The reliability of the Czech version of the Richards–Campbell Sleep Questionnaire

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Abstract

Background: Sleep disorders are very frequent among all intensive care unit patients, and disturbed sleep quality has clear and straightforward negative consequences for patients’ recovery and level of distress. To promote sleep, nurses must have instruments for observing and evaluating patients’ sleep.

Objective: The objective of the research was to determine the internal consistency of the Richards–Campbell Sleep Questionnaire (RCSQ) and to compare the selected relationships between the variables (gender, age, type of admission) in the Czech clinical environment of the intensive care unit.

Design: Cross-sectional study.

Methods: The RCSQ has been translated according to the translation and cultural adaptation manual. The quality of sleep was assessed using the Czech version of the RCSQ. The sample consisted of 105 patients hospitalised in an interdisciplinary intensive care unit. The quality of sleep was measured using a visual analogue scale (0–100).

Results: The internal consistency (Cronbach’s $\alpha$) of the Czech version of the RCSQ is 0.89. The average RCSQ score in the sample was 53.2 (SD 20.1). Return to sleep was the lowest rated item at 51 (SD 24.2), while sleep quality was the highest rated item at 55.6 (SD 26.4). There was no statistically significant relationship ($p < 0.05$) between sleep quality and selected variables: age ($F = 0.1; p = 0.736$), gender ($F = 0; p = 0.929$), type of admission ($F = 1.8; p = 0.183$).

Conclusions: The study demonstrates that the Czech version of the RCSQ is rated as a reliable tool and can be used to subjectively assess sleep quality in critically ill patients. The association between sleep quality and selected variables has not been statistically proven and its perception is very individual.

Keywords: Intensive care unit; Reliability; Richards–Campbell Sleep Questionnaire; Sleep quality

Introduction

Sleep is one of the basic physiological needs. Sleep disorders are very common in patients in an intensive care unit (ICU) (Parthasarathy and Tobin, 2004). Sleep studies have revealed (Frisbee, 2008; Weinhouse and Schwab, 2006) that total sleep time over the duration of 24 hours is very often unchanged (6–9 hours), but up to 50% of this time is patients sleeping during the day. According to sleep-related studies (Cooper et al., 2000; Freedman et al., 2001; Parthasarathy and Tobin, 2004), sleep abnormalities mainly manifest as prolonged sleep latency, significant sleep fragmentation and severe reduction in stage 3, and rapid eye movement sleep. Sleep disorders are associated with a general alteration of the patients’ state, with negative biological effects on the organism, which are then manifested in all systems. It affects cardio-respiratory (Leung and Bradley, 2001) with a higher risk of failure of non-invasive ventilation (Roche Campo et al., 2010); metabolic, endocrine and immunological responses (Ganz, 2012; Spiegel et al., 1999), and is also involved in prolonged wound healing (Mostaghimi et al., 2005) and a greater incidence of falls (Wu and Sun, 2017). A Puerto Rican study (Figureoa-Ramos et al., 2009) confirms a higher incidence of delirium that leads to prolonged hospitalisation. The ICU environment is very inhospitable and there are many factors that negatively affect sleep quality in critically ill patients. Factors contributing to sleep disorders in the ICU can be divided into two categories (environmental and non-environmental), and there is a significant causal relationship between them. The non-environmental factors include the patient’s underlying disease and physical condition, pain and discomfort, psychosocial factors (stress, anxiety) and medication. The environmental factors comprise noise, light and nursing interventions (Pisani et al.,...
The questionnaire technique was used. The distribution of questionnaires and the selection of suitable patients was carried out by four trained nurses. It took approximately 2 to 5 minutes to complete the questionnaire. The research took place from December 2017 to May 2018. To eliminate possible distortions, patients evaluated the previous night’s sleep the following day (between 7 am and 9 am in the morning), and always only once during their hospitalisation in the ICU. In the case of patients with visual impairment or another physical handicap, a trained nurse completed the questionnaire with them.

**Questionnaire on sleep quality assessment**
Sleep quality assessment in the intensive care unit was measured by a specific standardised Richards–Campbell Sleep Questionnaire (RCSQ), which was designed by Dr. Richards in 2000. The RCSQ contains 5 items which are focused on determining the following items: sleep depth, falling asleep, awakening, return to sleep, and sleep quality + optional noise item (rated separately). Each item is rated using a 0–100 visual analogue scale (VAS). The total score is derived from the sum of the individual items divided by their number. 0 represents the worst sleep, 100 the best sleep. According to Richards (Richards et al., 2000), it is possible to supplement the subjective evaluation based on the formula with the sleep efficiency index (SEI): \(46.88 + (0.39 \times \text{total RCSQ score})\). An SEI higher than 85% indicates good sleep quality. The Australian study (McKinley et al., 2015) categorises the answers into three sections: 0–33 (<34): poor sleep, 34–66: satisfactory sleep, 67–100 (>66) good sleep. The following data were collected from demographic data: age and gender from clinical data, mechanical ventilation, length of hospitalisation in the ICU, type of admission, surgery, main diagnosis, and medication (benzodiazepines, antipsychotics and opiates).

**Translation process**
The translation and linguistic validation of the questionnaire was carried out according to the translation and cultural adaptation of “Translation and the cultural adaptation of patient – reported outcome (PRO)” of 2005 (Wild et al., 2005). The translation of the questionnaire proceeded in the following steps:

1. **Forward translation**: translation from the English version into Czech language by two independent professional translators, including the creation of a unified Czech version.
2. **Backward translation** a backward translation in English, which was compared with the original questionnaire after its completion. Subsequently, he/she commented on the differences between the original and the backward translation and suggested the adaptation of the items in Czech.
3. **Expert group**: after the translation phase, an expert group consisting of an academic and four nurses met up. The purpose of the meeting was to agree that the proposed final translation was equivalent to the original questionnaire and that the Czech items matched in terms of the content and semantics.
4. **Patient testing**: the pilot testing was performed in 10 patients at the IDICU in hospital Nový Jičín. The patients included in the pilot test were not included in the final sample.

The process of linguistic validation took 5 weeks.
**Data analysis**

Descriptive statistics was used to analyse demographic clinical data, and to assess the individual items in the questionnaire. Of the methods of descriptive statistics, absolute frequency \((n)\), relative frequency \(\%\), calculation of the arithmetic mean (mean), and standard deviation (SD) were applied. The statistical analysis of relationships between the RCSQ, gender, age and type of admission was carried out using a model of three-factor analysis of variance at the significance level \(p < 0.05\).

Before the correlation analysis, the symmetry of the distribution of individual variables was verified using the quantitative-quantile graph for normal distribution. Multidimensional data homogeneity was then verified using Hotelling’s \(T^2\) statistics at \(p < 0.001\) level, and at this level 2 points were identified as non-homogeneities and excluded from the correlation analysis. Data homogeneity and symmetry were verified by the residue analysis (Meloun et al., 2002; 2004). The estimation of internal consistency was performed using Cronbach’s \(\alpha\) after pairwise correlation analysis. The correlation analysis and calculation of Cronbach’s \(\alpha\) were performed using the NCSS 2007 software (Kaysville, UT, USA). Statistical Software Statgraphics Centurion XV Version 12.2.06 from Statpoint, Inc. (Warrenton, VA, USA) was used to analyse the variance and verify data symmetry.

**Results**

**Demographic and clinical characteristics**

A total of 105 patients met the entry criteria. The sample of patients consisted of 48 men (45.7%) and 57 women (54.3%), with the average age 63.2 (SD 14.7). The average length of hospitalisation on the day of completing the questionnaire was 3.31 (SD 1.73). 69 of the planned patients were admitted to the IDICU (65.7%). 88 patients (83.8%) underwent a surgery and 23 respondents (21.9%) were supported by mechanical ventilation. The most common diagnosis was oncology in 45 respondents (42.9%) and 55 patients (52.4%) were medicated with opiates (Table 1).

**Richards–Campbell Sleep Questionnaire**

The average RCSQ score of the 105 respondents was 53.2 (SD 20.1). 20 patients (19%) reported a score of 0–33 (poor sleep), 52 patients (49%) reported a score of 34–66 (satisfactory sleep) and 33 patients (32%) reported a score of 67–100 (good sleep). The lowest rated item was ‘return to sleep’ which scored 51 (SD 24.2), while the highest rated item was ‘sleep quality’ at 55.6 (SD 26.4). The sleep efficiency index (SEI) was 67.6 (SD 7.84) < 85%, indicating lower sleep quality (McKinley et al., 2013). The optional noise item reached the value of 65.8 (SD 23.2) (Table 2).

<table>
<thead>
<tr>
<th>Table 2. Richards–Campbell Sleep Questionnaire (n = 105)</th>
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<tbody>
<tr>
<td>Richards–Campbell items</td>
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<tr>
<td>Mean ± SD</td>
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<tr>
<td>sleep depth</td>
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<tr>
<td>falling asleep</td>
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<tr>
<td>awakening</td>
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<tr>
<td>return to sleep</td>
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<tr>
<td>sleep quality</td>
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<tr>
<td>RCSQ total&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>noise</td>
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<tr>
<td>sleep efficiency index&lt;sup&gt;b&lt;/sup&gt;</td>
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</table>

<sup>a</sup> RCSQ total: mean 5 items (Q1–Q5) / 5

<sup>b</sup> Sleep efficiency index (SEI) = 46.88 + [0.39 * RCSQ total]; SEI < 85% = good quality of sleep

The internal consistency of the Czech version of the RCSQ was evaluated in 103 patients (2 patients excluded for data inhomogeneity) and Cronbach’s \(\alpha = 0.89\) (Table 3).

**Relationships between variables**

The parameters of gender, age, and type of admission in relation to sleep quality were evaluated in a total of 105 patients. The sample consisted of 48 men (45.7%) and 57 women (54.3%). 47 patients > 65 years old (44.8%) and 58 patients ≥ 65 years old (55.2%). The admission of the majority of patients was planned (69 patients, 65.7%); 36 patients (34.3%) were emergency cases. There was no statistically significant correlation between gender and sleep quality \((F = 0; \ p = 0.929)\) or between the type of admission and sleep quality \((F = 1.8; \ p = 0.183)\). There were also no significant differences in subjective sleep quality assessment among patients up to 65 and above this age limit \((F = 0.1; \ p = 0.736)\) (Chart 1).

**Discussion**

In the case of patients hospitalised in intensive care, quality sleep is essential and its disorders adversely affect the whole organism. The impact of homeostatic sleep demand deficiency is a complex problem that not only affects the somatic state of the individual but also interferes with some other levels of the individual; it exacerbates physical deprivation, accentuates experiencing and threatens the balance (Salzmann-Erikson et al., 2016). Drake et al. (2004) state that sleep is a vulnerable state and can be included among “trait factors” manifested by “sleep responsiveness”, which the author defines as a specific, predisposing character of an individual to respond to a specific event (illness) by a situational sleep disorder caused by maladaptation (hospitalisation). This finding may have a
profound clinical significance for the nurse who takes care of such a patient. A US study (Ye et al., 2013) states that one of the barriers to improving sleep quality in the case of hospitalised patients is the lack of standardised tools to evaluate and meet this need. If a nurse is to assess the quality of sleep in the case of intensive care patients, she must monitor it using appropriate assessment tools (questionnaires, scales). In the Czech Republic, there has been no tool available for nurses to assess the subjective quality of sleep, and this is perhaps one of the reasons that nurses do not routinely evaluate sleep. RCSQ is a short comprehensive tool for subjective sleep quality assessment in the case of intensive care patients. It is the most extensively used one abroad. Its psychometric properties have been verified by studies: reliability was assessed using Cronbach’s $\alpha = 0.89–0.92$ (Aitken et al., 2017; Frisk and Nordstorm, 2003; Kamdar et al., 2013; Krotsetis et al., 2017; Li et al., 2011; Menea et al., 2017; Navarro-Garcia et al., 2017; Nicolás et al., 2008; Ritmala-Castren et al., 2017), the content validity (RCSQ versus polysomnograph) shows correlation $r = 0.58$ ($p < 0.001$) [eigenvalue: 3.61, variance 72.2] (Richards et al., 2000). The reliability of the Czech version of RCSQ evaluated by Cronbach’s $\alpha$ was 0.898. Usually, as the acceptable minimum is stated as $\alpha > 0.70$, and the value 0.8 ≤ $\alpha$ < 0.9 is therefore interpreted as good (Terwee et al., 2007). We can see that RCSQ is assessed as a reliable tool and can be used for subjective assessment of the sleep quality in the case of critically ill patients in our sociocultural conditions.

When evaluating individual RCSQ items, the lowest rated item was ‘return to sleep’ (51, SD 24.2), while the highest rated item was ‘sleep quality’ (55.6, SD 26.4). The study also confirms that subjective sleep quality of the intensive care patients is impaired: a total score of 53.2 (SD 20.1). This is consistent with the available results of foreign works (Aitken et al., 2017; Chen et al., 2018; Frisk and Nordstorm, 2003; Kamdar et al., 2013; Krotsetis et al., 2017; Li et al., 2011; Menea et al., 2017; Navarro-Garcia et al., 2017; Nicolás et al., 2008; Richards et al., 2000; Ritmala-Castren et al., 2017).

Sleep problems of hospitalised patients are very often related to the illness causing their hospitalisation and to the hospital environment. The intensive care environment is very inhospitable (light, noise, nursing interventions). In the theory of Florence Nightingale, the environment is a central concept that the nurse can significantly influence with appropriate nursing interventions. In her conception, she described three levels of relations: patient – environment, nurse – environment, and nurse – patient. There is a new concept arising from the Nightingale model, which is known as “healing environment” (HE). The approach emphasises the “bio-behavioural perspective” in all three levels of relations. The aim of this holistically oriented integrative approach is to eliminate the negative effects of the hospital environment (noise, light, air quality and temperature, patient’s comfort) by targeted nursing interventions (Fontaine et al., 2001; Mellot et al., 2008). This concept is further elaborated and integrated in relation to the need for sleep in “sleep promoting strategies” (Elliott and McKinley, 2014; Gardner et al., 2009). The principle of the so-called “sleep promotion strategies” are non-pharmacological nursing interventions. In this strategy, four major domains

### Table 3. Pearson’s correlations between components of RCSQ ($n = 103; p < 0.001$)

<table>
<thead>
<tr>
<th>Sleep depth</th>
<th>Falling asleep</th>
<th>Awakening</th>
<th>Return to sleep</th>
<th>Sleep quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>$r$</td>
<td>1.000</td>
<td>0.578</td>
<td>0.706</td>
<td>0.566</td>
</tr>
<tr>
<td>$p$</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
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<table>
<thead>
<tr>
<th>Falling asleep</th>
<th>$r$</th>
<th>0.578</th>
<th>1.000</th>
<th>0.549</th>
<th>0.517</th>
<th>0.581</th>
</tr>
</thead>
<tbody>
<tr>
<td>$p$</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
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<table>
<thead>
<tr>
<th>Awakening</th>
<th>$r$</th>
<th>0.706</th>
<th>0.549</th>
<th>1.000</th>
<th>0.660</th>
<th>0.778</th>
</tr>
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<tbody>
<tr>
<td>$p$</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
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<table>
<thead>
<tr>
<th>Return to sleep</th>
<th>$r$</th>
<th>0.566</th>
<th>0.517</th>
<th>0.660</th>
<th>1.000</th>
<th>0.701</th>
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<tr>
<td>$p$</td>
<td>&lt;0.001</td>
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<tr>
<th>Sleep quality</th>
<th>$r$</th>
<th>0.797</th>
<th>0.581</th>
<th>0.778</th>
<th>0.701</th>
<th>1.000</th>
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<tbody>
<tr>
<td>$p$</td>
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Cronbach’s alpha = 0.898

### Chart 1. Correlations between variables

($n = 105; p < 0.05$; three-way ANOVA model): Sex ($F = 0; p = 0.929$); age ($F = 0.1; p = 0.736$); admit ($F = 1.8; p = 0.183$)
can be identified: noise reduction, reduction of light, clustering of nursing activities and increasing of patient’s comfort (Blassen and Hopstock, 2011). An analysis of available studies indicates that factors inducing sleep disorders can be modified by targeted interventions (Elliott and McKinley, 2014; Poongkunran et al., 2015; Salzmann-Erikson et al., 2016). There is also a growing number of studies demonstrating that the introduction of these organisational changes also reduces significantly the occurrence of delirium (Flannery et al., 2016; Patel et al., 2014). Usage of alternative and complementary techniques can improve the quality of sleep, too. These practices are becoming more important in both the non-professional and professional community, where a particular role also begins to be attributed to them according to the principles of evidence-based practice (EBP). These techniques are appropriate in relation to the sleep of critically ill patients. However, their efficacy is very variable. These techniques originate from the numerous studies that were conducted in Asia (Chen et al., 2012). In the Czech Republic, their application is also difficult due to the lack of experts (no study was conducted that evaluates the benefit of this method in our socio-cultural conditions). Another area of nursing interventions are educational programmes for patients with a focus on adherence to the principles of sleep hygiene, which can be a suitable tool for nursing care. In order for the nurse to be able to educate the patient correctly and comprehensively about the correct principles of sleep hygiene and the negative effects of sleep disorders on the body, it is very important to raise the awareness of the nurses themselves about this need (e.g. an expert seminar on innovative concepts of sleep need). It can be summarised that the introduction of these sleep-promoting strategies is perceived as a cheap and effective tool to improve sleep quality of hospitalised patients. While the described measures are gradually becoming a common part of everyday nursing practice around the world, in the Czech Republic, this tool – that may potentially improve the quality of care has not yet been implemented in a substantial way.

The correlations between the selected variables (age, gender, type of the admission) in relation to the sleep quality were also evaluated. Age is an important factor that affects both the condition of the patient and sleep quality. In our study, a statistically significant difference in age-related sleep quality was not confirmed ($F = 0.1; p = 0.736$). The impact of age was evaluated in the studies of the authors (Matsumoto et al., 2015; Sterniczková et al., 2014), who, on the basis of the results, suggest that stages of sleep change in people aged 60 years and more, and there is a higher incidence of sleep-related respiratory disorders and abnormal movements related to sleep, and subjectively impaired sleep quality. The sociological analysis sought to examine the relationship between sleep quality perception in patients in ICU from the gender perspective. This correlation was not found to be statistically significant in our work (despite the initial theoretical assumptions) ($F = 0; p = 0.929$). Despite the fact that our results did not confirm a statistically significant relationship, most studies agree that emotional and cognitive processes are significantly affected by gender (Bem, 1974; Formánková, 2009) and can affect patients both at the physical level (sleep) and mental level (loss of motivation, resignation to the situation). The intensive care environment has its own specifics and differences that predestine its character and can be significantly stressful for the patient. Emergency admission can be one of the attributes that can significantly affect this stressful situation and thus contribute to sleep disorders. Although study outcomes provide evidence (Buter and Koopmans, 2015; Hofhuis et al., 2003) that the emergency patients (in comparison with electives) are significantly older and their health issues are more severe (APACHE score), it is also biochemically proven that these patients have a significantly reduced level of glutamine, which may negatively influence the clinical results, and based on these findings, worse sleep quality may occur. Our statistical analysis, however, did not confirm significant interdependency between the type of admission and its quality ($F = 1.8; p = 0.183$).

**Implication for practice**

1. Sleep disorders are very frequent among all intensive care unit patients (compared to the general ward patient population).
2. Sleep deprivation and disturbed sleep quality have clear and straightforward consequences for a patient’s level of distress.
3. Use of the tools to assess sleep and its quality is neglected by nurses.
4. The Czech version of the RCSQ is a reliable tool for assessing sleep quality in ICU.
5. Subjective sleep quality of patients in ICU is very individual.
6. Interventions improving the quality of sleep could affect the global critical care outcome of intensive care unit survivors and should be a part of good quality clinical practice in the future.

**Limitations of the study and recommendations**

The unicentric nature of the study is its limitation. The selection of the sample according to the identified criteria, which can distort the results, is another limitation. Further research could be focused on inter-rater reliability (nurse cf. patient) when assessing sleep quality using the Czech version of the RCSQ.

**Conclusions**

Lack of adequate quality sleep and length in an intensive care unit is a significant negative factor affecting the quality of provided care. In many respects, it is rather challenging to satisfy one’s need for sleep; mainly due to difficulties in sleep quality assessment. Based on the data obtained from our study, the Czech version of the Richards–Campbell Sleep Questionnaire provides a short, applicable, comprehensive and simple tool with proven reliability to assess sleep quality and is a useful tool for clinical practice. The association between sleep quality and selected variables (age, gender, type of admission) has not been statistically proven and its perception is very individual. However, at present, expert publications agree on the importance of the use of non-pharmacological strategies for inducing sleep in intensive care units.

**Ethical aspects and conflicts of interest**

The authors declare that there is no conflict of interest regarding the surveillance study and that the ethical aspects were respected while processing the results. All the used bibliographical sources were properly cited.

**Acknowledgements**

Our study had no external funding source.

**Authors’ contributions**

Concept and design (HL), data collection (DŠ, SČ, NR, VP), manuscript draft (HL), critical revision of the manuscript (DŠ), final approval of the manuscript (KŽ).
Reliabilita české verze Richards–Campbell Sleep dotazníku

Souhrn
Cíl: Cílem výzkumu bylo určit míru vnitřní konzistence Richards–Campbell Sleep Questionnaire (RCSQ) a porovnat vytípované vztahy mezi proměnnými (pohlavlí, věk, druh přijetí) v českém klinickém prostředí jednotky intenzivní péče.
Design: průřezová studie.
Metodika: RCSQ byl přeložen podle manuálu pro překlad a kulturní adaptaci. Hodnocení kvality spánku bylo zjišťováno pomocí české verze RCSQ. Soubor tvořilo 105 pacientů hospitalizovaných na mezioborové jednotce intenzivní péče. Hodnocení kvality spánku bylo měřeno pomocí vizuální analogové škály (0–100).
Výsledky: Průměrné skóre RCSQ v souboru bylo 53.2 (SD 20.1). Nejníže hodnocenou položkou bylo opětovné usínání po probuzení – 51 (SD 24.2), naopak nejlépe hodnocenou položkou byla kvalita spánku – 55.6 (SD 26.4). Vnitřní konzistence (Cronbachova a) české verze RCSQ je 0.89. Nebyl potvrzen statisticky signifikantní vztah (p < 0.05) mezi kvalitou spánku a vytípovanými proměnnými: věk (F = 0.1, p = 0.736), pohlavlí (F = 0, p = 0.929), druh přijetí (F = 1.8, p = 0.183).
Závěr: Studie demonstruje, že RCSQ v české verzi je hodnocen jako spolehlivý nástroj a může být používán k subjektivnímu hodnocení kvality spánku u kriticky nemocných. Asociace mezi kvalitou spánku a vytípovanými proměnnými nebyla statisticky prokázaná a jeho vnímání je velmi individuální.

Klíčová slova: Jednotka intenzivní péče; Kvalita spánku, reliabilita; Richards–Campbell Sleep dotazník

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