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Repeated sleep-quality assessment and use of sleep-promoting interventions in ICU

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ABSTRACT

To describe sleep quality using repeated subjective assessment and the on-going use of sleep promoting interventions in intensive care. Both the measurement and promotion of sleep are challenging in the complex environment of the intensive care unit. Repeated subjective assessment of patients' sleep in the intensive care unit and use of sleep-promoting interventions has not been widely reported. An observational study was conducted in a 58-bed adult intensive care unit. Sleep quality was assessed using the Richards-Campbell Sleep Questionnaire each morning. Intensive care unit audit sleep-promoting intervention data were compared to data obtained prior to the implementation of a sleep guideline. Patients answered open-ended questions about the facilitators and deterrents of their sleep in the intensive care unit. Descriptive statistics were performed. Audit data from the intensive care unit quality database were examined. An independent sample t-test was performed to compare self-reported sleep quality (Richards-Campbell Sleep Questionnaire Total scores) of patients cared for prior to the time the guideline was implemented and after the guideline was implemented. Content analysis was used to explore responses to the open-ended questions on facilitators and deterrents of sleep. The sample (n=50) was predominately male (76%), with a mean age of 62.6±16.9 years. Sleep quality was assessed on 2 days or more for 21 patients. The majority of patients (98%) received sleep-promoting interventions. Sleep quality had not improved significantly since the guideline was first implemented. The mean Richards-Campbell Sleep Questionnaire score was 47.9±24.1mm. The main sleep deterrents were discomfort and noise. Frequently cited facilitators were nothing (i.e. nothing helped) and analgesia. The Richards-Campbell Sleep Questionnaire was used on repeated occasions, and sleep-promoting interventions were used extensively. There was no evidence of improvement in sleep quality since the implementation of a sleep guideline. The use of the Richards-Campbell Sleep Questionnaire for the subjective self-assessment of sleep quality in intensive care unit patients and the implementation of simple promoting interventions by intensive care unit clinicians is both feasible and may be the most practical way to assess sleep in this context.Relevance to clinical practice. The use of the RCSQ for the subjective self-assessment of sleep quality in ICU patients and the implementation of simple promoting interventions by ICU clinicians is both feasible and may be the most practical way to assess sleep in the ICU context.

Key words: critical care nursing; critical illness; sleep

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INTRODUCTION

Patients treated in the intensive care unit (ICU) are critically ill. The busy environment and the effects of critical illness are not conducive to sleep.(Aitken et al., 2016, Salandin et al., 2011, Li et al., 2011). Research has highlighted that patients treated in the ICU report poor sleep quality (Beecroft et al., 2008, Freedman et al., 2001). Investigations using polysomnography (PSG) have revealed sleep structure significantly different from that of healthy adults and typically described as disrupted (Watson et al., 2013, Elliott et al., 2013, Drouot et al., 2012). Sleep assessment in this population is challenging.

BACKGROUND

The function of sleep has yet to be completely elucidated; although it is acknowledged for its important role in wellbeing and restoration (Siegel, 2005). The difference in sleep structure and sleep stage progression displayed by ICU patients in comparison with healthy adults, indicates that patients may not experience the complete restorative benefits of sleep. Arguably critically ill patients are particularly in need of this. Many of the specific factors that disrupt sleep for ICU patients are not well understood. Factors specific to the ICU environment, such as non-circadian light, high sound levels and discomfort related to invasive monitoring, have been reported as disruptive by patients (Aitken et al., 2016, Freedman et al., 2001). The role of factors related to the underlying illness such as systemic inflammatory response and treatment such as mechanical ventilation on sleep quality is less clear (Drouot and Quentin, 2016, Rittayamai et al., 2016, Pisani et al., 2015).

Sleep interventional research has focused either on modulation of one postulated sleep disruptive factor, such as mechanical ventilation mode (Rittayamai et al., 2016, Roussos et al., 2010) or on multiple factors, such as a sleep guideline or 'quiet time protocol' (Elliott and

McKinley, 2014, Kamdar et al., 2013). Sleep improvement has been reported in some investigations (Patel et al., 2014, Li et al., 2011), while no significant improvements in sleep have been identified in others (Kamdar et al., 2013), leading to difficulty generalising benefits.

When used as methods to assess sleep in ICU, nurse observation and PSG have significant limitations. Nurse observation has yet to be established as reliable (Beecroft et al., 2008, Ritmala-Castren et al., 2016) while PSG is intrusive, technically difficult and interpretation is uncertain using conventional scoring (Watson et al., 2013, Drouot et al., 2012). Therefore patient self-report, when possible, is recognised as a practical alternative for the assessment of sleep quality (Storti et al., 2015, Ritmala-Castren et al., 2013). The Richards-Campbell Sleep Questionnaire (RCSQ)(Richards et al., 2000) is a reliable self-report instrument that has evidence of validity against PSG.

Aims and objectives of the study

The aims of this study were to (i) assess the feasibility of the on-going repeated use of the RCSQ to assess ICU patients' sleep quality, (ii) contrast the use of sleep promoting strategies in a locally developed clinical practice guideline to usage previously reported(Elliott and McKinley, 2014), iii) assess any improvement in self-reported sleep quality since its implementation and outline self-reported sleep facilitators and deterrents.

DESIGN AND METHODS

Study design overview

We conducted a prospective observational study in which quantitative data from the RCSQ were compared with data from previous investigations in the same ICU (Elliott et al., 2013). Some of the data in the current study were also analyzed for a larger previously published

study (Aitken et al., 2017). In this larger study the same study instruments and protocol was used in two study sites (including the study site described in this paper) but the uptake of sleep promoting interventions was not examined. Data were collected during May and June 2014.

Setting

This investigation was conducted in Sydney, Australia in a tertiary referral hospital providing statewide specialty services. The hospital had a 58 bed ICU, separated into four areas, two general ICUs, a cardiothoracic ICU and a neurological ICU. The registered nurse to patient ratio in the ICU was one to one for mechanically ventilated patients and one to two or three for high dependency patients. The ICU consisted of only single rooms, each with sliding glass doors to the outer and windows to adjoining rooms.

Participants

Participants were adult ICU patients (≥18 years) treated in the ICU for ≥24 hours and had demonstrated capacity to provide informed consent in English. Screening occurred between Monday to Friday; patients who met the eligibility criteria and had no exclusion criteria were invited to participate. Exclusion criteria included known or suspected preexisting sleep disorder, diagnosis or high suspicion of dementia and confirmed or high suspicion of excessive intake of alcohol or drug abuse. Patients were enrolled only once during the study period, even if readmitted to the ICU.

Instrumentation

The RCSQ is a brief self–report instrument specifically designed to assess the perception of critically ill patients' sleep (Richards et al., 2000). The RCSQ consists of five visual analogue scales (VAS); each scale represents a different sleep domain with scores ranging from 0

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(poor quality) to 100 mm (excellent quality). Respondents were requested to place an 'X' along each VAS to indicate the quality of that sleep domain for the previous night. The distance from zero mm to the 'X' was measured and the mean distance of the five VAS was calculated to derive the RCSQ Total Score. The RCSQ Total Score is considered a global measure of sleep quality with higher scores indicating better sleep quality (Richards et al., 2000). It takes approximately two minutes to complete the RCSQ (Hoey et al., 2014). Patients were also asked open-ended questions about what had facilitated i.e. 'What strategies or interventions helped you get to sleep last night?' or impeded (sleep deterrents) i.e. 'What activities woke you or kept you awake last night?' their sleep on the previous night.

Data collection

Research personnel introduced themselves to eligible patients in the ICU when they were not undergoing clinical activities (such as wound dressing changes) after first consulting with the bedside nurse. Patients were required to be calm, cooperative, conscious (only lightly sedated) and to have adequately corrected eye sight to read the study instrument. The patients' sedation level was assessed using the Richmond Agitation Sedation Score (RASS) (Sessler et al., 2002). A patient who was assessed to have a sedation level between -1 and 1 on the RASS was eligible to participate (interactive and cooperative). After explanation, verbal agreement was sought and written informed consent obtained later (retrospectively). The RCSQ was administered daily (mostly in the morning) during the patients' entire ICU stay or up to three months for long stay patients. The RCSQ was administered on an A4 sized sheet of paper. For participants who were unable to write (e.g. in the case of quadriplegia), the researchers traced a pen along each VAS and instructed the participant to

provide a cue for where they wished to place the 'X'; the correct placement was confirmed with the participant.

Clinical and demographic details were recorded on a case report form including date of birth, gender and primary reason for admission, medications, ventilation and airway interventions and APACHE II severity of illness score.

Participants were approached on subsequent days and asked to report their sleep quality for the previous night. If participants declined RCSQ completion, they were asked to clarify whether they were declining on that occasion only or declining further participation. Participants who declined ongoing RCSQ self-reports were not approached again but were asked to consent to have the data that they had already provided included in the analysis. Participant discharge dates for the ICU and hospital were censored at three months.

The guideline evaluation (audit) data were part of the routine quality improvement data collection in the study ICU and were obtained from the ICU Quality Database to identify the use of sleep promoting strategies. The ICU quality database contained checklists with 'yes' and 'no' alternatives for nurses to self-report on clinical activities at the point of care. The checklist included one item for sleep containing: 'Usual sleep practices noted, patient settled before 2200hrs, ear plugs and eye shades offered, care/treatment clustered to allow 1.5–2hrs rest' to which nurses entered 'yes' or 'no'. The responses for the sleep item were obtained from the database for the investigation period (5 May 2014 to 18 June 2014).

Ethical considerations

Ethics approval was provided by the health service and University Human Research Ethics Committee (approval numbers: LNR/14/HAWKE/60 and 2014000199). Retrospective written consent was obtained either at the conclusion of their ICU stay or in the hospital ward

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following transfer from ICU. Where a patient was unable to sign, their proxy signed the consent form on the patient's behalf. At each time point of being approached for RCSQ completion, consent was obtained and patients were assured that they could decline further participation at any time without affecting their future healthcare.

Data analysis

The distributions of data were examined. Descriptive statistics were performed, means and standard deviations (e.g. age and RCSQ scores) and medians and interquartile ranges (e.g. ICU length of stay) for continuous data and frequencies (e.g. gender) for categorical data. Audit data from the ICU Quality Database were presented as frequencies. An independent sample t-test was performed to compare self-reported sleep quality (RCSQ Total scores) at the time the guideline was implemented and after the implementation of the guideline (during the current study). A p value <0.05 was considered statistically significant. Microsoft Excel (Version: 14.0.7015.1000) and IBM SPSS Statistics (Version 22) were used for statistical analyses. For the current study a retrospective sample size calculation confirmed that a sample size of 50 provided 95% confidence that the point estimate for the mean total RCSQ score represented the population mean. Content analysis was used to explore responses to the open-ended questions on facilitators and deterrents of sleep.

RESULTS

Fifty patients participated. They were on average 60 years old, had a median length of ICU stay of over 3 days and three-quarters were male. Two hundred and seventy-seven patients were screened and 182 met the inclusion criteria, 145 were eligible but 74 were missed (Figure 1). Seventy-one patients were approached and 50 were able to participate (only

three declined). A summary of selected demographic and clinical characteristics for the sample is provided in Table 1.

Feasibility of repeated assessment of sleep quality using the RCSQ

Forty-two percent of study participants completed more than one RCSQ. The reasons that repeated data were not collected from 29 participants were; 17 completed the RCSQ on the day of ICU discharge, 4 were recruited on Friday and discharged over the weekend (data collection was not performed at the weekend), 5 were busy (e.g., having lunch or undergoing a radiological investigation), and 3 discontinued from data collection. Almost all participants who were approached on or after day four of their ICU stay completed a repeated RCSQ (13/14 participants). The mean number of occasions the RCSQ was completed (including the initial RCSQ) was 4.2±3.5 and the median (IQR) was 3.0 (3.0–4.0) per patient. Participants who completed the RCSQ on more than one occasion had a greater median ICU length of stay (LOS) than those who had completed the RCSQ only once (9 (5-25) verses 2 (2–3) days). The RCSQ repeated completion percentage was 72% when adjusted to exclude those who did not complete because they were discharged (Figure 1).

Use of sleep promoting strategies

Data from the ICU quality database for nurses' responses to the statement 'Usual sleep practices' was examined. For the study period there were 1427 audits of sleep with 1409 indicating 'Yes' and 18 indicating 'No'. From the audit, 98.7% of nurses reported that sleep-promoting strategies were in use in this ICU.

Self-reported sleep quality

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The RCSQ Total Scores from all participants in this investigation (n=50) were compared with the RCSQ Total Scores from all participants in the previous investigation in the same ICU (n=42) when the sleep promoting interventions had recently been implemented (Elliott et al., 2013). Scores were 47.9±24.4 mm and 51.3±24.4 mm respectively (p = 0.50).

Overall, sleep quality reported on the RCSQ was poor with sleep depth having the lowest score and returning to sleep after awakening having the highest score (Table 1). Although a majority of patients identified 'nothing' as facilitators or deterrents to their sleep the most common facilitator was 'medications' with 'pain and discomfort' being the most common deterrent.

Discussion

This investigation was designed to explore the feasibility of assessing sleep quality of patients in an adult ICU using the RCSQ on repeated occasions, to contrast the use of sleep promoting strategies in a locally developed clinical practice guideline to usage previously reported (Elliott and McKinley, 2014) and to assess any improvement in self-reported sleep quality since its implementation.

The repeated completion rate of 72% indicated that collection of sleep quality data using the RCSQ repeatedly was feasible. Sleep interventions were reported by bedside nurses to be in use for almost all patients. Patient self-reported sleep quality did not show any improvement following implementation of the locally developed guideline which had been in use for four years at the time the current study was conducted. Patients in the ICU experienced poor sleep quality, with an average score of less than 50/100mm. Perhaps

tellingly many patients were unable to identify any facilitators of their sleep and discomfort and care activities were frequently highlighted as sleep deterrents.

We were encouraged by the ability of many patients to complete the RCSQ daily (only three patients discontinued). We found the RCSQ to be non-burdensome and routine administration by clinicians (rather than researchers) would probably have reduced the number of missed opportunities to assess sleep (e.g. absent for radiological investigation). Given its ease of use it is somewhat surprising that the use of the RCSQ for ongoing sleep assessment in the ICU is published infrequently. Exceptions include two studies (Kamdar et al., 2013, Aitken et al., 2017) that compared sleep assessments by patients' and nurses'. Fifty percent of participants completed the RCSQ on two or more occasions in two studies; one conducted in Australia (Aitken et al., 2017) and the other in North America (Kamdar et al., 2013). In the North American study the RCSQ was completed on 88% of available days by either the patients (or by nurses if patients were unable to respond). Despite the scarcity of reports of the repeated use of the RCSQ, these studies and our own repeated completion rate of 72% are evidence to support its feasibility for routine assessment of patients' sleep in the ICU, as well as for evaluating interventions to improve sleep.

The audit of the ICU quality database indicated that nurses' self-reported adherence to strategies presented in the 'Rest and Sleep guideline for ICU patients' was high. The finding of high self-reported adherence indicated that the strategies either were used or considered for use, if they were appropriate for the individual patient (e.g. non-delirious if ear plugs were offered). The selected components of the guideline used for the audit were clustered hence the nurse could only respond once (yes or no) to answer for all components. Consequently, identifying the guideline components with the highest and lowest adherence

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rates could not be reported. However, it appears that adherence has improved since the original audit of the guideline, which suggested limited uptake of the strategies (Elliott and McKinley, 2014). The relocation of the ICU to a new building before the current study and after the original audit and the length of time for clinicians to be familiarised with the guideline may be contributing factors for the increased adherence.

In a similar study that did report the use of individual components of a 'sleep bundle' improvements were noted in creating sleep conducive environmental conditions that required little time and effort from clinicians such as dimming night time lighting (Kamdar et al., 2014) but this did not result in improved sleep quality (Kamdar et al., 2013). Likewise Patel et al.(2014) reported that patients perceived less sleep disruption associated with noise and inappropriate light levels after the implementation of a 'sleep bundle' and in this study the self-reported sleep efficiency using the RCSQ improved significantly. Both pre-post evaluation studies assessed sleep in a relatively short period (e.g. less than six months) after implementation of sleep promoting strategies (Patel et al., 2014, Kamdar et al., 2013). It is unclear whether any improvements in practice or outcomes were maintained beyond the time in which the studies were conducted. Similar problems with methodology were revealed in a recent Cochrane review that highlighted the need for well-designed and conducted research to strengthen the evidence for the use of non-pharmacological interventions for improving sleep in critically ill adults (Hu et al., 2015).

Mean RCSQ Total Scores representing poor sleep quality have been reported in previous investigations in ICU patients including 47.18 mm in the same ICU, (McKinley et al., 2013) and internationally 47.00mm (Krotsetis et al., 2017), 45.5 mm (Frisk and Nordstrom, 2003) and 51.42 mm (Nicolas et al., 2008) and was perhaps reflective of the many sleep deterrents

identified by patients. Self reports of the facilitators and deterrents of sleep by ICU patients appear to be consistent between studies. Noise, in particular from staff conversations, is a universally reported sleep deterrent (Freedman et al., 1999, Stewart et al., 2016, Krotsetis et al., 2017, Elliott et al., 2013). In contrast in the current study noise was not the most commonly reported deterrent to sleep and this may be a feature of the study ICU in which patients were exclusively located in single rooms fitted with closing doors. The frequently mentioned deterrents 'pain and discomfort' and 'care activities' were concerning. Likewise care activities were highlighted as reasons for poor sleep by patients in a recent study to test the reliability of the German version of the RCSQ (Krotsetis et al., 2017). In the current study 'analgesia' was frequently cited as a sleep facilitator while a sense of relief/ fatigue was facilitative for patients in the Krotsetis et al. (2017) study. Many patients were unable to identify anything specific ('nothing') which assisted or deterred their sleep which is unsurprising given the multi-factorial effects of illness, the environment and treatment on sleep. This response was reported among former ICU patients in a phenomenological interview study about the experience of sleep deprivation; 'I don't sleep. I don't know why' (Tembo et al., 2013).

Limitations of the study

Recruitment and data collection were limited to Monday to Friday (hence the number of missed eligible patients). Convenience sampling is known to increase the risk of bias, (Williamson, 2003) for example more patients with surgical diagnoses are admitted to ICU during weekdays than on weekends. The sampling and data collection methods used in this investigation could have impacted the representativeness of the sample and ability to generalize the findings.

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The methods for audit data collection were different in the original audit and the current study. In the original audit the researcher reviewed patient charts to identify adherence to components of the Guideline and observed implementation of the usual rest period (Elliott and McKinley, 2014). The components of the Guideline used for the audit in the current investigation were clustered and allowed only one response (yes or no) for all components (so adherence for the entire guideline may not have been 98%). Consequently, interpretation of the audit data is limited.

In addition a structured delirium assessment instrument was not routinely used in the study ICU at the time of data collection. However the researchers sought the opinion of the nurse about whether the patient was delirious and performed an informal assessment themselves before performing the sleep assessment. The RCSQ was not administered to patients who were considered to be delirious.

Implications and recommendations for research and practice

The RCSQ has not been validated in healthy populations; validation with PSG would be useful in order to better interpret critically ill patients' RSCQ data. Importantly it would be valuable to further validate the instrument in the critically ill populations. The original validation was performed using PSG in 70 male cardiac patients, none of whom were reported to have had sepsis, respiratory or other diagnoses or were mechanically ventilated (Richards et al., 2000). This would further consolidate its usefulness for ongoing sleep assessment at various time points of a patient's ICU stay and provide confidence in its value as an adjunct to sleep research and quality activities designed to improve sleep in this population.

CONCLUSION

Our study demonstrated that it is feasible to use the brief and non-burdensome RCSQ to assess patients' sleep on multiple occasions while they are treated in the ICU. Few studies report repeated measures of sleep quality using the RCSQ. Sleep quality varies with environmental and internal conditions therefore arguably a 'one off' assessment is of limited use in the context of critical illness when many patients experience prolonged treatment in ICU. The study provides evidence of increased adherence to sleep strategies in the Rest and Sleep Guideline. Evidence of guideline use contributes to the findings of a relatively small number of studies conducted on this topic about sleep in ICU patients. The results from this investigation characterised patient sleep in the ICU as poor quality and light. However, as has been reported in previous studies, apparently good uptake of the guideline did not result in improved sleep quality for patients.

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What is known about this topic

- The quality and quantity of patients' sleep in ICU is poor.

- Assessment of ICU patients' sleep is challenging.

What this paper contributes

- Repeated self-assessment using the Richards-Campbell Sleep Questionnaire of sleep quality by ICU patients is feasible.

- Quality of ICU patients' sleep may not improve despite the use of a 'rest and sleep' guideline.

- Sleep and rest interventions require further investigation to establish their efficacy in critically ill adults.

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Figure title and legend

Figure 1: Flow chart of patient screening, recruitment and participants' initial and subsequent RCSQ completions

*RCSQ = Richards-Campbell Sleep Questionnaire, [†]Data collection occurred Monday to Friday
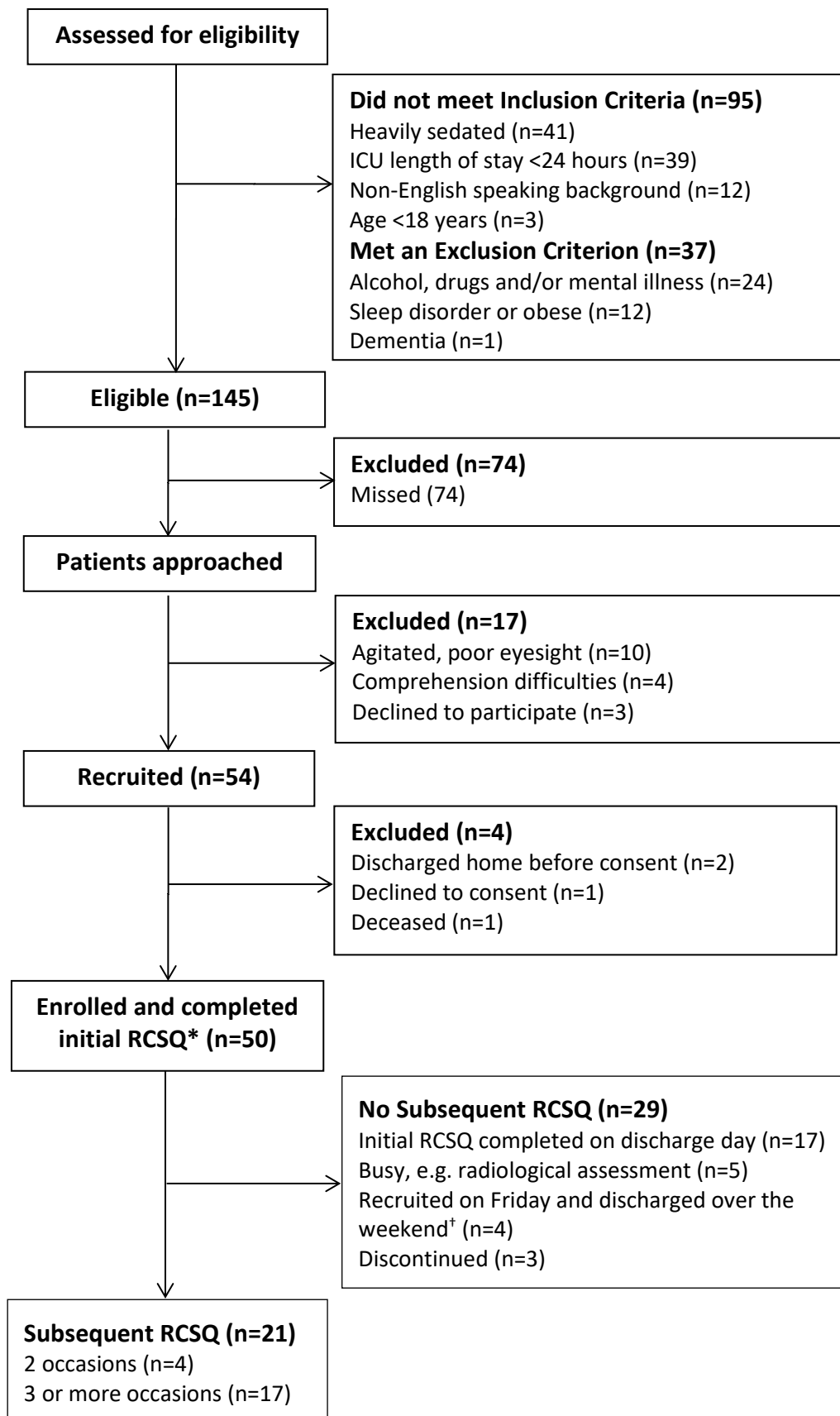
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Figure 1: Flow chart of patient screening, recruitment and participants' initial and subsequent RCSQ completions

*RCSQ = Richards-Campbell Sleep Questionnaire, [†]Data collection occurred Monday to Friday

Table 1: Selected sample characteristics and scores for RCSQ

Characteristic	Statistic
Age, years, Mean±SD*	62.6±16.9
Male gender, n (%)	38 (76)
Diagnosis, n (%)	
Non–operative	26 (52)
Operative	24 (48)
Main diagnostic categories, n (%)	
Cardiovascular operative	11 (22)
Neurological operative	5 (10)
Respiratory non–operative	5 (10)
Other	29 (58)
APACHE[†] II score, Mean±SD	12.5±6.3
Artificial airway, n (%)	6 (12)
Invasive or non-invasive ventilation, n (%)	7 (14)
Medication, n (%)	
Antipsychotic	4 (8) [‡]
Benzodiazepine	6 (12)
Opioid	24 (48) [§]
ICU length of stay, days, Median (IQR)[^]	3.4 (1.9–7.6)
Hospital length of stay, days, Median (IQR)	12.5 (7.2–29.5)
ICU day on which initial data collection occurred, Median (IQR)	2.0 (2.0–4.0)

RCSQ[#] Descriptors	Mean±SD[†] Score (mm)
My sleep last night was:	39.9±25.8
Light… Deep	
Last night, the first time I got to sleep, I:	46.8±30.3
Just never could fall asleep… Fell asleep almost	
immediately	
Last night I was:	46.0±27.6
Awake all night long… Awake very little	
Last night when I woke up or was awakened, I:	55.9±31.3
Couldn't get back to sleep… Got back to sleep	
immediately	
I would describe my sleep last night as:	50.7±31.6
A bad night's sleep… A good night's sleep	
Total RCSQ score	47.9±24.4

* SD = standard deviation, [†] APACHE = Acute Physiology and Chronic Health Evaluation, [‡] One patient received antipsychotic, benzodiazepine and opioid medications, [§] five patients received benzodiazepine and opioid medications, ^ IQR = interquartile range, [#]RCSQ = Richards-Campbell Sleep Questionnaire