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Individualized sleep promotion in acute care hospitals: Identifying factors that affect patient sleep

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Abstract

Background/aim: One major challenge of inpatient sleep promotion is that there is no "one-size-fits-all" intervention as patients' sleep may be bothered by different factors. A tool evaluating factors that disturb patient sleep is greatly needed as a foundation for generating a personalized action plan to address the patient's specific need for sleep. Unfortunately such tools are currently unavailable in clinical practice. In this study we developed and psychometrically evaluated a brief assessment tool for sleep disruptors important for hospitalized patients, the Factors Affecting Inpatient Sleep (FAIS) scale.

Methods: The FAIS items were developed by literature review and validated by content validity testing. A survey collected from 105 hospitalized patients was used to select the most significant sleep disruptors. Psychometric evaluation using survey data included item analysis, principal components analysis, and internal consistency reliability.

Results: The final FAIS scale included 14 items in three subscales explaining 56.4% of the total variance: 1) emotional or physical impairment due to illness or hospitalization; 2) sleep disturbance due to discomfort or care plan schedule; 3) sleep interruption due to hospital environment or medical care. The Cronbach's alpha coefficient for the FAIS scale was 0.87, and the reliability of the subscales ranged from 0.72 to 0.81.

Conclusion: The FAIS is a brief tool assessing sleep disruptors important for patients, and is empirically grounded, judged to have content validity, and has demonstrated psychometric adequacy. The FAIS scale can be used to guide the development of an individualized patient-centered sleep promotion plan.

Keywords

Inpatient sleep; Sleep promotion; Instrument development

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1. Introduction

Sleep is a fundamental human need for survival, health, and wellbeing (Rechtschaffen, 1998). The importance of sleep does not diminish just because a person is admitted to the hospital. In fact, a person's need for sleep is greater during periods of illness, and adequate sleep is critical to optimizing recovery (Rechtschaffen, 1998). Patients themselves are concerned about the inability to get restorative sleep while in the hospital setting (Frighetto et al., 2004). Approximately 50% of general medical patients complain of sleep disruption (Frighetto et al., 2004; Meissner et al., 1998), and this percentage can be even higher among those in the intensive care units (Friese, 2008; Friese, Diaz-Arrastia, McBride, Frankel, & Gentilello, 2007). Sleep disturbance can also worsen other symptoms such as fatigue, pain, and depression, which are commonly experienced by hospitalized patients (Barsevick, 2007; Illi et al., 2012). Furthermore, inpatient sleep disturbance and medications prescribed in an attempt to improve sleep, have been linked to clinically relevant and detrimental outcomes such as delirium (Inouye et al., 1999; Weinhouse et al., 2009) and falls (Mazer, 2006; Patel et al., 2008); both of which are known risk factors for morbidity, mortality, prolonged hospital stays, and increased healthcare costs. Finally, poor sleep in the hospital may lead to chronic sleep disruption even after hospital discharge (Altman, Knauert, & Pisani, 2017).

Despite the growing evidence linking sleep to outcomes which are critical to patient safety and healing, sleep is not valued as a recovery modality during hospitalization (Ye, Keane, Johnson, & Dykes, 2013). Although guidelines may recommend an assessment of sleep, the lack of clear methods of improving sleep mean that, in practice, clinicians rarely inquire about sleep. Inpatient pharmacological sleep-aid use remains common, even in older patients in spite of a warning of high risk of side effects including delirium and falls, again reflecting the perceived lack of options by clinicians to improve sleep (Gillis et al., 2014).

As a basic human need, inpatient sleep should be emphasized as we seek to improve care quality and safety through patient-centeredness (Xu, Wick, & Makary, 2016). In our previous work we found that routine assessment, open dialogue with the patient, collaborative care planning, and tailored interventions, are key to patient-centered care to improve sleep for hospitalized patients (Ye et al., 2013). A recent nationwide multicenter study in Netherlands demonstrated compromised sleep quantity and quality in hospitalized patients and called for interventions that target modifiable hospital-related sleep-disturbing factors (Wesselius, van den Ende, Alsma, et al., 2018). One major challenge of inpatient sleep promotion is that there is no "one-size-fits-all" intervention as patients' sleep may be disturbed by different factors. Studies testing various non-pharmacologic sleep promotion interventions (e.g., daytime artificial light therapy, quiet time, white noise, relaxation techniques such as massage, music, and audiotaped guided imagery) in a general inpatient setting have provided overall insufficient to low strength evidence supporting those interventions (Tamrat, Huynh-Le, & Goyal, 2014). These studies typically applied a specific intervention without seeking patients' input to identify or address what interfered with their sleep, which might have contributed to the limited overall success. For example, a study of eye masks to promote sleep may find little overall benefit if 1) some patients do not perceive bright light as a barrier to sleep, or 2) if some patients do not accept the eye mask. A tool evaluating factors that disturb patient sleep is greatly needed as a foundation for generating a

personalized action plan to address the patient's specific need for sleep. Unfortunately such tools are currently unavailable in clinical practice.

Thus, as a first step, we developed and psychometrically evaluated a brief assessment tool for sleep disturbing factors in hospitalized patients, the Factors Affecting Inpatient Sleep (FAIS) scale. Specifically, instead of including a comprehensive list of factors that could affect inpatient sleep, the goal of this study was to develop a brief tool covering the most significant sleep disturbing factors perceived by patients, that could be used to facilitate further discussion of sleep leading to individualized sleep promotion plan.

2. Methods

2.1. Overview

We carried out three phases of investigation to develop and psychometrically evaluate the FAIS scale. Table 1 summarized the methods and outcomes for each study phase. Established criteria were followed to ensure that both individual items and the FAIS scale would be empirically grounded, judged to have content validity, reliable by meeting accepted standards of internal consistency, and accepted by both patients and clinicians (Waltz, Strickland, & Lenz, 2005). Institutional review board (IRB) approval at the study institute was received. Each study participant obtained informed verbal consent.

2.2. FAIS scale development

2.2.1. Phase 1: what affected patient sleep? - FAIS item development and validation—A list of factors affecting patient sleep was first identified by literature review, then enriched by the content analysis of a database of interviews from our previous investigations of sleep in acute care hospitals, including four focus groups with clinicians on how they access, communicate about, and manage patient sleep (Ye et al., 2013), and four individual interviews with patients for their experience about sleep during hospitalization. As the result, four categories of factors were identified, including 1) *hospital environment* such as excessive lighting and noise that disturbs patient sleep; 2) *nocturnal patient care activities* by clinicians such as taking vital signs and giving medications that awake patients from sleep; 3) *anxiety and other emotional distress* from patients caused by the illness or hospitalization that bother their sleep; and 4) *symptoms or discomfort associated with disease, treatment, and equipment*, such as pain and discomfort caused by heart monitor that disrupt patient sleep.

A survey including approximately 50 items to evaluate these sleep disturbing factors based on the literature review and our previous investigations was drafted and refined by the study team, and subjected to content validity assessment. Guided by an established method (Lynn, 1986; Waltz et al., 2005), five content experts for inpatient sleep (including 2 nurses and 3 physicians) rated each item and its description for relevance with the corresponding category (yes, relevant; or no, not relevant), and responded if they believed that the survey items adequately and accurately captured the most common factors affecting sleep in the hospital. Comments from the content experts were examined and incorporated into the updated version(s) for further assessment. In addition, 8 hospital-based nurses and 3 patient advisors

from the Patient Family Advisory Council in the study hospital reviewed the items and provided feedback regarding usability of the scale. Recommendations for clarification of the items were incorporated to refine the survey. The retained 40 items in the final version of the survey were scored as relevant by all content experts, and provided a content validity index of 1.0. The 40 items were arranged as follows: 1) *hospital environment* (20 items); 2) *nocturnal patient care activities* (5 items)*; 3) anxiety and other emotional distress* (5 items); *and* 4) *symptoms or discomfort associated with disease, treatment, and equipment* (10 items).

2.2.2. Phase 2: what were the most significant factors affecting patient sleep? - FAIS item selection—We conducted a survey in which patients were asked to rate how much each factor disrupted their sleep during the current hospitalization on a numeric rating scale of 0 (not disturbing at all) to 10 (yes, the most disturbing it could be). This scale was chosen because of its similarity with the commonly used pain intensity numeric rating scale (McCaffery & Beebe, 1993), which could be easily followed by most patients. In addition, the relatively wide range of scores could facilitate the ranking of those factors to identify the most significant causes of poor sleep for individuals. At the end of each of the four categories, patients were asked to add any other factors that disturbed their sleep but were not on the list, and if they had "Any suggestions on how to lessen or control any of these problems?" in order to collect written feedback of sleep promotion strategies.

Alert and cognitively intact hospitalized patients who were able to give feedback in English were invited to complete the survey on the day of discharge. The disturbance score for each factor (ranged from 0 to 10) was reviewed and ranked across and within the four categories. Among the 40 items, 19 items were scored on average below or close to 2, and thus were considered "insignificant" contributing to poor sleep by the patients. As the result, 21 items were selected from the original 40 items, and were included in *Phase 3* for psychometric evaluation. The distribution of the 21 items were: 1) *hospital environment* (7 items); 2) *nocturnal patient care activities* (5 items)*; 3) anxiety and other emotional distress* (3 items); *and* 4) *symptoms or discomfort associated with disease, treatment, and equipment* (6 items).

2.2.3. Phase 3: FAIS scale psychometric evaluation—Data from the remaining 21 items on the survey were used for psychometric evaluation. Data were analyzed using the Statistical Package for Social Sciences Software (SPSS), version 24. Psychometric evaluation included: 1) item analysis, 2) principal components analysis (PCA), and 3) internal consistency reliability using Cronbach's alpha coefficient. The "exclude cases listwise" option in the SPSS was selected so that all cases with missing data were excluded from the analysis. Upon psychometric evaluation, the final FAIS scale included 14 items in three subscales: 1) *emotional or physical impairment due to illness or hospitalization* (4 items)*; 2) sleep disturbance due to discomfort or care plan schedule* (4 items)*; 3) sleep interruption due to hospital environment or medical care* (6 items). Details of psychometric evaluation are reported in the Results.

3. Results

3.1. Characteristics of survey participants

A total of 105 patients completed the survey in Phase 2 from March through July 2013. Characteristics of survey participants are summarized in Table 2. On a scale of 0 (the poorest) to 10 (excellent), respondents rated a significantly poorer sleep during their current hospital stay compared to their sleep at home over the month prior to hospitalization (5.8 ± 1.7 vs.7.4 ± 2.4, $p < .001$). All respondents had < 10% missing data. No significant differences were found in the mean sleep disturbance total scores between respondents with missing data and respondents without missing data (83.5 vs. 69.6, $t = -1.4$; $p = .19$), suggesting random occurrences of missing data. The sample size of 105 provided at least 5 respondents per item, which was considered adequate for a Principal Component Analysis (PCA) (Knapp & Brown, 1995).

3.2. Psychometric evaluation

A PCA on the 21 items selected from the 40-item survey was conducted to initiate the process of item reduction. The correlation matrix and communalities were examined. Four items with a correlation lower than 0.3 indicating not contributing to an internally consistent tool, and one item with a correlation > 0.9 indicating redundancy, were deleted. Repeated psychometric analysis on the remaining 16 items revealed two additional items with inter-item correlations higher than 0.9. These two items were removed, leading to a final total of 14 items. A Kaiser-Meyer-Olkin value was 0.8, higher than the recommended value of 0.6, indicating that the data were suitable for PCA. The significant ($p < .000$) Bartlett's Test of Sphericity also supported the factorability of the correlation matrix (Ferguson & Cox, 1993). PCA with Varimax rotation and Kaiser Normalization was applied with a cutoff difference at 0.35, in order to determine which items significantly contributed to the factor. The PCA suggested the presence of four components with Eigenvalues exceeding one, explaining 63.8% of the total variance. However, the 4-component solution, although parsimonious, was not easily interpretable. The scree plot leveled off after the third factor, suggesting a three-component solution. A subsequent Varimax rotation restricted to three factors revealed strong loadings on each of the three components. Two items with strong side loadings (> 0.35) are indicated by an asterisk in Table 3. These items were grouped with the factor with the strongest loading which was conceptually consistent with the statement. The three factors that emerged from PCA accounted for 56.4% of the total variance and were congruent with the literature review and content analysis of the interview data completed in Phase 1. Thus, the three-factor solution was accepted as both parsimonious and interpretable. The internal consistency for the confirmed 14-item FAIS scale measured by Cronbach's alpha coefficient was 0.87. The reliability of the three subscales ranged from 0.72 to 0.81. Table 3 outlines the three-factor solution with psychometric properties and variance.

The first subscale, *emotional or physical impairment due to illness or hospitalization*, accounted for 21% of the variance. This subscale included items such as being worried about medical condition or procedures and reduced daily activity. The second subscale, *sleep disturbance due to discomfort or care plan schedule*, explaining 18.1% of the variance,

included items such as pain and common nocturnal care activities that wake patients up. The third subscale, *sleep interruption due to hospital environment or medical care*, accounted for 17.3% of variance and included causes of sleep disruption such as alarm noise, staff talking, and catheters or drains.

4. Discussion & conclusion

4.1. Discussion

Our work has identified a concise list of sleep disruptors important for patients which can be acted upon by patients and clinicians to improve sleep. This work could change current practice on how patient's sleep is assessed and communicated about in acute care hospitals, and lead to a more tailored plan of sleep promotion meeting individual patient's needs. The FAIS scale is empirically grounded, judged to have content validity, and has demonstrated psychometric adequacy.

To our knowledge, this is the first report developing and psychometrically evaluating a tool assessing factors affecting patient sleep in the hospital setting. The sleep disruptors on the FAIS scale are similar to those reported in the literature (Ding, Redeker, Pisani, Yaggi, & Knauert, 2017; Dobing, Frolova, McAlister, & Ringrose, 2016; Wesselius et al., 2018; Young, Bourgeois, Hilty, & Hardin, 2008). However, we emphasize the following novelties. First, the selection of our list was largely derived from patient feedback, not based solely on factors chosen a priori from clinicians. Second, we considered not only environmental factors, but also patient specific factors such as mood and discomfort. It is likely that the success of interventions aimed at only one aspect of sleep will be limited. That is, even if environmental barriers to sleep are removed, patients with anxiety or uncertainty may still suffer from poor sleep. Third, while there are a multitude of potential disruptors, we identified a relatively concise list. Thus, use of the FAIS tool may be an iterative process to continually optimize sleep during the course of a hospital stay. Finally, while other questionnaires exist to measure sleep quality (e.g. Richards-Campbell Sleep Questionnaire [RCSQ] (Richards, O'Sullivan, & Phillips, 2000), PROMIS Sleep Disturbance (Buysse et al., 2010)), none specifically offers understanding about the underlying causes of poor sleep thus could not be used to guide sleep promotion interventions. For example, two patients with the same sleep quality score may have very different sleep disruptors and would need different interventions to improve sleep. The FAIS scale could be used with either subjective or objective measures of sleep (e.g. actigraphy) to guide sleep promotion. This could fill the current gap of a validated tool guiding the evaluation of causes of poor inpatient sleep, and change sleep promotion practice from a "one-size-fits-all" intervention to a more individualized approach.

Sleep promotion in acute care hospitals is difficult for many reasons. However, one major impediment is the perceived inability to improve patient sleep. With the support of the FAIS scale, practical solutions could be developed for both patients and clinicians. We noted that many of the potential solutions can be part of routine clinical care. For example, concerns about adequate pain control, lack of information about care during the night, or worry about medical procedures are extremely common but also addressable as part of routine clinical care. Furthermore, information about which sleep disruptors are most important can be used

to further tailor the interventions and to focus patient education content on that which is most important to each patient. Realistically, while a patient might be queried about 14 different sleep disruptors on the FAIS scale, only a handful may be important for the patient, and staff can focus on 2–3 per day. This may make the sleep promotion effort more feasible and tailored to each individual patient's needs.

A strength of our study is the engagement of patients and value placed on their input in sleep assessment. A major limitation in current sleep promotion practice or research is that clinicians typically develop a protocol without seeking patients' input, which may limit its success. For example, one recent study using a multidisciplinary non-pharmacologic protocol developed by clinicians to improve sleep in medical inpatients, primarily by addressing common environmental sleep disruptors, did not observe any positive effect on patient sleep (Dobing, Dey, McAlister, & Ringrose, 2017). Sleep promotion needs to be a collaborative effort between patients and clinicians. Instead of being passive receivers of any protocol designed by clinicians, patients should be engaged and encouraged to communicate their concerns and make suggestions for sleep promotion.

This study does have limitations. The brief FAIS tool cannot cover all the important sleep disputers. To address this, we recommend adding an open-ended question at the end of the 14 items, which gives the opportunity for patients to report other important factors affecting their sleep. Clinicians should also be trained to ask patients if anything that is not on the list disturbed their sleep. The FAIS is designed to be a self-assessment tool, which may not be applied to patients who are not orientated or alert, or who are too ill to complete the questionnaire. As a result, the FAIS scale may not be applicable to patients in the intensive care units. In Phase 2 of the FAIS development, patient feedback was collected on the day of discharge and thus may be subject to recall bias. Additional psychometric testing should be performed with separate and larger inpatient samples.

4.2. Conclusion

In conclusion, the FAIS scale is a brief tool to assess sleep disruptors important for patients, and has demonstrated content validity and psychometric adequacy. The FAIS scale can be used to guide the development of an individualized sleep promotion plan. By engaging patients in the sleep assessment and care planning process, non-pharmacologic sleep promotion may be more successful with individualized strategies. Future investigation is warranted to develop, test, and implement patient-centered interventions promoting sleep in hospital settings.

4.3. Practice implications

The FAIS scale is a brief tool to access important sleep disruptors perceived by patients and can be used on a daily basis in routine clinical practice. By reviewing these sleep disruptors at bedside, patients and clinicians can work together to develop a feasible sleep promotion plan to address those disruptors. By engaging patients in the sleep assessment and planning process, clinical sleep promotion practice can move from the traditional "one-size-fits-all" to a more individualized approach.

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Table 1

Aims, Methods, and Outcomes for FAIS Scale Development.

Study phase/aims	Methods	Outcomes
• Phase 1: To identify factors that disturb patient sleep in the hospital - *Item Development and Validation*	• Literature review • Content analysis of interview data with clinicians and patients • Content validity test	• A 40-item survey evaluating the 40 sleep disturbing factors summarized in four categories was developed and validated
• Phase 2: To select the most significant sleep disturbing factors perceived by patients - *Item Selection for Psychometric Evaluation*	• Survey collected from 105 hospitalized patients to evaluate the 40 sleep disturbing factors • The sleep disturbance scores on a numeric scale of 0 to 10 were reviewed	• 21 items selected from the original 40 items to be used for psychometric analysis
• Phase 3: To psychometrically evaluate the FAIS scale with reduced items	• Psychometric evaluation using survey data from the remaining 21 items, including item analysis, principal components analysis, and internal consistency reliability	• A final scale including 14 items with 3 subscales which demonstrated psychometric adequacy

Table 2

Characteristics of survey participants.

Characteristics	***N* = 105**
Age in years (mean ± standard deviation)	61.5 ± 15.0
Male gender, n (%)	59 (56.7%)
Hispanic, n (%)	7 (6.7%)
Race, n (%)	White, 86 (81.9%); Black, 10 (9.5%)
Days in hospital (median, interquartile range)	4.5, 3–7
Perceived sleep quality on a scale of 0 (the poorest)-10 (excellent)	
O At home over the past month	7.4 ± 2.4
ODuring the current hospital stay	5.8 ± 1.7

Table 3

FAIS Items' Factor Loadings and Descriptive Characteristics.

Item	Factor loading	Item total correlation	Mean (SD)
Factor 1 [4 items]: Emotional or physical impairment due to illness or hospitalization (Eigenvalue = 5.4; 21% Variance) Mean (Standard Deviation): 3.5 (2.6), Median 3.1, Range 0–10, α Value 0.82			
1. Worried about medical condition or procedures	0.71	0.56	4.6(3.6)
2. Uninformed about nighttime care plan	0.65	0.64	3.2(3.0)
3. Changes to the normal bedtime routine	0.78	0.74	2.9(3.0)
4. Reduced daily activity	0.81	0.63	3.4(3.1)
Factor 2 [4 items]: Sleep disturbance due to discomfort or care plan schedule (Eigenvalue = 1.4; 18.1% Variance) Mean (Standard Deviation): 4.6 (2.5), Median 5.0, Range 1–10, α Value 0.72			
5. Pain	0.38	0.30	4.6(3.5)
6. Awakened to take medications	0.83	0.65	5.5(3.5)
7. Awakened for vital signs & assessment	0.88	0.70	5.3(3.4)
8. Awakened for personal hygiene (e.g., bathing, changing the linens, using the bathroom)	0.56	0.45	2.5(3.2)
Factor 3 [6 items]: Sleep interruption due to hospital environment or medical care (Eigenvalue = 1.1; 17.3% Variance) Mean (Standard Deviation): 2.7 (1.9), Median 2.5, Range 1–10, α Value 0.74			
9. Alarm noise	0.84	0.53	2.7(2.5)
10. Staff talking	0.67	0.56	2.8(2.6)
11. Excessive lighting*	0.42	0.53	3.7(3.4)
12. Bedding discomfort	0.66	0.48	2.8(2.8)
13. IV discomfort*	0.48	0.36	1.8(2.5)
14. Catheters or drains concerns	0.35	0.43	2.5(3.0)

Side loadings > 0.35.