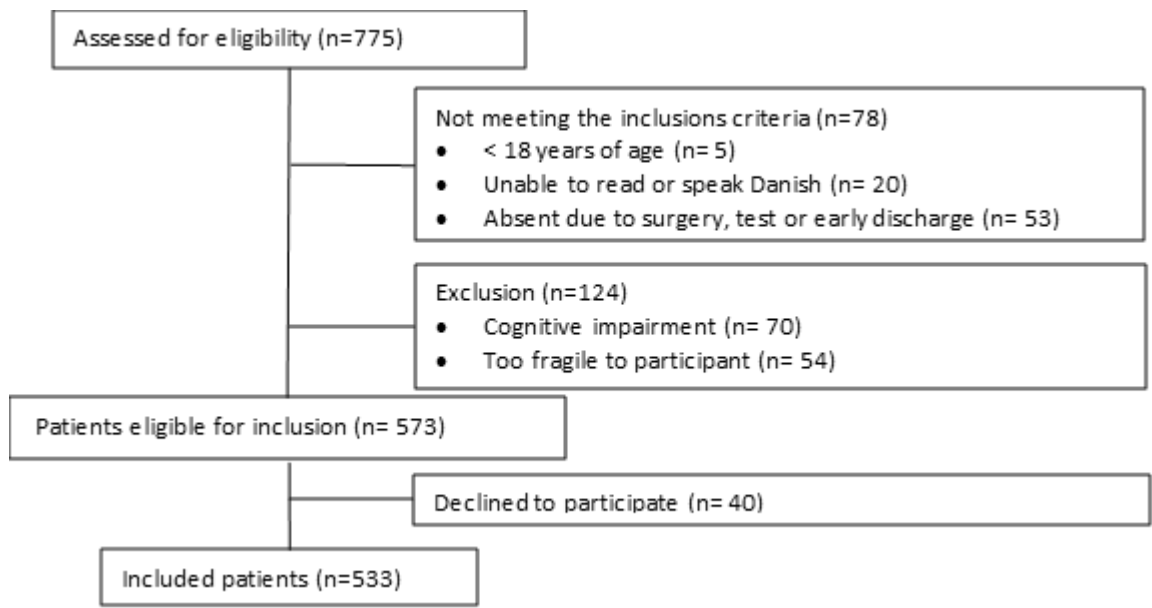
As the study was anonymous and no sensitive personal data was collected, did approval of the local ethics committee (Journal 18053101) and the Danish data protection agency was not required.

## **RESULTS**

Nineteen Orthopaedic departments in Denmark participated in the study. During the two days of data collection, 775 patients were admitted and 573 were eligible for inclusion. A total of 533 patients participated in the study giving a 93% response rate. (Figure 1). The average age of the included patients was 65 years, and most women were included (55%) (Table 1). Half of the patients were acutely hospitalised, and majority of the patients had not spent more than two night at the hospital. Approximately 43% of the patients had a single hospital room, and 23% were given sleep medication.



**Figure 1. Flowchart of the included patients**



**Table 1. Demographic data of 533 patients from 19 departments of orthopaedic surgery in Denmark**

Variable	n	Description	Percentage (95% CI)
Age <sup>1</sup>	531	Years	65 (64;67)
Gender	528	Women	55 % (51;59)
		Men	45 % (41;49)
Admission	530	Acute	50 % (46;54)
		Planned	50 % (46;55)
Night at the hospital	533	First or second	65 % (60;69)
		Third or more	35 % (31;39)
Number of patients in the room	527	Single bed hospital room	43 % (39;48)
		Multi bed hospital room <sup>2</sup>	57 % (52;61)
Sleep medication	521	Yes	23 % (19;27)
		No	77 % (73;81)
Disturbed by a Television	529	Yes	2 % (1;4)
		No	98 % (96;99)

<sup>1</sup>Mean,(Q1,Q3) <sup>2</sup> 2 or more patients sharing a room

**Patients self-reported quality of sleep**

The overall mean sleep quality score was 54. A variation from 46 to 69 in the mean sleep quality was found between the participating hospitals. Looking at the five dimensions of sleep, sleep latency had the highest score (60), while sleep depth had the lowest or best score (44) (Table 2). The additional question about noise had an average score of 80, which indicated that patients generally experienced low levels of noise at night.

**Table 2. Patient self-reported sleep quality and patients' perception of the noise level**

Dimensions of sleep	(n)	Questions	Mean (95% CI) <sup>1</sup>
1. Sleep depth	(532)	My sleep last night was: light sleep (0) ... deep sleep (100)	44 (41;47)
2. Sleep latency	(532)	Last night, the first time I got to sleep, I: Could not fall asleep (0) ... fell asleep almost immediately (100)	60 (57;63)
3. Awakenings	(533)	Last night, I was: awake all night long (0) ... awake very little (100)	56 (54;59)
4. Returning to sleep	(531)	Last night, when I woke up or was awakened, I: Not getting back to sleep (0) ... got to sleep immediately (100)	57 (55;59)
5. Sleep quality	(533)	I would describe my sleep last night as: a bad night's sleep (0) ... a good night's sleep (100)	54 (51;61)
<b>Sleep Quality</b>		<b>Mean questionnaire 1-5</b>	<b>54 (52;59)</b>
6. Noise	(533)	I would describe the noise level last night as: very noisy (0) ... very quiet (100)	80 (72;77)

<sup>1</sup>0-100, high score indicates good sleep quality

### **Problems relevant to the quality of sleep**

The association between a patients' age (under 65 and 65 years or more) and quality of sleep indicated that the older patients had a better quality of sleep (Table 3). The results showed that quality of sleep improved for patients later in their hospitalisation compared to the first night at the hospital. Patients who used sleep medication did not have improved sleep quality while sleeping in a single room was significantly improved sleep quality. No significant differences in sleep quality were found between men and women and between acute and planned hospitalised patients. Although, a small number of patients were disturbed by the television, with a lower sleep quality, the number of patients (9) was too small to identify a significant difference.

**Table 3. Sleep quality among orthopaedic patients according to demographic data**

Variable	Descriptions	N=533 n	Mean sleep quality <sup>1</sup> (95% CI)	Difference in sleep quality (95% CI)
Age	<65 years	205	52 (48;56)	5 (0;10) *
	≥65 years	326	57 (53;59)	
Gender	Women	291	56 (53;59)	4 (-1;9)
	Men	237	53 (49;56)	
Admission	Acute	263	57 (54;60)	4 (0;9)
	Elective	267	52 (49;56)	
Number overnight	First or second	351	52 (49;55)	6 (2;11) *
	Third or more	180	59 (55;63)	
Number of patients in the room	Single bed hospital room	227	56 (53;60)	4 (0;9) *
	Multi bed hospital room	301	53 (50;56)	
Got sleep medication	Yes	119	50 (46;56)	5 (2;8) *
	No	398	55 (53;58)	
Disturbed by a television	Yes	9	37 (15;58)	18 (-2;37)
	No	519	55 (53;57)	

<sup>1</sup>Visual analogue Scale 0-100, a high score indicates good sleep quality, \*Statistically significant P<0.05

**Table 4. Patients evaluation of sleeping problems and the impact on the sleep quality during admission to an orthopaedic department**

I had problems sleeping this night because <sup>2</sup>		Sleep quality <sup>1</sup>			Difference in sleep quality (95% CI)
		n	(%)	(95% CI)	
Cannot get to sleep within 30 minutes	Yes	223	(42%)	32 (29;34)	40 (36;44)*
	No	302	(59%)	72 (69;74)	
Wake up in the middle of the night	Yes	379	(72%)	48 (45;51)	25 (20;30)*
	No	145	(18%)	73 (69;77)	
Wake up early morning	Yes	346	(67%)	48 (46;51)	19 (14;24)*
	No	173	(33%)	67 (64;71)	
Have to get up to use the bathroom	Yes	155	(30%)	32 (28;36)	33 (28;37)*
	No	354	(70%)	65 (62;68)	
Cannot breathe comfortably	Yes	25	(5%)	35 (24;47)	20 (9;32)*
	No	500	(95%)	56 (52;58)	
Coughing	Yes	40	(8%)	52 (42;61)	4 (-13;5)*
	No	486	(92%)	55 (53;58)	
Feel too cold	Yes	32	(6%)	48 (37;59)	8 (-3;17)
	No	490	(94%)	55 (53;58)	
Feel too hot	Yes	127	(24%)	46 (41;51)	12 (6;17)*
	No	395	(76%)	58 (55;61)	
Have bad dreams	Yes	22	(4%)	38 (28;49)	17 (5;29)*
	No	503	(96%)	56 (53;58)	
Have difficulties sleeping in new places	Yes	180	(35%)	46 (42;50)	14 (9;19)*
	No	340	(67%)	60 (57;63)	
Have speculations	Yes	142	(27%)	44 (39;48)	15 (6;21)*
	No	380	(73%)	59 (56;62)	
Noise from other patients	Yes	111	(21%)	44 (39;49)	14 (8;19)*
	No	409	(79%)	57 (55;60)	
Too much light	Yes	66	(13%)	38 (32;45)	19 (12;26)*
	No	455	(87%)	57 (55;60)	
Have pain	Yes	326	(62%)	48 (45;50)	18 (13;23)*
	No	201	(38%)	66 (63-70)	

<sup>1</sup> Visual analog scale 0-100, high score indicates good sleep quality, <sup>2</sup>Modified questionnaire from the Pittsburg Sleep Quality Index, \*Statistically significant P<0.05

As shown in Table 4, many patients (42%) had problems falling asleep at night and had significantly poor sleep quality (score 32) compared to patients who fell asleep within 30 minutes (score 72). Most patients woke during the night (72%), which affected their score of sleep quality (score 48) compared to patients who did not wake (score 73)). Poor sleep quality was associated with two-thirds of the patients, who woke up early in the morning (score 48) compared to patients who did not wake early (score 67)). A total of 30% of the patients needed to use the bathroom during the night, which related to poorer sleep quality. Few patients experienced breathing (5%) and coughing problems (8%), or indicated they felt too cold (6 %) or had nightmares (4%). One-quarter of the patients (24%) indicated the room was too hot, affecting their sleep quality (score 48 compared to 55). Difficulties sleeping in new places were a problem

for more than one-third of the patients (35%), which also was related to poor sleep quality. 27% of patients, speculated during the night reducing sleep quality (score 44) compared to patients without speculations (score 59).

***The severity and frequency of problems related to sleep quality***

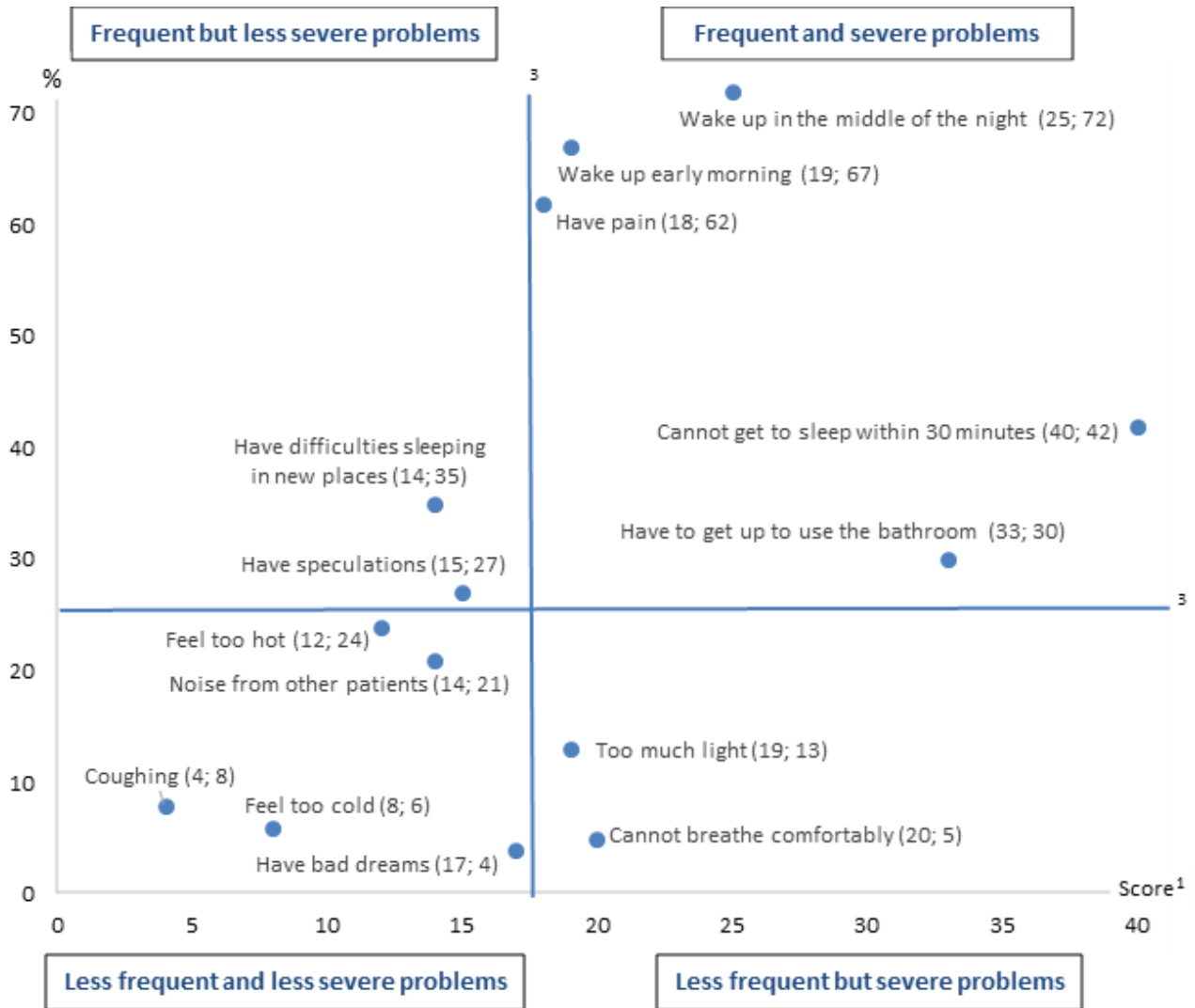
As illustrated in Figure 2, the most frequent and severe factors impacting sleep quality were waking during the night, difficulties falling asleep, waking early, waking for toileting or pain. Severe but less frequent problems influencing sleep quality were breathing problems and sleeping difficulties due to too much light. Less severe but frequently experienced problems affecting sleep quality were difficulties sleeping in new places and speculating during the night. The less frequent sleeping problems with a minor influence on sleep quality was temperature – feeling too hot or too cold, noise from other patients, coughing problems and bad dreams. Pain which disturbed sleep was a problem for 62% of the patients. The intensity of pain was proportional to the quality of sleep (Table 5). The higher the degree of pain the more reduced was the quality of sleep.

**Table 5. Sleep quality and pain**

<b>Pain assessment</b> (n)	<b>No pain</b> (201)	<b>Mild pain</b> (49)	<b>Moderate pain (150)</b>	<b>Severe pain</b> (124)
<b>Mean sleep quality</b>	67	60	51	39
(95% CI)	(63-70)	(53-66)	(46-55)	(34-44)
<b>p-value <sup>1</sup></b>	p=0.00			

<sup>1</sup>P-value for difference between groups

**Figure 2.** Diagram illustrating the severity (X-value) and frequency (y-value) of the patients sleeping problems. Problems are divided by the median into four squares regarding the severity and frequency of the problems.



<sup>1</sup> The score is the difference in the sleeping quality score between patients having the problem and not having the problem

<sup>2</sup> The frequency is the prevalence of patients having the problem

<sup>3</sup> The lines are the median of the frequency (25) and the severity (18)

## DISCUSSION

Patient's' overall self-reported sleep quality score was 54. The mean sleep quality score from the 19 participating hospitals varied between 46 to 69. The best sleep quality was found among the older patients and patients who had slept more than one night in the hospital. There was no difference in sleep quality among patients admitted acutely or planned. Pain was highly prevalent (62 %) in this study where moderate and severe pain was significant associated with low sleep quality. Sleep inducing medication was used by 23 % of patients and was associated with a significantly lower sleep quality. The patients evaluated the noise level at night to be low while the most frequent and severe factors influencing sleep quality were related to waking during the night, difficulties falling asleep and waking early, use the toilet during the night and experiencing pain.

### **Sleep quality and pain.**

In this study, the sleep quality was just above the midpoint of the scale (RCSQ mean 54). The overall interpretation of the RCSQ is <26 as very poor sleep and >76 as very good sleep (Karaman Özlü et al., 2018; Krotsetis et al., 2017; Mannion et al., 2019; Missildine et al., 2010b). The reported sleep quality among patients varies from poor sleep quality in the emergency departments (RCSQ mean 22±45) to a very good sleep (RCSQ mean 77±34) at an in-bed ward (Mannion et al., 2019) to ICU patients between RCSQ 52.1 to 60 (Louis et al., 2020; Richards et al., 2000b). Orthopaedic patients have significant lower sleep quality (RCSQ mean 26±28) compared to patients undergoing general (RCSQ mean 47±31) or cardiovascular surgery (RCSQ mean 74±18) (Karaman Özlü et al., 2018). In all, Danish orthopaedic nurses do provide a reasonable sleep quality to their patients despite the need for further improvement. Further, sleep quality has been reported to be lower in the beginning of a hospital stay (Dobing et al., 2016; Missildine et al., 2010b) which our study confirmed and may indicate patients' capacity for adjusting to new surroundings. By implementing a nonpharmacological sleep protocol that included personal hygiene, room temperature adjustment, noise and light control, relaxation techniques and eliminating unnecessary interruptions the patients' ability to remain asleep (RCSQ Q3,  $p=0.18$ ) and the sleep quality (RCSQ Q5,  $p=.001$ ) can be significantly improved (LaReau et al., 2008). This study highlights the need for improved nursing practice to increase patients' sleep quality. The use of a tool like the RCSQ may be relevant for nurses to adjust their practice as nurses tend to underestimate both very poor and good sleep quality (Delaney et al., 2018).

Our study also revealed that a vast majority of Danish Orthopaedic patients experience nightly pain where both moderate and severe pain significantly was associated with poor sleep quality. In agreement, Long et al. reported pain to be associated to difficulties falling asleep and resulted in easy awakening during sleep

which were still present two months postoperatively among 40 % of the patients despite the use of pain medication (Long et al., 2019). Additionally, pain and depression systems have also been associated with increased likelihood of being a chronic poor sleeper (Dzierzewski et al., 2015). The association between pain and sleep quality seems evident but Gerhart et al. suggest that poor sleep quality appears to be related to the experience of pain intensity and patients' ability to coping with pain and not that pain results in poor sleep quality (Gerhart et al., 2017). In agreement, Cho et al. found in a randomised trial the use of sleep-inducing medication reduced the use of analgesia following a alloplastic rotator cuff repair (Cho et al., 2015). This perspective is supported by a recent systematic review that suggests based on weak evidence that sleep-promoting pharmacological may reduce the reported pain and analgesic use (Bjurström and Irwin, 2019).

### ***Sleep medication, noise and the organisation of nursing***

The prevalence of using sleep-inducing medication (23 %) in this study was low compared to a similar study who reported a prevalence of 37 % among patients with no previous use of sleep-inducing medication and 17 % among patient who used sleep-inducing medication at home (Heinemann et al., 2019). Heinemann et al. also found a significantly association between the wish to use of sleep medication after discharge to the used sleep medication prior to the admission compared to patients who had not used sleep medication before (60 % vs 27%)(Heinemann et al., 2019). Among the general older population in Denmark, the probability of using sleep-inducing medication is 15 % for (Christensen et al., 2019). In contrast, the results of this study showed that the most frequent and severe problem for patients was difficulty falling asleep (figure 2). Difficulty falling asleep at the hospital is well described (Dobing et al., 2016; Shapiro and Flanigan, 1993; Wesselius et al., 2018) and is so common that patients, themselves, expect under hospitalization to have a poorer quality sleep (Delaney et al., 2018).

Interesting, this study found a negative association between sleep quality and the used of sleep-inducing medication which endorses the need for more knowledge about successful non-pharmacological interventions (Miller et al., 2019).

Noise in hospitals is well documented (Delaney et al., 2018; Park et al., 2014; Stewart and Arora, 2018). In contrast to many other studies (Dobing et al., 2016; DuBose and Hadi, 2016; Wesselius et al., 2018) patients in this study evaluated noise level at night as quiet. This result is surprising and may be explained either by the fact that 43 % of the study population slept in single rooms or that the questionnaire only referred to noise from other patients instead of noise relating specific to nursing staff or the surrounding environment. The result related noise must therefore be interpreted with caution as one restless sleep due to noise can have severe consequences for the patients who experience this. Other studies have

shown that noise from the nursing staff affects patients sleep (Dobing et al., 2016; Fillary et al., 2015; Wesselius et al., 2018) and that the noise also are associated with the numbers of nursing staff present on the ward (Christensen, 2005). There is a need to reorganise nursing care in order to promote patients sleep quality. A recent study tested the use of earplugs and eye masks in a randomised trial and found them to have a significant effect on sleep quality (RCSQ score 6.33 vs 5.09,  $p < 0.0001$ ). Although interventions with earplugs, eye masks and reduced light easily are implemented, there is still a need to establish the effect of these non-pharmacology interventions in large randomized trials (Miller et al., 2019). Nursing staff have requested more knowledge related to sleep promoting interventions with emphasis on how bedside communication between nurses and patients affects feelings which influence the quality of the patients sleep (Gellerstedt et al., 2014).

### ***Strengths and limitations***

The strength of this study is that the majority of all orthopaedic departments in Denmark participated in the study. The study further shows that VIDOKS have the organisational support to conduct a nationwide study. The used of RSCQ instrument makes the result reliable and comparable especially since nurses tend to underestimate the severity of difficulties sleeping (Kamdar et al., 2012). The primary limitation of this study was the used of the modified questions where the responses were changed from rating of frequent to a simple categoric response. Additionally, the modified question from PSQI is not validated for short term hospitalization as it has been used in this study.

### ***The implication for practice and research***

The results of this study have implications in relation to benchmarking. There is a considerable degree of variation of quality of sleep between the 19 participating hospitals providing opportunities for hospitals to inspire each other in the practice of providing a good sleep environment. Individual participating hospitals can use the results to examine the procedures related the sleep environment and focus on quality improvement. The study also revealed a need for improved identification and treatment by the nursing staff. More than half of the patients had moderate to severe pain during the night. It is therefore crucial for nurses to identify and successfully manage pain particularly during the night. The use of questionnaire instruments such as the RCSQ and PSQI were uncomplicated and straightforward for patients and nurses and was useful in assessing patients' self-reported sleep quality in a simple, consistent and quantitative manner. These tools give nurses the basis for assessing the effect of possible interventions that can improve a patients' sleep. The results from this study highlight the need for studies examining how pain



treatment can improve patients sleep quality and which type of interventions nurses can initiate to improve sleep quality.

## CONCLUSION

There is room for improvement to enhance Danish orthopaedic patients sleep quality during their hospital stay. The most common and severe sleeping problems influencing sleep quality was related to waking up during the night, difficulties falling asleep, waking early, and waking for toileting or pain. There is a need for nurses to focus on sleep-inducing interventions to reduce awakens and pain during the night.

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