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Original Article

Adaptation of the Pittsburgh Sleep Quality Index in Chinese adults with type 2 diabetes

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Abstract

Background: Sleep disturbance is a major health issue in people with type 2 diabetes (T2DM). The Pittsburgh Sleep Quality Index (PSQI) has been the most widely used instrument to measure subjective sleep disturbance. Nevertheless, its factor structure in the context of T2DM has not been examined. The purpose of the study is to evaluate the factor structure of the PSQI in Chinese adults with T2DM and thereby to facilitate its use in clinical practice and research.

Methods: The PSQI (Chinese version) was administered to 240 patients with T2DM. Confirmatory factor analysis was conducted to examine the one-factor, adapted one-factor by removing the component "use of sleep medication", and the three-factor structure of the PSQI. Goodness-of-fit indices were used to evaluate the fit of the model. Construct validity of the resultant model was further examined using contrasted groups. Cronbach's α of the resultant model was obtained to evaluate its internal consistency.

Results: The three-factor model proposed by Cole et al. did not fit the sleep data. Confirmatory factor analysis supported the adapted one-factor model with the PSQI global score as an indicator of overall sleep quality, and the goodness-of-fit indices for the adapted model were better compared to the original one-factor model. As expected, women, older adults, and patients with poor glycemic control had higher adapted PSQI global score ($p < 0.01$). Cronbach's α of the adapted PSQI was 0.78.

Conclusion: The adapted PSQI was similar to the original PSQI in that only the component "use of sleep medication" was removed from the original scale and the one-factor scoring worked better. In contrast, the three-factor model has limited usefulness in this population.

Keywords: Diabetes; Factor analysis; PSQI; Psychometric property; Sleep; Symptom

1. Introduction

Globally, one in 11 adults has diabetes; one person dies from diabetes every 6 s, resulting in 5.0 million deaths in 2015.[1] In China, the overall prevalence of diabetes in adults was estimated to be 11.6%.[2] Proliferating evidence suggests that sleep disturbance might play a role in the drastic increase in diabetes prevalence.[3,4] Diabetes alone is a leading cause of death, but when coupled with sleep disturbance poses even more severe threats to health. In people with type 2 diabetes (T2DM), the prevalence of sleep disturbance ranged from 55% to 71%.[5,6] Sleep disturbance, in turn, is correlated with poor glycemic control or quality of life.[5,7] Although the etiology of sleep disturbance in people with diabetes remains unclear, it is likely that diabetes-related pathophysiological changes could make the sleep in people with diabetes unique.

Sleep can be measured both objectively and subjectively. With the advancement of technology, polysomnography (PSG) and actigraphy are being widely used to measure objective sleep. However, their use is limited by intensive training, higher

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costs, and inability to assess subjective sleep. In contrast, Pittsburgh Sleep Quality Index (PSQI)[8] is a brief instrument that can be easily administered. Importantly, it assesses an individual's subjective perception of his/her sleep and complements with objective measurement of sleep, making the sleep assessment more comprehensive. To date, the PSQI remains the most commonly used instrument assessing subjective sleep disturbance.[9] The PSQI has been translated into multiple languages and validated in various populations. It evaluates seven conceptual domains of sleep, including sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction.

No consensus has been reached regarding the internal structure of the PSQI, although the one-factor model has been traditionally used by summing the seven components.[8] A recent systematic review examined current evidence in the factor structure of PSQI and found that the one-factor model performed poorly in most studies.[9] Particularly, Cole et al.[10] found that a three-factor structure of PSQI (i.e., sleep efficiency, perceived sleep quality, and daily disturbances) performed better than the original one-factor structure in older adults, suggesting the multidimensionality of sleep disturbance. Similarly, the three-factor structure also worked better in other populations.[11,12] It is possible that the one-factor model cannot capture the multidimensionality of the sleep disturbance in various populations. More interestingly, questions have been raised regarding the contribution of the component "use of sleep medication" to the scale across populations. Studies have reported low correlations between "use of sleep medication" and other components as well as the global score, and removing "use of sleep medication" has resulted in an improvement of the psychometric properties of the PSQI.[13,14]

Sleep disturbance in various populations likely has different attributes. Specifically, people with T2DM commonly undergo pathophysiological changes, including nocturia or neuropathic pain that could disturb their night sleep, making frequent awakenings a characteristic of sleep disturbance. Evaluation of the PSQI factor structure that is most relevant for T2DM patients is essential for our understanding of the sleep disturbance in this population. To our best knowledge, the factor structure of PSQI has not been examined in the context of T2DM despite its wide use. Therefore, the objective of this study is to examine the factor structure of the PSQI in Chinese adults with T2DM. In this study, we evaluated whether the original one-factor,[8] the adapted one-factor (by removing "use of sleep medication"), or the three-factor[10] structure of the PSQI fits the sleep data in a sample of Chinese adults with T2DM. We provided further evidence for the validity of the factor solution by examining the relationships between the resultant factor and health-related indicators including age, gender, and glycemic control.

2. Methods

2.1. Participants

Data used in this report was from a cross-sectional study[15] aimed at investigating the relationship between sleep and glycemic control in people with T2DM. A convenience sample of 240 patients administered in the endocrinology unit in two general hospitals (Xi'an, Shaanxi, China) was recruited between September 2013 and January 2014. The sample size was determined *a priori*. The inclusion criteria were: 1) diagnosed with T2DM for over 1 year, as verified by the medical chart; 2) aged 18 or over; and 3) able to understand, read, and write in Chinese. Participants were excluded if they had medical chart confirmed: 1) gestational diabetes and other types of diabetes; 2) acute diabetic complications and severe heart, lung, and cerebral disease; or 3) mental illness or severe cognitive disorders.

2.2. Measures

2.2.1. Demographics and physiological parameters

Participant demographics were collected using a baseline questionnaire, which assesses participant age, gender, education, and marital status. Physiological parameters were collected from the patient record obtained while they were staying at the endocrinology unit, including height, weight, blood pressure, and A1C. According to the American Diabetes Association recommendation, A1C < 7% is considered good glycemic control.[16]

2.2.2. PSQI (Chinese version)

The PSQI was developed to evaluate subjective sleep disturbance over the past month by Buysse et al.[8] It consists of 19 self-rating items that can be categorized into seven components, including subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. Each component is scored on a 4-point Likert scale (0–3). The sum of the seven components results in a global score of 21. A high score indicates worse sleep quality. The PSQI (Chinese Version) was translated and validated by Liu et al. in a sample of college students and patients with insomnia or psychiatric diseases.[17] In that study, the internal consistency Cronbach's α was 0.84, the split-half reliability was 0.87, and the 2-week test-retest reliability was 0.81. The PSQI had a sensitivity of 98.3% specificity of 90.2% when the cutoff point was set at 8.

2.3. Procedures

The study was approved by the Institutional Review Board of a large Health Science Center in Midwestern of China. Written informed consent was obtained from all participants prior to data collection. Participants completed the self-reported questionnaire in the paper-and-pencil format in their own ward. Data were checked immediately after completion, and further clarification from the participants was obtained to minimize missing data. Details about the recruitment and instrument administration were described in a previous paper.[15]

2.4. Data analysis

Data were entered into Epi Info 7.1 using a double-entry method. Stata 13.1 (College Station, Texas, USA) was used