



Original Research

“The Days Are Long But the Nights Are Even Longer”: A Mixed-Method Study of Sleep Disturbances Among Patients in an Inpatient Rehabilitation Program



Miia Rahja, PhD ^a, Kate Laver, PhD ^a,
Dylan A. Mordaunt, BHB, MB, ChB, PGDip (Data Science),
FRACP, FAIDH ^{a,b}, Nurul Adnan, BNurs ^b,
Andrew Vakulin, PhD ^c, Nicole Lovato, PhD ^c,
Maria Crotty, PhD, MPH ^{a,b}

^a Flinders Health and Medical Research Institute, Flinders University, Flinders Drive Bedford Park, Australia

^b Department of Rehabilitation Aged and Palliative Care, Flinders Medical Centre, Bedford Park, Australia

^c Flinders Health and Medical Research Institute Sleep Health, Flinders University, Bedford Park, Australia

KEYWORDS

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Abstract *Objective:* To assess sleep quality of patients on a rehabilitation ward and to identify staff practices and beliefs about management of sleep disturbance.

Design: Mixed-methods design including patient surveys and staff interviews.

Setting: Inpatient rehabilitation ward in a tertiary teaching hospital in Adelaide, Australia.

Participants: Of the 345 screened inpatients who had been in a mixed post-acute rehabilitation ward for at least 5 days, 120 (43% women) were included. The mean age was 67.7 years and the main admission reason was functional decline (40%). Patients with stroke or traumatic brain injury were excluded. Eleven (n = 11) staff (a mix of doctors, nurses, and allied health) were interviewed.

List of abbreviations: CI, confidence interval; DR, doctor/physician specialized in rehabilitation; ESS, Epworth Sleepiness Scale; FFS, Flinders Fatigue Scale; FIM, functional independence measure; NN, nurse; PRN, pro re nata; PSQI, Pittsburgh Sleep Quality Index; SIQ, Sleep Inertia Questionnaire.

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Main Outcome Measures: The surveys comprised of the Pittsburgh Sleep Quality Index, the Epworth Sleepiness Scale, the Flinders Fatigue Scale, and the Sleep Inertia Questionnaire. The survey results were compared with functional outcomes using the functional independence measure (FIM). Staff interviews delved into barriers to good sleep, ward practices, and knowledge about sleep hygiene.

Results: 43% of the surveyed patients reported having healthy amount of sleep. Sleep quality was not significantly correlated with rehabilitation outcomes (assessed using FIM). Staff reported having a good awareness of sleep hygiene; however, acknowledged limitations about the environment and routine which were not conducive to healthy sleep. They identified several actions which could be taken to improve patients' sleep hygiene.

Conclusions: Sleep disturbance is common for patients in rehabilitation. Rehabilitation wards should address this often-neglected critical component of rehabilitation to improve patient experience and potential participation in therapy. Introducing a systematic approach for assessing sleep during admission, establishing clear roles regarding sleep assessment and intervention among staff, and ensuring that patients and staff are aware of good sleep hygiene practices may promote better sleep during inpatient rehabilitation.

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A healthy amount of sleep (7-9 hours) is critical for wellbeing.^{1,2} However, sleep is often disturbed in hospital settings.³ In a hospital environment, sleep disturbances may be attributed to intrinsic factors (such as anxiety or discomfort)^{4,5} or environmental factors (such as lighting, nursing procedures, or noises).⁶⁻⁹ Frequent sleep disturbances can negatively affect cognitive function, mood, and health-related quality of life.^{1,10-12} For people participating in inpatient rehabilitation programs, sleep disturbance can reduce participation in therapies¹³⁻¹⁵ and daytime sleepiness has been associated with poorer functional recovery.¹⁶

Simple sleep hygiene practices or other ward procedures may help improve self-reported quality of sleep among inpatients.^{17,18} Providing earplugs and eye-masks¹⁹ and changing the timing of medication rounds, fixing noisy doors and applying a "lights off" rule for night staff can also help with sleep.⁸ However, few studies have explored patient and staff perceptions about sleep and sleep disturbances during a hospital admission using qualitative methodologies.^{7,20} Among these studies, environment (eg, noise or lights), symptoms (eg, pain), and medical intervention (eg, checking of vital signs) were among the most staff-reported disruptive factors.^{7,20}

In-depth assessments of sleep disturbance, its contributors and management in inpatient rehabilitation settings is still lacking. It is unclear to what extent health professionals perceive sleep disturbance to be an issue, and which team members are perceived to have a role in promoting healthy sleep on rehabilitation wards. Our aim was to identify the prevalence of sleep disturbance on an inpatient rehabilitation ward through patient self-report, to explore the relation between sleep disturbance and rehabilitation outcome, and to understand staff knowledge and beliefs around management of sleep on the ward. Our longer-term goal is to use this information to co-design a "healthy sleep environment and practices" guide with users of the service.

Methods

This study was approved by the Southern Adelaide Clinical Human Research Ethics Committee (ID: HREC/18/SAC/238).

Written informed consent was collected from all study participants. We used a mixed-methods triangulation study design to address the study aims. We administered patient surveys to explore prevalence and nature of sleep disturbance on the rehabilitation wards. Staff were interviewed about their knowledge and beliefs about sleep for people staying on the inpatient rehabilitation ward.

Setting and study sample

Setting

This study took place on a rehabilitation ward (55 beds) within a large metropolitan teaching hospital (566 inpatient beds) in Adelaide, Australia. The ward has some sleep hygiene policies already in place including quiet hours and preference for non-pharmacologic remedies (such as warm drink) to assist with sleep.

Patient participants

Inclusion criteria were as follows: aged 18 or over and had been admitted to the ward for at least 5 days at the time of survey completion. Patients with stroke or traumatic brain injury were excluded because of their established links with certain sleep conditions such as sleep disordered breathing and insomnia.²¹ Patients with sleep apnea and patients who were unable to communicate in English were also excluded. The aim was to recruit 100 rehabilitation inpatients over the 7-month data collection period (May-November 2019).

Staff participants

Staff from different disciplines and a mix of junior and senior roles were included to capture information from a range of different health professionals. Temporary staff whose rosters change weekly or agency staff were excluded.

Data collection

Patient surveys

Patient participants were asked to complete a survey which comprised of modified versions of the Epworth Sleepiness

Scale (ESS)²², the Pittsburgh Sleep Quality Index (PSQI)²³, the Flinders Fatigue Scale (FFS),²⁴ and the Sleep Inertia Questionnaire (SIQ),²⁵ which described the characteristics of their sleep while on the rehabilitation ward. Minor modifications were made to the instruments so that the wording of the questions asked patients about their last 5 days of sleep (on the ward) rather than the past month.

The ESS measures daytime sleepiness by asking participants to rate their usual chances of having dozed off or fallen asleep while engaged in activities. An ESS score of ≥ 10 is considered clinically significant excessive daytime sleepiness.^{22,26} The ESS has shown to be a reliable tool to measure daytime sleepiness showing high internal consistency as measured by Cronbach's alpha (0.88) with medical students in Australia and patients with a variety of sleep disorders.^{22,26} The minimum clinically important difference (MCID) for improvement of the ESS score is believed to be between -2 and -3 .²⁷

The self-rated PSQI measures sleep quality and sleep disturbance. It consists of 7 domains (subjective sleep quality, latency, duration, efficiency, disturbances, medication use, and daytime dysfunction) and differentiates "poor" from "good" sleep over the last month. A global sum of greater than 5 on the PSQI indicates a "poor" sleeper.²³ The questionnaire has shown high internal consistency (Cronbach's alpha 0.83) and appropriate concurrent validity when validated with 148 individuals with and without sleep complaints.²³ The MCID ranges from 1.3 to 4.4.^{28,29}

The ESS and PSQI were used to capture information about current (inpatient) and pre-admission (to rehabilitation ward) sleep quality. This meant that we asked the patient to complete both the ESS and the PSQI when thinking about their usual (pre-admission) sleep quality and then again when thinking about their current (inpatient rehabilitation) sleep quality.

The FFS²⁴ was used to measure the level of fatigue in a variety of situations. The tool can be used to categorize borderline (scores 13-15), moderate (scores 16-20), and severe (scores ≥ 21) fatigue.³⁰ The SIQ²⁵ was used to measure the patients' current sleep inertia, that is, the transitional state of reduced alertness (grogginess) after awakening from sleep and has been validated with 439 community dwelling adults, and adults with a range of clinical conditions.³⁰

We also collected details about participant demographic characteristics, reason for admission to rehabilitation, medications, as well as functional ability (using the Functional Independence Measure [FIM])³¹ at admission and discharge. FIM is a routinely completed functional assessment measure used in inpatient rehabilitation where higher scores (out of 7) indicate higher levels of independence.³¹

Staff interviews

The staff interviews involved questions about ward routines, sleep management procedures and protocols on the ward, and knowledge about sleep hygiene principles. We also asked staff to identify barriers to sleep hygiene on the ward and how this could be improved. The interview guide is included as [appendix 1](#). The interviews lasted up to 30 minutes and were completed between October 2019 and January 2020. All interviews were audio recorded and transcribed verbatim by a third-party transcription company.

Data analysis

Quantitative data from the sleep questionnaires were analyzed using SPSS Version 25.^a Descriptive statistics were used to summarize sociodemographic data and to describe sleep characteristics from the questionnaires. Linear regression analyses were used to understand the effects of sleep quality on rehabilitation outcomes. We ran a simple linear regression to explore the relation of sleep quality (PSQI), as well as to explore the relation of fatigue (FFS) on rehabilitation outcomes (FIM efficiency score). Multivariate models were not performed based on the findings of the linear regression.

Qualitative data from staff interviews were analyzed using QSR NVivo software version 12.^b An inductive thematic approach was used and our coding was based on naturally occurring themes.³² The first study author (M.R.) completed the coding and subsequent analysis. The second study author (K.L.) also independently initially read and coded all the transcripts. These codes and impression were then compared, and we found high level of agreement. The initial codes were made to represent overall impressions about sleep and related comments on the rehabilitation wards. These codes were then organized into themes that summarized the key messages behind the initial codes. We continued this process of refining codes to capture key messages. Finally, we identified the themes that we are presenting here. Words in [brackets] have been added for contextual clarity.

We used a variety of credibility, dependability, and confirmability strategies described by Kresting³³ to enhance the rigor of this study. MR kept field notes to record ideas during interviews and any actions taken related to the research. Regular meetings were used to discuss data and themes that emerged from the interviews. These meetings enabled a wider exploration of the responses and consideration of multiple viewpoints for the interpretation of the data.

Results

Figure 1 depicts the patient participant recruitment process. Of 345 screened inpatients, 124 did not meet the study criteria (mostly as their reason for admission was stroke) and 100 were either unavailable or declined to participate. One person had been an inpatient twice during the study duration, and their details were only included once in the results. Data were collected from 120 inpatients. Eleven staff members were interviewed. This included 4 nurses (NN), 3 occupational therapists, 2 physicians specialized in rehabilitation (DR), 1 dietitian (DT), and 1 physiotherapist (PT).

Table 1 summarizes the main characteristics of patient participants. The mean age was 67.7 years (range 24-93), and 43% were women. The mean FIM efficiency score per week (that is, the change in functional status from admission to discharge as measured by the change in FIM score divided by length of stay) was 9.6 (range -29.90 to 33.44). The main admission reason was functional decline (42.5%).

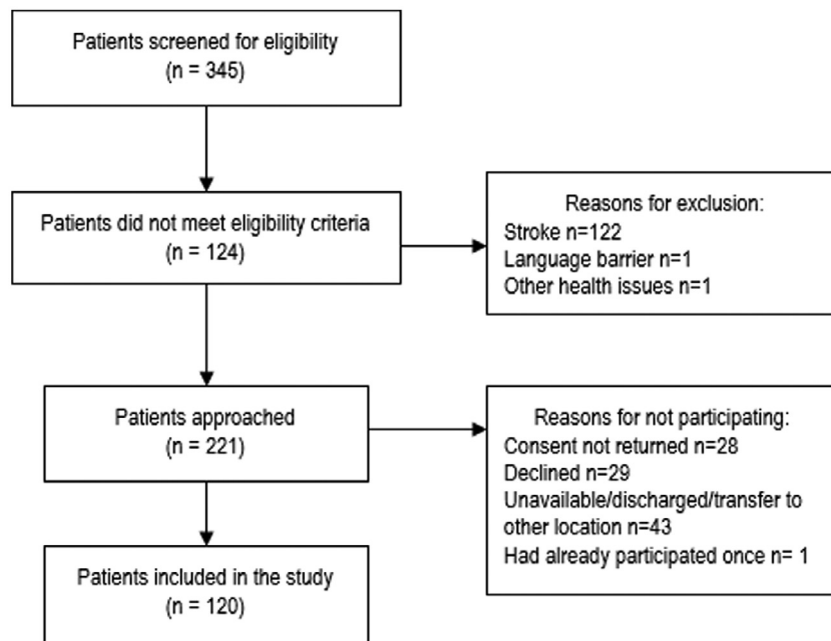


Fig 1 Patient participant recruitment process.

The self-reported average time (in minutes) it took the patient participants to fall asleep each night during their rehabilitation stay was 72 minutes (SD 76), and the average time patients slept was 6.5 hours (SD 2.0). The self-reported average time to fall asleep each night prior to hospital admission was a significantly less, with the mean time to fall asleep prior to admission to rehabilitation ward being 37 minutes (SD 48). The mean difference in time it took to fall

asleep between pre-admission (to rehabilitation ward) and during admission (in rehabilitation ward) was 35 minutes, SD 89.1 (95% confidence interval [CI] 19.2-52.0), $P < .001$ (appendix 1, table S1).

The average number of medications listed on a patient's medical record while on the ward was 12. Eighty-four patients (70%) were prescribed a form of pain medication (such as opioids or anticonvulsants), with an average of 1

Table 1 Patient participant characteristics

Age, mean \pm SD	67.7 (14.4)
Sex (Women), n (%)	51 (43.2%)
Reason for admission*	
Functional decline (medical or surgical)	51 (42.5%)
Fracture	17 (14.2%)
Amputation	14 (11.7%)
Spinal surgery	10 (8.3%)
Neurological (excluding stroke)	6 (5.0%)
Brain dysfunction or injury	5 (4.2%)
Trauma	4 (3.3%)
Spinal cord dysfunction or disorder	3 (2.5%)
Cancer	2 (1.7%)
Other	8 (6.7%)
FIM admission, mean \pm SD	82.7 (18.0)
FIM discharge, mean \pm SD	102.7 (25.6)
FIM efficiency, mean \pm SD	9.6 (8.6)
Self-reported time to get to sleep while in inpatient rehabilitation, mean \pm SD	72 minutes (76)
Self-reported hours of actual sleep while in inpatient rehabilitation, mean \pm SD	6.5 hours (2.0)
Average of medications prescribed for regular use, (range)	12 (range 3-25)
Average number of pain medications prescribed for regular use, (range)	1 (range 0-5)
Average number of sedative medications prescribed for regular use, (range)	0.1 (range 0-1)

* Main reason for admission was not recorded for all patients, hence the total number does not equate to 120.

pain medication (range 0-5) per person, not including pro re nata (PRN) prescriptions. Of the 74 patients who were offered PRN pain medication, 62 used these. Fifteen patients received regular sedative medications (such as benzodiazepines) excluding those who had sedatives prescribed PRN.

Fatigue and sleep inertia

Table 2 presents the data from the 4 questionnaires (FFS, SIQ, ESS, and PSQI). On the FFS, over half of the participants (n=65, 54%) self-reported fatigue to be a problem

Table 2 Results from the Flinders Fatigue Scale (FFS), Sleep Inertia Questionnaire (SIQ), Epworth Sleepiness Scale (ESS), and Pittsburgh Sleep Quality Index (PSQI)

FFS; In the last 5 days...	n	Not At All	Most Unlikely	Moderately	Likely	Extremely
Was fatigue a problem for you?	120	41 (34.2%)	14 (11.7%)	43 (35.8%)	14 (11.7%)	8 (6.7%)
Did fatigue cause problems with your everyday functioning (eg, work, social, family)?	120	76 (63.3%)	15 (12.5%)	20 (16.7%)	7 (5.8%)	2 (1.7%)
Did fatigue cause you distress?	120	89 (74.2%)	9 (7.5%)	12 (10.0%)	9 (7.5%)	1 (0.8%)
How often did you suffer from fatigue?	120	42 (35.0%)	23 (19.2%)	21 (17.5%)	12 (10.0%)	22 (18.3%)
How severe was the fatigue you experienced?	120	42 (35.0%)	25 (20.8%)	33 (27.5%)	13 (10.8%)	7 (5.8%)
How much was your fatigue caused by poor sleep?	119	79 (66.4%)	9 (7.6%)	14 (11.8%)	5 (4.2%)	12 (10.1%)
Total number of time periods a day you typically experience fatigue?	115	Not at all 40 (34.8%)	Once 36 (31.3%)	Twice 21 (18.3%)	Three times 4 (3.5%)	More than 3 times 14 (12.2%)
SIQ; On a typical morning in the past 5 days...	n	Not at all	A little	Somewhat	Often	All the time
Have problems getting out of bed?	119	50 (42.0%)	22 (18.5%)	15 (12.6%)	6 (5.0%)	26 (21.8%)
Need an alarm to wake up?	120	118 (98.3%)	2 (1.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Hit the snooze button on the alarm?	120	119 (99.2%)	0 (0.0%)	0 (0.0%)	1 (0.8%)	0 (0.0%)
Bump into and drop things?	120	106 (88.3%)	12 (10.0%)	1 (0.8%)	0 (0.0%)	1 (0.8%)
Notice that you move more slowly?	120	40 (33.3%)	32 (26.7%)	15 (12.5%)	10 (8.3%)	23 (19.2%)
Notice that you feel sleepy?	120	55 (45.8%)	31 (25.8%)	18 (15.0%)	12 (10.0%)	4 (3.3%)
Notice your eyes feeling heavy, sore, or itchy?	120	73 (60.8%)	21 (17.5%)	11 (9.2%)	13 (10.8%)	2 (1.7%)
Notice that your arms and/or legs feeling tired or heavy?	120	49 (40.8%)	25 (20.8%)	22 (18.3%)	11 (9.2%)	13 (10.8%)
Notice that your mind feels groggy, fuzzy, or hazy?	120	75 (62.5%)	23 (19.2%)	13 (10.8%)	5 (4.2%)	4 (3.3%)
Notice that you get more winded more easily?	120	81 (67.5%)	16 (13.3%)	7 (5.8%)	7 (5.8%)	9 (7.5%)
Notice that it is difficult to keep you balance?	119	35 (29.4%)	24 (20.2%)	15 (12.6%)	13 (10.9%)	32 (26.9%)
Notice that you feel tense?	120	81 (67.5%)	17 (14.2%)	13 (10.8%)	4 (3.3%)	5 (4.2%)
Feel anxious the upcoming day?	120	82 (68.3%)	15 (12.5%)	13 (10.8%)	5 (4.2%)	5 (4.2%)
Dread starting your day?	120	100 (83.3%)	10 (8.3%)	5 (4.2%)	3 (2.5%)	2 (1.7%)
Wish you could sleep more?	120	61 (50.8%)	17 (14.2%)	8 (6.7%)	21 (17.5%)	13 (10.8%)
Have difficulty concentrating?	120	79 (65.8%)	21 (17.5%)	14 (11.7%)	3 (2.5%)	3 (2.5%)
Find that you think more slowly?	120	61 (50.8%)	38 (31.7%)	12 (10.0%)	5 (4.2%)	4 (3.3%)
Find that you react more slowly?	120	58 (48.3%)	43 (35.8%)	10 (8.3%)	7 (5.8%)	2 (1.7%)
Find that you make more mistakes/errors?	120	100 (83.3%)	13 (10.8%)	4 (3.3%)	2 (1.7%)	1 (0.8%)
Cannot imagine being able to wake up?	120	115 (95.8%)	2 (1.7%)	3 (2.5%)	0 (0.0%)	0 (0.0%)
Have difficulty getting your thoughts together?	120	89 (74.2%)	15 (12.5%)	8 (6.7%)	5 (4.2%)	3 (2.5%)
How long does it take you to come to in the morning?	120	Immediately 50 (41.7%)	Less than 5 minutes 42 (35.0%)	10-15 minutes 18 (15.0%)	30 minutes to 1 hour 10 (8.3%)	
How many days over the past 5 days if this is the case?	117	Some days 2 (1.7%)	Most days 9 (7.7%)	Varies each day 7 (6.0%)	Everyday 99 (84.6%)	
ESS; How likely are you to doze off or fall asleep in the following situations...		Would never doze	Slight chance of dozing	Moderate chance of dozing	High chance of dozing	
Sitting and reading	120	47 (39.2%)	29 (24.2%)	29 (24.2%)	15 (12.5%)	
Watching TV	117	43 (36.8%)	39 (33.3%)	21 (17.9%)	14 (12.0%)	
Sitting, inactive in a public place (eg, theatre or meeting)	120	108 (90.0%)	7 (5.8%)	5 (4.2%)	0 (0.0%)	
As a passenger in a car for an hour without break	0	NR	NR	NR	NR	
Lying down to rest in the afternoon when circumstances permit	120	30 (25.0%)	19 (15.8%)	39 (32.5%)	32 (26.7%)	
Sitting and talking to someone	120	107 (89.2%)	10 (8.3%)	3 (2.5%)	0 (0.0%)	
Sitting quietly after lunch without alcohol	120	59 (49.2%)	20 (16.7%)	32 (26.7%)	9 (7.5%)	
In a car, while stopping for a few minutes in traffic	0	NR	NR	NR	NR	
PSQI; In the last 5 days, how often have you had trouble sleeping because you...		Not during the past month	Less than once a week	Once or twice a week	Three or more times a week	
Cannot get to sleep within 30 minutes	120	40 (33.3%)	0 (0.0%)	29 (24.2%)	51 (42.5%)	
Wake up in the middle of the night or early morning	120	28 (23.3%)	0 (0.0%)	20 (16.7%)	72 (60.0%)	
Have to get up to the bathroom	118	17 (14.4%)	0 (0.0%)	17 (14.4%)	84 (71.2%)	
Cannot breathe comfortably	119	102 (85.7%)	0 (0.0%)	6 (5.0%)	11 (9.2%)	
Cough or snore loudly	119	97 (81.5%)	0 (0.0%)	12 (10.1%)	10 (8.4%)	
Feel too cold	120	68 (56.7%)	0 (0.0%)	20 (16.7%)	32 (26.7%)	
Feel too hot	120	86 (71.7%)	0 (0.0%)	19 (15.8%)	15 (12.5%)	
Had bad dreams	120	104 (86.7%)	0 (0.0%)	10 (8.3%)	6 (5.0%)	
Have pain	119	42 (35.3%)	0 (0.0%)	16 (13.4%)	61 (51.3%)	
Of other reasons	119	0 (0.0%)	0 (0.0%)	7 (5.9%)	66 (55.5%)	
How often have you taken medicine to help you sleep (prescribed or "over the counter")?	119	99 (83.2%)	0 (0.0%)	7 (5.9%)	13 (10.9%)	
How often have you had trouble staying awake while driving, eating meals, or engaging in social activity?	120	116 (96.7%)	0 (0.0%)	3 (2.5%)	1 (0.8%)	
How much of a problem has it been for you to keep up enough enthusiasm to get things done?	120	No problem 60 (50.0%)	Slight problem 33 (27.5%)	Somewhat of a problem 19 (15.8%)	A very big problem 8 (6.7%)	
How would you rate your sleep quality overall?	120	Very bad 12 (10.0%)	Fairly bad 23 (19.2%)	Fairly good 72 (60.0%)	Very good 13 (10.8%)	

Abbreviation: NR, not reported.

(moderate to extreme), and a quarter (n=31, 26%) self-reported their fatigue was caused by poor sleep (moderately to extremely). However, the FFS total scores suggest that almost 3 quarters (n=83, 73%) of the patients were not experiencing fatigue. Half of the participants (n=60, 50%) reported having a level of difficulty with their balance on the SIQ.

Daytime sleepiness

Over half (n=70, 59%) of the participants reported that there was a moderate to high chance that they would doze if they were lying down to rest in the afternoon while in rehabilitation (table 2). Two of the 8 questions in the ESS were not completed during this study, hence we were unable to calculate a global score, or decipher for MCID. These questions were related to being a passenger in and driving a car, which could not have been done as participants were hospital inpatients during the survey period. When compared with fatigue experienced at home (supplemental table S1), the patients were significantly more likely to doze off or fall asleep while watching TV while in hospital with a mean difference of -0.32 (95% CI -0.53 to -0.10), $P < .05$.

Sleep quality

Forty-three percent of patients reported having a duration of sleep of 7-9 hours. However, data from the PSQI revealed that 75% of the participants who responded to all questions about their sleep while an inpatient (n=113) were classified as poor sleepers (a global score of >5). The average global score was 8.8 (SD 4.1). The 7 domains that are calculated to obtain the PSQI global score are presented in supplemental table S2. The poorest (highest) scores were reported in "sleep efficiency" or the time spent asleep in relation to the time spent in bed (mean 1.96, SD 1.28). When compared with prior to hospital admission, the participants reported significantly poorer sleep during rehabilitation (PSQI global score), with a mean difference of 1.44 (95% CI 0.61-2.26), $P < .05$. A difference of 1.44 could also be considered clinically meaningful using the MCID.

Linear regression analyses were completed to explore relations between sleep quality (PSQI global score), fatigue (FFS total score), and FIM efficiency scores. Two patients had unusually low FIM efficiency scores (-29.90 and -24.20). However, keeping or removing these cases did not affect the overall outcome of the results and they were therefore included in the analyses. We did not find relations between sleep disturbance and FIM efficiency scores. The average global Pittsburgh score or the FFS did not significantly predict FIM efficiency scores. There were also no significant correlations between FIM efficiency and hours of sleep or time taken to fall asleep. Based on these findings we did not conduct multivariable regression analyses.

Findings from staff interviews

All interviews delved into barriers to good sleep and these findings are presented first. Three overarching themes emerged from the interviews: "there's always room to improve", "lack of systems", and "current roles and

responsibilities", and these are then described. Lastly, suggestions on strategies to improve sleep are summarized. Table 3 provides further quotes relevant to themes discussed.

Barriers to good sleep

All staff recognized that there were interruptions to the patients' sleep. The nurses described "most of [the patients] will wake up at least one time..." [NN1]. The staff identified several barriers to good sleep. Noise was described to cause sleep disturbance in all, and pain in most (9 out of 11) of the interviews (table 3).

Other barriers identified were physical comfort and positioning, anxiety, hunger, need to use the toilet, fixed ward routines (such as night observations), and limited to none early evening activity options. Daytime napping was also considered a potential issue (n=7), although it was recognized that for some patients a break, or a "power nap", was needed. There was a sense that there was a lack of things to do in the evening (table 3).

One comment really sticks out, um, that someone down once [said], which is something like, you know, "the days are long, but the nights are longer"...That, that real sense of, um, you are just sort of waiting for things to happen. [DT1]

The therapy staff felt that if patients were engaged in more activities during the day and in the early evenings, their daytime napping would be limited and chances of more consolidated sleep overnight would be increased.

There's always room to improve

All staff appeared to have some knowledge about sleep hygiene. They also felt that patients could be educated about sleep hygiene, which is not part of routine practice. There appeared to be a gap and opportunity for more education of both staff and patients (table 3).

Lack of systems

Knowledge about the patients' usual sleep routine was considered helpful in understanding why they may have trouble with adapting to the rehabilitation setting. However, the ward had no systems in place, such as thorough initial assessment about sleep, that would facilitate better knowledge about patients' sleep (table 3). Sleep was often only inquired about in a conversational manner, such as when seeing a patient first thing in a morning (table 3).

I think that's to be encouraged to know how the patient wants their night managed... There's no discussion with them [patients about their sleep routine]... Like as far as all their admission documentation, there's no section on what is your sleeping routine like- [NN2]

It also appeared unclear whose role it is to talk about sleep with patients. One of the therapists' commented that not everyone should ask a patient about their sleep and that there should be a person responsible to address this domain (table 3).

Table 3 Additional quotes relevant to each theme

Theme	Additional Quotes
Barriers to Good Sleep	<p>...it'll be because of disturbances, um, external to them so the, um, the call bell is going off, another patient with their TV blaring.. um, just, um, yeah. The noises of a ward I suppose, um, but quite often there's like intrinsic factors as well so people experiencing pain. [OT2]</p> <p>They'll have little naps... I said, "are you particularly tired?" and they'll say, "No, I'm just napping because there's nothing, you know, I've just gone to sleep cause there was nothing else to do." [OT3]</p>
There's Always Room to Improve	<p>Firstly, for the staff, maybe we need to, uh, improve our education. [NN1]</p> <p>I'm not aware of any of it [sleep hygiene] being talked about with patients... It doesn't mean it doesn't happen, though... I guess whether maybe it could be on an individual basis if someone's having a lot of issues with sleeping where their medical or nursing teams are giving advice to try and improve their sleep patterns. [PT1]</p>
Lack of Systems	<p>... we had a family meeting, um, with a gentleman, and his daughter brought up the fact that at home he and his wife don't go to bed until about 2 or 3 o'clock in the morning and then they sleep through until midday. And the question was asked, is that a problem for a person's recovery and... they were like, "no", it had never been brought up before in the patient's admission, and he was being discharged today." [OT3]</p> <p>... I guess it's like when you're with your family as well, "Oh, how did you sleep?" You know, "Did you sleep well last night?" Um, in the same way quite often that might be a question I will ask a patient, you know, "Did you sleep well last night?" [OT2]</p> <p>That, it probably needs to be defined whose role it is because um, I mean, maybe it does sit with, sit with nursing staff to ask them those questions on admission things, but probably it's one of those things again, like you don't want 10 people going in and asking them how they sleep... Um, it could be someone's role. So have a person who has a specific role... But um, but yeah, I don't know whose job it could be. [OT3]</p>
Current Roles and Responsibilities	<p>And I'll take the, um, obs machine [vital signs monitor] and I'll go down along the line and whoever is awake, I'll do their obs [vital signs]. Whoever is not awake, I'll leave them be. And if lights are on or something I'll flick them off and make sure things have gone quiet for them so as I can leave them to sleep until they next wake. And that's when I will do their obs or give Panadol. [NN2]</p> <p>Ac- actually it's, uh, sleeping tablets is uh, second in line, normally. Usually we ask if I can make milk or some tea for you? Or some uh, drink, let him feel relaxed... So let them feel safe or secure in the nights, yeah. [NN1]</p> <p>Um, and so, if they're not performing as well they, they might actually say, "I'm feeling really tired today, I didn't sleep well."... I guess it's almost their way of apologizing for not performing as well as they have on previous occasions perhaps. Um, so yeah, sleep does come up, I would say relatively often. [OT2]</p>

Abbreviations: OT, occupational therapist; PT, physiotherapist

Current roles and responsibilities

If a patient was having ongoing problems with sleep, the staff felt that this should be discussed with the treating team in case conferences. Yet, all felt that they had different roles to play in terms of addressing sleep-related problems.

The doctors [physicians] have more responsibility to ensure that [they] look into just finding the causes and way to try to manage it [sleep disturbance] [DR2].

The occupational therapists also felt that it was within their scope of practice to inquire and provide brief education (for example, by providing a leaflet).

I think we [occupational therapists] would be the only ones to talk about it... Yes. If it [sleep] was highlighted that it's an issue, I think no one else would do it. [OT1]

The nursing staff felt more responsible for actions such as comfort, lighting, minimizing noise, completing observations, and distributing medications. They acknowledged there was some flexibility in night-time routines which would promote longer blocks of sleep (table 3).

...We just try and make the patient comfortable- either positioning, toileting, or medication.[NN4]

Therapy staff were more concerned about the timing of and effect/participation in therapy. Fatigue and difficulty performing physical activities were common after-effects of disturbed sleep. The therapy staff reflected how patients would often refer to "poor sleep" as reason for not performing as well in their sessions (table 3).

Suggestions to improve sleep practices

The staff made several recommendations regarding how sleep and sleep hygiene could be improved. These are

Box 1 Recommendations (identified by staff interviews) to improve sleep for patients on the wards

- Assess for sleep (history and routines) at admission
- Ensure pain is controlled
- Provide sleep hygiene education for both staff and patients
- Consider offering/using white noise machines, ear plugs, and/or eye masks
- Introduce sleep champion roles (ie, a staff member who champions good sleep hygiene practices on the ward)
- Use psychology or other holistic approaches to improve sleep hygiene
- Add activities (including mindfulness, yoga, or calming therapy) for the evenings
- Limit caffeine intake

summarized in [box 1](#). Introducing a systematic approach to assess for sleep during admission was considered key, as well as ensuring that patients and staff are aware of good sleep hygiene practices.

I guess good sleep history is the beginning of the mission... You know, we usually talk about social factors, you know, and about all this medical issues, and I think if they get the point of really good history of, sleep history, would be really good to have as well. [DR1]

Non-pharmacologic approaches and implementation of “extra activity in [patients’] therapy program” [DR2] were common suggestions. Many proposed the use of “head-phones” and “eye masks”, as they acknowledged that it may be difficult to eliminate certain environmental factors (including noise and light) that can affect sleep.

Discussion

We sought to identify current sleep quality in among rehabilitation inpatients and ward practices and staff knowledge and perceptions about sleep hygiene. Less than half of the surveyed patients reported getting healthy amounts of sleep overnight. They took longer to fall asleep than prior to their rehabilitation stay and issues such as pain and needing to go to the toilet overnight affected on their sleep quality. Staff reported that they had a good understanding of sleep hygiene. However, assessment and management of sleep disturbance was based on an ad hoc approach and relied on staff taking initiative to ask about sleep and then use problem solving to try and develop solutions.

A recent review¹⁵ revealed that few studies have been conducted related to sleep in an inpatient rehabilitation settings.³⁴⁻³⁷ Those that have been conducted show similar results to ours, suggesting that sleep in inpatient rehabilitation settings is an issue around the world. For example, 1 study found that 48% of their population had sleep disturbances (measured using the Medical Outcomes Study Sleep Scale).³⁷ A study conducted in the United States found that

70% of post-acute rehabilitation patients (N=226) had sleep disturbance according to the PSQI.³⁶ Our data showed that 75% of patients were poor sleepers based on the PSQI global score which is higher than the previous studies. Our data also showed that daytime sleepiness (as measured on the ESS) was an issue with 63% of patients who reported that there was a chance of them dozing off while watching TV. A higher percentage (79%) of patients in inpatient rehabilitation in Germany (N=129) reported high levels of daytime sleepiness.³⁵

We did not find relations between self-reported sleep disturbance and FIM efficiency scores. It is likely that FIM efficiency was not a sufficiently sensitive outcome measure to detect changes in function over time for this population. The FIM tends to focus on physical outcomes rather than cognitive or emotional/mood outcomes which may be more affected but were not systematically examined in this study.

We found that nurses consider themselves as having an important role in addressing sleep during inpatient rehabilitation. Indeed, nurses are in a key position to enable good sleep practices for hospital inpatients during the night.³⁸ We discussed several barriers to good sleep (such as night-time disturbance) that are applicable to rehabilitation nursing. Staff also made recommendations for several inexpensive and easy strategies that could be implemented to assist with promoting better sleep for inpatients. Several of the recommendations, such as provision of white noise machines, ear plugs and/or eye masks, can be inexpensive and feasible to implement. However, others such as assessing patients for sleep at admission, increasing evening activities and sleep hygiene education may require a culture shift in the rehabilitation ward which can be more challenging to achieve.

Strengths and limitations

A strength of this study is that it combined findings of surveys administered with patients with information gained from interviews with staff who work on the ward. Information from the surveys and interviews were complementary and in agreement. For example, survey data showed that patients frequently had pain, woke-up, or had to go to the toilet overnight. Nurses who worked overnight also identified these issues as being the most common causes of sleep disturbance.

Another strength is that this study provides a comprehensive evaluation of sleep on the ward and helps identify a way forward to improve sleep (as presented in [box 1](#)). The next step is to design an intervention based on these principles and test whether this results in improvements in sleep for patients.

A limitation is that this study was conducted on a single ward and the results should not be generalized to other, especially stroke rehabilitation, wards. Environment and staff practices are likely to vary at different sites. We relied on self-report data from surveys which were extensive, and we did not use activity monitoring devices to quantify sleep disturbance. The use of an objective measurement of sleep should be considered in future work. The surveys also required participants to think back and recall their sleep prior to their admission to the hospital inpatient rehabilitation ward. Patients with stroke were excluded even though

they make up a large number of patients in rehabilitation wards. The relation between sleep and stroke is complex and sleep disturbance is common in stroke survivors.²¹ The etiology of stroke may contribute to impaired sleep and therefore we believe this group should be studied independently.²¹ Sleep among stroke survivors in hospital rehabilitation is an area that needs addressing.³⁹ Lastly, many participants were also unavailable or declined to participate in the survey, so selection bias may be present with this study sample.

Conclusions

This paper provides important information about sleep during rehabilitation which is an often overlooked but critical factor in recovery. Sleep disturbance was reported to be common among rehabilitation inpatients. Only 43% reported getting healthy amount of sleep and over half of the participants found fatigue to be a problem. We found no correlation between the functional ability (as measured using the FIM scores) and sleep quality. Our data suggest that there are possible, easy to implement, strategies that may improve sleep quality for patients within inpatient rehabilitation. Implementation of these strategies requires further evaluation.

Suppliers

- a. IBM SPSS Statistics for Windows, Version 25.0; IBM Corporation.
- b. Nvivo Qualitative Data Analysis Software. Version 12; QSR International Pty Ltd.

Corresponding author

Dr Miia Rahja, Department of Rehabilitation, Aged and Palliative Care, Flinders Health and Medical Research Institute, Flinders Drive, Bedford Park, SA 5042. *E-mail address:* miia.rahja@flinders.edu.au.

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