An Arabic translation, reliability, validity and feasibility of the Richards-Campbell Sleep Questionnaire for Sleep Quality Assessment in Intensive Care Unit: Prospective-Repeated Assessments

Abstract

Purpose: To translate Richards-Campbell Sleep Questionnaire (RCSQ) into the Arabic language (RCSQ-A), to assess content validity of the translated tool, to analyse the internal consistency and to evaluate its feasibility.

Methods: A rigorous translation was completed using the process of translation by World Health Organization. Cognitive debriefing interviews were performed. Repeated assessments using RCSQ-A was conducted in critical care patients in Saudi Arabia.

Result: Cronbach's alpha of 0.89 was seen in the RCSQ-A. The cognitive interviews showed that the RCSQ-A well understood and interpreted correctly and consistently. 57 participants reported their sleep using RCSQ-A a total of 110 times.

Conclusion: RCSQ-A has adequate translation validity, provided good internal consistency and content validity, making it suitable for use as a measurement tool in practice and research in Arabic-speaking countries.

Key words: Arabic version, Intensive Care Unit, Richards-Campbell Sleep Questionnaire**,** Sleep Assessment, Cognitive interview, Repeated Assessment.

Introduction

Sleep is a basic human need that enables the human body to restore and refresh itself, and is fundamental to a person's optimum health and wellbeing (Banks & Dinges, 2011). In patients who are critically ill, alterations in their normal sleep patterns have been documented to include sleep deprivation and poor sleep quality (Boyko et al., 2012). Their sleep is characterized by frequent disruption and a reduction in the deep, restorative stages (Tembo et al., 2013; Elliott et al, 2013). It is important to recognize these altered patterns, as they can have adverse biological and physiological effects if left untreated (Brummel & Girard, 2013). Previous research indicates that sleep disorders in intensive care units (ICUs) can persist for months long after the patient is discharged from the hospital and returns home (Pisani et al., 2015). If unrecognized, short-term sleep disorders can develop into chronic issues that can severely impact a patient's recovery and ability to be wholly functional. Poor quality of sleep in critically ill patients can result in increased morbidity, mortality and length of stay in the hospital (Kamdar et al., 2012; Pulak and Jensen,2016) and can lead to an increased risk of developing delirium during the stay in ICU (Roche-Campo et al.,2010; Brummel and Girard,2013).

Studies suggest that there are a number of factors associated with disrupted sleep in ICU patients. These factors can be by-products of severe illness, pain, sedation, medications (Elliott et al., 2013; Gay, 2010), or can stem from anxiety and stress (Frisk et al., 2003; Krotsetis et al., 2017). Alternatively, sleep disruption can result from factors related to the ICU environment, such as noise, light, and patient care activities (Andersen et al., 2013; Pisani et al., 2015; Bihari et al., 2012). Recent ICU sleep studies strongly recommend that ICU patients' sleep be monitored and assessed in ICU environments and that this aspect of patient care should not be overlooked (Aitken et al., 2017, Jeffs et al., 2017).

The Richard Campbell Sleep Questionnaire (RCSQ) is one of the most commonly used methods for sleep quality assessment in ICU (Richards et al., 2000; Nicolas, et al., 2008). The RCSQ tool, which is simple and easy to administer, has been developed to meet the needs of ICU patients (Richards et al., 2000). It is validated by a five-item visual analogue scale (VAS).

(VAS) is a self-report device used to measure such subjective sensation as pain, dyspnea and fatigue (Richards, 2000). Each VAS in RCSQ represents a different aspect of sleep: sleep depth, falling asleep, number of awakenings, percentage of time awake, and the overall quality of sleep. Each scale ranges from 0 (poor quality) to 100 mm (excellent quality). The RCSQ total score is an overall assessment of sleep quality, with better quality sleep indicated by higher scores (Aitken et al., 2017; Richards et al., 2000). It is proposed by McKinley et al. (2013) to use 70 as a cut-off point between good and poor-quality sleep. However, Frisk and Nordström (2003) and Krotsetis et al. (2017) recommend 25 be the cut off to indicate very poor-quality sleep and 75 to indicate very high-quality sleep. Nicolás et al. (2008) used different categories to rate sleep, with defined as 0–33 poor, 34–66 fair, and 67–100 good; this scale approximates McKinley et al.'s definition. The tool has been translated into multiple languages, including German, Swedish and Spanish (Krotsetis et al. 2017, Frisk and Nordstrom 2003, Nicolas et al. 2008). However, an Arabic version of the RCSQ is needed to assess and monitor sleep quality in Arab-speaking ICU patient populations. In this paper, authors aimed to create an Arabic version of a valid tool for sleep assessment in ICU "RCSQ" to assist the nursing process and enable healthcare providers and researchers to examine, promote and improve sleep in ICU patients.

Background and conceptual framework

Assessment is the first critical point in the care process and treatment plan (Jervas, 2004; Munroe, et al., 2013). Accurate detection of the problem is the foundation to successful outcomes for the patient (Munroe, Curtis, Considine and Buckley, 2013). Without a thorough and accurate assessment tool any strategy to improve the quality of sleep could be unreliable and difficult to evaluate (Jeffs and Darbyshire, 2017). Therefore, in order to conduct an effective analysis, appropriate research tools are required (Polit and Beck, 2012). One of the most important considerations when identifying an appropriate tool is consistency and the ability to compare and contrast with other research studies (Squires, et al., 2012). This is important in order to draw conclusions and benchmark against other findings.

In terms of the translation of languages, using a widely recognised and employed tool is particularly vital. This ensures the quality of the translation and reduces the potential for errors.

According to Drost (2011), the effectiveness of a tool used to translate one language to another is determined by the accuracy of the outcome compared to the content of the original. A key determiner of this accuracy is the understanding of individuals. To ensure a valid translation, this study will use cognitive interviews, as proposed by Reeve et al. (2011). This process evaluates research participants' understanding of each translated item, providing a quality assurance mechanism that identifies any errors.

Sleep assessment, has been undertaken in previous research using an objective tool called polysomnography (PSG), which is a method for assessing sleep architecture by electroencephalography (EEG). PSG uses passive sensing technology that must be worn continuously in a lab-controlled setting for sleep-quality data to be collected and interpreted. Whilst it is considered the gold standard measure of sleep quality, it is costly and impractical to use on every patient admitted to ICU (Elliott et al., 2013). Due to the challenges of obtaining objective measurements of patients' sleep, alternative approaches have been sought; these include subjective methods being developed.

Subjective methods include using nurses' observations and patients' perception of their sleep. However, the evidence indicates that nurses' assessments of patients' sleep are inferior to patients' own assessment of their sleep. Nurses significantly overestimated the quality of patients' sleep, thus such observations are unsuitable for routine use (Jeff et al., 2017; Kamdar et al., 2012; Aitken et al., 2016; Nicolas et al., 2008). Timing and a regular routine are essential for quality sleep measurements to be reliable (Richardson et al., 2007 and Hoey et al., 2104). The disruptive environment of ICU means patients experience frequent awakenings; therefore, intensive observation is required for precise recording of sleep quality (Fontaine et al., 1989). The importance of this is emphasized in a study by Bourne et al. (2007), in which observation time data was missing. There is, however, increasing recognition of the usefulness of subjective perceptions of patients' sleep in ICU (Kamdar et al., 2012 and Jeff et al., 2017). Aitken et al., 2017 assert that sleep quality is a highly subjective matter; as is demonstrated when an individual lays claim to an insalubrious sleep episode yet provides a normal PSG reading. The clinically meaningful outcome of sleep quality is the patient's experience and evaluation of their sleep. Thus, self-reporting is the most appropriate method for conducting sleep assessment (Shaughnessy et al., 2003), albeit one limited to the cognitive capabilities of the ICU patient

(Bourne et al., 2007). Nevertheless, according to Nicolas et al. (2008), it is both a simple and cost-effective means of obtaining extensive information on patients' sleep patterns.

Several sleep assessment questionnaires have been developed, including the Verran and Synder-Halpern Sleep Scale (VSH) (Snyder-Halpern and Verran, 1987), the Pittsburgh Sleep Quality Index (PSQI) (Buysse et al.,1989), the Sleep in Intensive Care Unit Questionnaire (SICQ) (Freedman et al., 1990), the Insomnia Severity Index (ISI) (Bastien et al., 2001) and the RCSQ. The RCSQ is demonstrably superior, both in terms of its reliability and validity, in comparison with the assessment tools employed in the previous studies (Amirifar, et al., 2018). It has been confirmed by Jeffs et al. (2017) that when compared to other assessment tools, such as SICQ, PSQI and VSH, the RCSQ had superior predictive value. A review study aimed at identifying and evaluating subjective measurement tools was conducted by Hoey et al. (2014), the findings revealed that the RCSQ offers superior use in acute settings, because it is short, easy to use and comprehend, and it has proven reliability and validity as a tool for capturing sleep data to facilitate global assessment. This is due to that

The RCSQ has been validated against the PSG (Richards et al., 2000) and when measured against the PSG, has displayed positive psychometric properties in reliability and correlated with polysomnographic measures to capture some of the domains of sleep quality in terms of sleep onset, awakenings and depth of sleep (Hoey et al., 2014). In the reliability testing, Richards et al. (2000) obtained a Cronbach's alpha of 0.9. Regarding the validity testing, Richards et al. (2000) performed factor analysis for the questionnaire validation and the results of this study ascertained that the character of the unidimensional scale (the RCSQ scores) validity measured the construct "sleep" in ICU patients. In Richards et al. (2000), the questionnaire's developer measured the RCSQ against the PSG using a sample of ICU patients. Their study showed that RCSQ items had a strong association with sleep onset (r =-.51). The RCSQ also showed a strong correlation with deep sleep (r = .59), the lighter sleep stage of N2 (r = .64), and REM (r = .55). The RCSQ has demonstrated acceptable levels of consistency throughout numerous translated versions. For example, in the German version there was, according to Krotsetis et al. (2017), a Cronbach's alpha of 0.88. Furthermore, a Cronbach's alpha of 0.89 has been observed by Nicolás et al. (2008) for the Spanish adaptation. Frisk and Nordström et al. (2003) similarly recorded a Cronbach's alpha of 0.92 for the Swedish edition.

Many studies have been conducted to assess ICU patients' sleep quality in a Western health care context (Aitken et al., 2015; Elliott et al., 2013; Frisk et al., 2003; Kamdar et al., 2012; Krotsetis et al., 2017; Nicolas et al., 2008). These studies are attracting increasing interest in Western countries. Whether ICU patients' sleep quality assessment have been conducted in non-Western contexts, particularly Middle East countries, has not been considered. In fact, only one study conducted in Saudi Arabia have monitored 46 patients' sleep for a twenty- four-hour period in Coronary Care Care Unit (CCU) using SensWear Armbands (SWA) (Al Otair et al., 2011). The study revealed that the patients experience short nocturnal sleep durations. However, this study was limited to objective method of sleep assessment. As this method of sleep assessment is impractical for the ICU environment.

The RCSQ is empirically valid and highly recommended for assessing the sleep quality of ICU patients, as yet there is no Arabic version of the RCSQ (RCSQ-A). PSQI and ISI are other subjective instruments that assess sleep quality have been translated into Arabic (Suleiman et al., 2015 and Suleiman et al., 2001); yet, none of these instruments are designed to assess the quality of sleep in critically ill ICU patients. RCSQ is the only tool developed specifically for ICU patients (Richards et al. 2000). To the best of our knowledge this is the first study designed to develop a valid and reliable non-invasive instrument (RCSQ-A) specifically in the Arabic-language for sleep assessment in ICU which may generate improvements in nursing assessments in nursing practice in Arabic countries, which may lead to the implementation of more appropriate nursing interventions promoting better sleep for inpatients.

The goal of this study to develop an Arabic version of the valid tool RCSQ. Our specific objectives were:

To translate the RCSQ into the Arabic language, using the recommended translation process guidelines set forth by the World Health Organisation (WHO).

To assess evidence of content validity of the translated version by assessing respondent understanding of RCSQ-A 5 items (cognitive interviews).

To evaluate the reliability of the translated instrument by testing evidence of internal consistency using Cronbach's alpha (α).

To describe the feasibility of using RCSQ-A in the repeated assessment of ICU patients' sleep quality and to use this version to ascertain patients' perceptions of sleep in a sample of critically ill patients.

Methods

This study was conducted in two stages during 2018-2019. The first stage of the study was translation of RCSQ into an Arabic version and linguistic validation. The second stage was carried out to perform the psychometric evaluation of the translated version RCSQ-A in a descriptive repeated-prospective assessment study to assess the content validity, reliability and feasibility.

Stage I: Translation of RCSQ to RCSQ-A and linguistic validation

To develop the (RCSQ-A), the well-established process of translation and adaptation by the (World Health Organization [WHO], n.d.) was strictly followed and applied. Implementation of this method included the following steps: forward translation, expert panel, back-translation, pre-testing and cognitive interviewing and final version.

Step1. Forward translation

The translation of the instrument into the Arabic language (forward translation) was performed independently by two native Arabic speakers with excellent knowledge of the

English language in Saudi Arabia. Both translators were recruited from the hospital in which the study was conducted and were selected in accordance with WHO-recommended criteria. One translator was a consultant in the field of pulmonary and sleep medicine, with over a decade's experience in ICU and sleep disorder management. This translator's academic training was acquired in Canada. The second translator was a certified professional translator of five- years' standing within the hospital's translation department, who in addition possesses knowledge of English-speaking cultures and previously worked as a professional translator in Australia for fifteen years. Recognising the need to use natural and acceptable language for the target population, the translators focused on conceptual, rather than literal translations. They used simple, clear and concise language, avoiding technical terms that may not be understood by the ICU-patient population.

Step2. Expert panel for forward translated (RCSQ-A)

Reconciliation of the two forward translated version RCSQ-A was provided by a three-person panel of medical experts. All panel members not only were native Arabic speakers in possession of outstanding command of the English language but were also selected in strict accordance with WHO criteria. According to the WHO, one criterion used to select panel members might be expertise related to the relevant conceptual framework, assuming the theoretical basis for the instrument has already been well defined. Thus, the panel's clinical expertise in critical-care and sleep-disorders was deemed appropriate for their role in the comparing and synthesizing of the two forward translated versions of RCSQ-A. The panel member who undertook the forward translation was a consultant in the field of pulmonary and sleep medicine. Remaining panel members consisted of a registered critical care nurse with four years practical ICU nursing experience and five years academic experience, and one consultant in critical care medicine who has over fifteen years of working experience in the ICU and an academic background in the United States (USA).

To ensure consistency and to fortify the conceptual equivalence of the forward translation, the panel initially constructed a well-defined conceptualisation of the basic precepts of the original RCSQ with the intention that the forward translation (RCSQ-A) should capture the essential meaning of the questions in the original RCSQ rather than simply constitute a

crude, literal translation. Panel members were thereby able to identify inadequate expressions or concepts in the translation in addition to discrepancies between the forward translations. Contentious concepts and inconsistencies were deliberated upon and resolved, resulting in a final, fully-reconciled forward translation ready for back translation.

Step3. Back translation

Using the same approach as that outlined in the first step, the instrument was translated back into English by two independent certified professional linguists in the UK, who were fluently Arabic speakers with no prior knowledge of the questionnaire. The translators were requested to emphasise conceptual rather than linguistic equivalence. The back translated RCSQ-A was compared with the original RCSQ after it was sent via email to the questionnaire developer. She agreed on the back translation with no any further comments.

Finally, a committee of bi-lingual experts in the field of the translated instrument, consisting of four medical staff from the hospital. This panel verified the consistency of both forward and backward translations and approved the final Arabic version (RCSQ-A). Three of these experts had been involved at an earlier step in the translation process, that is, the reconciliation of the forward translation. They were the consultant doctor in pulmonary and sleep medicine, the registered critical care nurse and the consultant in critical care medicine. The additional panel member was a sleep medicine professor with over fifteen years' clinical experience at a sleep medicine research centre in Saudi Arabia and a further seven years' experience in Canada. Each member of the panel was requested to assess how well the contents of RCSQ-A matched those of the original RCSQ. They were required to ensure that the translated elements were accurate, free from item-construction problems and grammatically correct. The final phase of the WHO translation and instrument adaptation process consists of pre-testing and cognitive interviewing. This was implemented for the RCSQ-A through the collection of data from a sample group of ICU patients. Details of this stage can be found in the following section (stage II of the study).

Stage II: A descriptive repeated assessment study to assess the content validity, reliability and feasibility of the translated version RCSQ-A**.**

Study Design

A descriptive prospective repeated measures study was conducted to assess evidence for validity of cognitive debriefing interview with target population " critically ill patients", internal consistency reliability and feasibility of using RCSQ-A in repeated assessments. The assessment included two steps: Pre-test (cognitive debriefing) assessment of RCSQ-A (step I), then RCSQ-A used again with the same participants to assess their perceived sleep quality by repeated assessments on multiple days. "Patients' Self-Reported Assessment of Sleep" (step II).

Data were collected during the period of March and April 2018. The sample size was based on recommendations by Streiner and Kottner (2014) and Johanson and Brooks, (2010) who recommended a sample size of at least 50 participants to assess the inter-rater reliability of the assessment tool. The study design was chosen to achieve high reliability, it is recommended to use repeated measures with the same persons in the study (Streiner and Norman, 2008, Shrout and Fleiss, 1979). The results of this study will help to describe the feasibility of using the RCSQ-A in multiple measurements with ICU patients.

Ethical issues

The study was undertaken in accordance with the ethical principles for medical research involving human subjects as set out by the World Medical Association (2013) in the Declaration of Helsinki. The study was independently reviewed and approved by an ethical board of the University Hospital in Saudi Arabia and the University of Glasgow in UK. Recruitment to the study was facilitated by the head nurse in the ICU department who identified and approached potential participants. Potential participants were given an information sheet and asked to give signed informed consent. Anonymity and confidentiality was maintained throughout the study.

Study Setting

Data was collected at the University Hospital in Jeddah city in Saudi Arabia. The hospital's ICU has a 26-bed facility that provides care for critically ill patients, both medical

and surgical. At time of study there was a single room for each patient and a 1:1 nursing ratio for all.

Inclusion and Exclusion Criteria

Participants were eligible to take part in the study if they met the following criteria:

Adult patients, aged ≥ 18 years.

In-patients exposed to the ICU environment for more than 24 hours.

Mechanically invasive or non-invasive, spontaneously breathing patients.

Exclusion Criteria:

Fully sedated or moderate sedated patients, as these medications are known to negatively impact sleep architecture (Boyko et al., 2012; Kamdar et al., 2012).

Patients who had sleep pathologies; patients with high cognitive dysfunction (defined as the presence or history of dementia, traumatic brain injury, stroke, or hepatic encephalopathy) or active delirium (positive CAM-ICU), as they could not be relied upon to provide accurate data when using sleep questionnaires, thus their sleep would not reflect that of the general ICU population (Bourne et al., 2007).

A Richmond Agitation and Sedation Score (RASS) (Sessler et al., 2002) score of <-1 or >+1 (agitated).

Patients with neuro-surgical needs, due to the need for hourly neurological observations overnight, which were considered to a barrier to sleep.

Patients who did not speak Arabic

Data collection and recruitment measures

A convenience sample of all mixed medical and surgical adult ICU patients who met the inclusion criteria were invited to participate in this study. The study was conducted by

obtaining data from 57 of Arabic-speaking adult ICU patients. All potential study participants were screened for eligibility criteria by using study enrolment survey every day morning between 8:00 and 12:00 by principal investigator and a head nurse, who is an experienced critical care nurse. A study enrolment survey used to facilitate participants, identification and recruitment. The survey includes participant inclusion and exclusion criteria.

Step I: Pre-test (cognitive debriefing) assessment administered before patients were requested to assess their previous night's sleep.

The cognitive debriefing method was utilized, to ensure that the RCSQ-A was used for accurate assessment of each patient's sleep quality and was employed exactly as it is used in the original RCSQ. Specifically, it was critical to ensure that the translated questionnaire measured what it was intended to measure (content validity), and that respondents understood and correctly interpreted all items (Reeve et al., 2011). Willis et al. (2005) explained that the cognitive debriefing method is used to identify and analyse sources of response error in survey questionnaires and this is acknowledged as an important way to ensure the quality and accuracy of translated survey instruments. Specifically, the purpose of this method is to understand whether subjects understand the questions consistently across subjects and in the way intended by the researchers (Collins, 2003).

Data collected through Data Collection Form for Cognitive Interviews. The form consists of four columns (item, number of correct explanation, number of wrong explanation and recommended paraphrasing and comments). During the first episode of data collection, a subsample of participants, 30 patients out of 57 patients were invited for cognitive interview, these patients were invited because they were not intubated at that time and could speak. While the rest of patients**,** (n= 27) were on mechanical ventilation and they included in step II. The questionnaire' questions RCQ-A (5 items) were read to the patients, one by one, in order to assess the clarity and interpretation of each item. Patients were asked the following questions about the questions in the questionnaire RCSQ-A in the manner recommended by WHO:

What is the question asking?

Can you repeat the question in your own words?

Are there any words you did not understand or any words you found ambiguous?

What came to your mind when you heard this term?

Patients were also asked to explain how they came to select their answers. These questions were repeated for each of the five items on the questionnaire. There were no comments from the 30 patients to suggests the presence of difficult or ambiguous items. This made the principal researcher to proceed to step II.

Step II "Patients' Self-Reported Assessment of Sleep (Repeated assessments)"

Data collection was conducted utilising subjective assessment using (RCSQ-A), was performed by the principal investigator. Inviting patients to undertake a self-assessment of their sleep is beneficial, as that it is a patient's individual sleep experience which provides the most clinically significant outcomes (Aitken, et al., 2017). Each patient's medical record was reviewed for clinical and demographic data (Table 1) including age, gender diagnostic group, status of mechanical ventilation (ventilated or non-ventilated), length of ICU stay and severity of critical illness. The latter was assessed using Acute Physiology and Chronic Health Evaluation [APACHE II], which is a severity-of-disease classification system. APACHE II score range from 0 to 71, with higher scores corresponding to more severe disease and an elevated risk of death (Knaus et al., 1985).

After the principal investigator had tested the RCSQ-A with the target population of ICU patients and was satisfied that the respondents understood the questionnaire, 57 patients were requested to rate their previous night's sleep each morning for 2 to 4 days for each patient at a point between 8.00 a.m. and 12.00 p.m. This approach was chosen to limit the potential of recall bias and to assure optimal reminiscence of the most recent night's sleep. Patients were requested to place a single mark or X on the answer line, (VAS), which is a non-divided line equivalent to 100 mm (0 mm = poorest, 100 mm = optimum rating) that best described their previous night's sleep. In cases where patients could not set the mark themselves, they pointed, with the tip of their finger, at the chosen spot and the investigator marked the scale accordingly. During the administration of the questionnaire, the principal researcher maintained proximity to the respondent, and was available to provide assistance to the subject or respond to any queries regarding the questionnaire.

Data analysis and management

Data was entered and analysed using SPSS (IBM Corp, Version 23.0). Descriptive statistics were used to obtain frequency, percent, mean, and standard deviation analyses. Demographic data and patient characteristics were analysed descriptively. Internal consistency was calculated using Cronbach's alpha coefficient with $\alpha \geq .70$ considered evidence of adequate internal consistency (Nunnally & Bernstein, 1994). The total score for sleep quality was calculated using the recommended method described by the questionnaire developer (Richards, 2000). This method adds the score for each VAS, which is then divided by 5 (total number of VAS) to provide a mean score for sleep quality per day for each patient. To arrive at a mean score of RCSQ-A for each patient, the total overall repeated RCSQ-A mean scores were divided by the number of days that the patient provided the data.

Results

Participants

In total 178 patients were screened for inclusion, but of these, 121 were excluded; thus, 57 patients were included in the final analysis. Figure 1 depicts the recruitment process and reasons for non-eligibility and non-participation in the study. The average age of participants was 54 years old, the majority (61%) of which were males. Participants were mostly post-surgery patients (63%). The mean (SD) APACHE II score was 17.80 (4.48). None of the patients was sedated during assessment. A total of 38 patients (67%) received non-opioid analgesics or non-steroidal anti-inflammatory drugs (NSAIDs) and the remainder received intermittent low-dose boluses of opioid analgesics as needed to manage moderate to severe pain. Opioids were only administered to patients who did not respond to non-opioid analgesics.

RCSQ-A content validity, reliability and feasibility

The results of this study ascertained that the character of the unidimensional scale (the RCSQ scores) validity measured the construct "sleep" in critically ill patients. As neither content-construct nor criteria were modified in the Arabic version RCSQ-A, the researchers solely examined the aspect of reliability (internal consistency) and content validity with a target

population of adult ICU patients by using a cognitive debriefing method and repeated assessment of self-reported patients' sleep quality. Results were satisfactory and comparable with the original RCSQ version. All the RCSQ-A (5 items) were well understood and interpreted correctly and consistently, there were no comments from the 30 patients during cognitive debriefing interviews to suggest the presence of difficult or ambiguous items. The overall internal consistency of the Arabic version of the RCSQ was 0.89. RCSQ-A demonstrated that it is an effective assessment tool, simple with an easy to understand scoring system with Arabic speaking ICU patients.

All assessed patients were able to provide a self-report of their sleep quality on multiple days, it was feasible to the ICU patients to complete all 5-items of the tool in each assessment they provided. 57 participants reported their sleep using the RCSQ-A a total of 110 times. Participants provided data from two to four days, with a mean score of 2.05 sleep reports per participant. Time required to complete the questionnaire was between two and three minutes.

Participants' self-reports of sleep on repeated assessment

The mean RCSQ-A total score was 33.24 (SD 14; range 0-95); (25%) patients had a total RCSQ score less than 26, indicating very poor sleep quality. Another (68%) patients had a total RCSQ score between 26 and 50 which indicated poor sleep; and (7%) patients obtained scores of between 70 and 75, which indicated they had good sleep. Table 2 shows the mean scores and standard deviation for all RCSQ-A 5 items. Depth of sleep was rated the lowest with a mean of 30.49 and falling asleep was rated the highest with a mean of 35.61.

Discussion

The aims of this study were to translate the RCSQ into the Arabic language, to evaluate the reliability and content validity of the translated version RCSQ-A. This study was important, in order to discern whether the translated version of a reliable instrument for assessing sleep quality could be feasibly used, to evaluate sleep in critically ill patients, would retain its

reliability if translated. The participants in our study fully understood and correctly interpreted the questions posed in the survey. No difficulties were reported. This either proves the effectiveness of our translations or reflects the fact that the RCSQ is simple to understand due to the fact that it only includes five clear questions. The ease of patient comprehension of the questionnaire and the subsequently accurate interpretation of the questions concurs with the findings of other studies which relied upon translations of the RCSQ, including investigations by Krotsetis et al. (2017), Nicolas et al. (2008), and Frisk and Nordstrom (2003). These studies have all concluded that the five items of RCSQ are succinct, unambiguous and comprehensible by ICU patients.

Richards et al. (2000) were responsible for performing the original ratification of the RCSQ, which had a Cronbach's alpha of 0.90. RCSQ-A, compared to the original and other translated versions, proved to be internally consistent and suitable for use in the assessment of perceived sleep characteristics and sleep quality in critically ill patients. The RCSQ-A showed very good internal consistency with Cronbach's alpha of 0.89. In accordance with Moghaddam et al. (2011) the result met all requirements for internal constancy and indicated tolerable levels of dependability. The Cronbach's alpha in this instance exceeded 0.7. This is consistent with the result of the German version of the RCSQ, evaluated by Krotsetis et al. (2017), had a Cronbach's alpha of 0.88 in 51 alert patients in an 85 ICU beds in five ICUs in Germany. The Spanish version, by Nicolas et al. (2008) was tested on 104 non-mechanically ventilated patients in a 16-bed surgical ICU in Spain, with a resulting alpha of 0.89. The Swedish version, by Frisk and Nordstrom (2003), was tested in 31 patients in a 6-bed surgical ICU in Sweden and had a Cronbach's alpha of 0.92.

This study investigated samples of mechanically ventilated and non-ventilated patients, i.e. the authors did not limit the reliability test to non-ventilated patients. The authors chose to do this because they wanted to be sure the questionnaire was feasible and could easily be used with ICU populations, both ventilated and non-ventilated, and thus could be deemed applicable in the ICU. There is no prior validation of RCSQ reliability in measuring and comparing sleep quality in ventilated and non-ventilated patients. RCSQ was used in a study conducted by Kamdar et al. (2012) and Kamdar et al. (2013), which repeated assessments with non-ventilated and ventilated patients. However, these studies failed to report on the effectiveness of using

RCSQ with ventilated patients. The present study was first step in assessing the translated version of RCSQ-A in intubated patients and its feasibility in ventilated patients. However, larger scale studies are required to evaluate the reliability and validity of the RCSQ-A with intubated patients.

Although the focus of this study was on assessing the instrument's reliability in patients' self-assessment, researchers assessed patients' sleep quality by using a repeated measures assessment. Comparable to the results of studies by Aitken et al., (2015) and Kamdar et al. (2012a, 2012b), depth of sleep (item 1) was rated the lowest (mean 44 and 48, respectively), whereas in Frisk and Nordstrom (2003), quality of sleep (item 5) was rated the lowest with a mean of 39. In Nicolas et al. (2008), the number of awakenings (item 3), with a mean of 42 was considered low. Reasons for the differing valuations of sleep could be attributed to the different intensive care settings and medical conditions of the patients in the study.

Participants were able to use the RCSQ-A multiple times. In this study, participants reported on their night-time sleep for two to four days. They reported their sleep using the RCSQ-A a total of 110 times. Most studies have used sleep self-reporting in intensive care patients on a single occasion. A notable exception was the study by Aitken et al. (2017) and a study by Kamdar et al. (2012). Aitken et al. (2017) reported that 151 participants reported their sleep using the RCSQ for a total of 356 times. Participants provided data from time periods of between one and 18 days, and 50% of participants were able to report on their sleep on two or more days. Kamdar et al. (2012) reported that 33 patients in a medical ICU for 137 days completed 121 self-reports a rate of 88% of available days, generating an average of 3.7 reports per patient. Thus, the present study's findings that ICU patients were able to respond to RCSQ-A questions on multiple assessments supported the recent findings of other researchers. A repeated assessment of this study with ICU patients suggested that the RCSQ is both simple to use and a feasible option for use in clinical ICU environments.

This study sought to translate the valid and reliable RCSQ tool, which was designed specifically for an ICU population, into the Arabic language by using a rigorous translation process. Additionally, this study sought to assess the reliability of the translated RCSQ-A as a

brief, easy to understand tool that is straightforward to use, and to provide sleep domain and validated patient-reported sleep assessments in ICU settings to assist the nursing process and enable healthcare providers and researchers to examine, promote and improve sleep in Arabic-speaking ICU patients.

Limitations

Limitations of this study were that the sample size was small and the study was conducted at a single site. Thus, researchers could not provide a broad insight about the correlations between patients' characteristics and their sleep quality. However, the goal of the study was to create a reliable and valid RCSQ tool in the Arabic language and to assess this version's reliability and feasibility for use with critically ill patients. A larger sample size is needed and recommended for future studies, if these are to yield more reliable data.

There was a recruitment bias in this study, sedated patients with RASS score of <-1 were excluded because sedatives are known to impact sleep architecture negatively. Also, because of the limitations of the self-report instruments for sleep assessment in ICU patients, patients require a degree of cognitive acumen and consciousness to complete the questionnaire accurately (Elliot et al 2011; Bourne et al., 2007). However, in this study the researchers did take care to include both ventilated and non-ventilated patients, and found there were no difficulties in using a self-reported RCSQ with patients on mechanical ventilation, as they were able to express their sensation of sleep quality on the questionnaire scales. This study was limited to medical and surgical patients. Future studies will be required to assess sleep quality using the RCSQ-A in more diverse critical care populations. Future studies might also investigate the inter-rater reliability of nurses using the Arabic version of the RCSQ to measure patients' sleep quality.

Nursing implications for practice, research and education

The findings from this study have important implications for nursing practice, research and education. This study demonstrates the feasibility of using repeated, self-reported RCSQ-

A assessments of sleep quality. Such assessments can be performed when patients are sufficiently alert, but not necessarily able to communicate verbally (Aitken et al. 2016). The findings reported here highlight that RCSQ-A data could be supplemented by implementing routine, early documentation of sleep patterns into the nursing care plan of ICU patients during their stay in the ICU. This included nurses needing to be aware of the importance of sleep to ICU patients and knowledgeable of how sleep disorders can affect critically ill patients. Further research assessing nurses' knowledge and awareness regarding ICU patients' sleep is needed. Future research could address the development and evaluation of appropriate educational interventions for nurses around assessing and managing sleep quality in the ICU setting.

The self-reported quality of sleep of ICU patients was very low in the study sample highlighting the need to be further tested in a larger sample size in the Middle East, and/or in Arabic-speaking populations. Further work large descriptive-cohort study is now needed, using RCSQ-A to assess ICU patients' sleep quality during their ICU stay until they deemed fit discharge from the unit, to assess the acceptability and ability of the ICU patients to report on their sleep on multiple days whilst an inpatient in the ICU. Furthermore, to identify factors that may affect their sleep as well as development of early interventions for this problem, which will improve and enhance healthy sleep and overcome the impact consequences of poor sleep.

Conclusion

There were no difficulties in the use of RCSQ-A. The reliability and validity of the RCSQ-A has been demonstrated and further, it has been shown to be an appropriate tool, with good internal consistency, feasible and able to assess Arabic-speaking patients' sleep in critical care units. The quality of sleep perception was very low in the collected sample group, stressing the need to monitor ICU patients' sleep, as well as the need to implement greater care concepts with regard to managing the sleep in ICU settings.

Conflicts of interest

None.

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