Evaluation of Sleep Problems or Disorders Using Sleep Questionnaires

Nayeong Kong, Jinhui Choi, and Wan Seok Seo

Department of Psychiatry, Yeungnam University College of Medicine, Yeungnam University Hospital, Daegu, Korea

Many people have various sleep problems or disorders. It is important to administer the appropriate sleep questionnaire for early diagnosis of sleep problems or disorders. Although sleep questionnaires are less accurate than polysomnography, they are inexpensive and easy to apply, making them useful for patients in primary care settings. They are also useful when following up on a treatment, when conducting a screening test for a specific population, and when using them as research tools. Some sleep questionnaires have recently been developed as a mobile app, making them easier to use. In this paper, we will review some sleep questionnaires used by physicians to diagnose sleep problems or disorders.

Key Words: Sleep; Sleep Wake Disorders; Surveys and Questionnaires; Mass Screening

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Corresponding author: Wan Seok Seo, MD, PhD, Department of Psychiatry, Yeungnam University College of Medicine, Yeungnam University Hospital, 170 Hyunchung-ro, Nam-gu, Daegu 42415, Korea.

Tel: 82-53-620-3344, Fax: 82-53-657-3921, E-mail: sws3901@ynu.ac.kr

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INTRODUCTION

Sleep is an important physiological process of cognitive and physical functioning in humans. Sleep deprivation and sleep disorders have negative effects on medical, physiological, behavioral, and academic functions in humans. Many modern people describe negative effects of chronic sleep and wakefulness difficulties on work, academics, and driving activity as well as physical and emotional health [1,2]. Lee et al. [3] reported that the loss in productivity owing to sleep problems costs approximately 10 billion dollars a year in Korea.

Sleep disorders were classified into seven major categories in the third edition of the International Classification of Sleep Disorders (ICSD) released in 2014 [4]. Most sleep-related complaints in clinical situations are as follows: insomnia, excessive sleepiness, sleep behavior, or irregular sleep-wake schedule [5].

Early diagnosis and intervention of various sleep problems or disorders are important. The gold standard for evaluating sleep disorders is polysomnogram (PSG). PSG is a complete lab-based monitoring tool that can accurately assess various sleep disorders. It can be used to diagnose sleep disorders by analyzing sleep stages, breathing patterns, and movements during specific sleep stages using records from many variables (e.g., electroencephalography,

electromyography, electrooculography) [6].

Meanwhile, the first step in diagnosing sleep disorders is history taking. History taking provides information about the patient's chief complaints, onset, and precipitating factors in their sleep problems, as well as sleep hygiene, substance use such as alcohol and caffeine, and night time lifestyle. However, this process can vary greatly depending on the physician's knowledge and experience with regards to sleep physiology and sleep disorders. Additional assessment tools should be used to complement history taking when diagnosing sleep disorders.

The primary tools for evaluating a person's sleep patterns or sleep problems are sleep questionnaires and sleep diaries. A sleep diary is a simple tool used to track a person's sleep patterns, usually completed within 1–2 minutes. Sleep diary entries include: time to go to sleep; time to wake up; how long taken to fall asleep; sleep duration; number, times and durations of awakening; presence of a nap during the day; exercise; medication, caffeine or alcohol use; etc. [5]. Meanwhile, a sleep questionnaire is a commonly used tool for the first diagnostic test in a primary care setting and provides a general measure of subjective quality of sleep. Sleep questionnaires have several advantages over sleep diaries. They have a short evaluation time, need no professional assistance, and no specific devices are required [7].

This paper reviews the purpose and utilization of sleep questionnaires, which are widely used in clinical settings, for helping general physician or sleep non-specialist to help diagnose patients.

GENERAL SLEEP ASSESSMENT

Sleep-Wake Activity Inventory

Sleep-Wake Activity Inventory (SWAI) was developed by Rosenthal et al. [8] in 1993, and consists of six subscales evaluating sleepiness, nocturnal sleep, ability to relax, energy level, social desirability, and psychic distress over the previous 7 days [8]. It can evaluate general aspects of sleep and awakening in the patients. SWAI consists of a total of 59 items. Each item is composed of semi-continuous Likert with 1–9 points (1=always, 9=never). SWAI-Excessive daytime sleepiness (EDS) is used for evaluating excessive daytime sleep; a score below 40 indicates excessive sleepiness, a score 50 or above is normal, and a score between 40 and 50 means possible sleepiness. SWAI has well been associated with multiple sleep latency test (MSLT), which are considered the gold standard tests of sleepiness. It is also known to be useful in determining the treatment effect of obstructive sleep apnea (OSA) [9].

Sleep Disorders Questionnaire

Sleep Disorders Questionnaire (SDQ) is a screening tool for evaluation of various sleep disturbances and sleep habits over the previous six months. SDQ was developed by Douglas et al. [10]. It consists of a long questionnaire including 175 items for assessing common sleep disorders such as sleep apnea, narcolepsy, psychiatric sleep disorder, and periodic limb movement disorder over previous six months. Each item can be scored from 1 (never) to 5 (always). SDQ was initially designed to help general practitioners diagnose sleep disorders. The developers have also created a smaller, 45-item version of the scale to assess four common sleep disorders.

Dysfunctional Beliefs and Attitudes about Sleep Scale

The original Dysfunctional Beliefs and Attitudes about Sleep Scale (DBAS) consists of a 30-item self-report questionnaire to evaluate sleep-disruptive cognition. Morin et al. [11] also created a 16-item based brief version of DBAS in 2007. It measures the person's sleep related cognitions (e.g., faulty beliefs and appraisals, unrealistic expectations, perceptual and attention bias) using 100-mm visual analog scales. A high score indicates a person having extensive false beliefs about sleep. This scale is useful for evaluating an individual's sleep-related beliefs, attitudes to insomnia, and for evaluating treatment outcomes according to cognitive changes in the patient. A Korean version of DBAS was validated by Yu et al. [12] in 2009.

INSOMNIA DISORDERS

Pittsburgh Sleep Quality Index

Pittsburgh Sleep Quality Index (PSQI) was developed by Buysse et al. [13] and is the most widely used tool to evaluate sleep quality

and sleep disturbance. It consists of 7 components (subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, use of sleeping medication, and daytime dysfunction) with a total of 24 items and takes about 5–10 minutes to complete. The 24 items consist of 19 items directly assessed by the patients and 5 items evaluated by the bed partners. Each item is rated from 0 to 3 points, with a total score ranging from 0 to 21 points. If the score is 5 or more, individuals are determined to be bad sleepers; if it is less than 5, they are evaluated as good sleepers. PSQI has been used in the diagnosis of various sleep and insomnia disorders. PSQI was validated as a Korean version [14].

Insomnia Severity Index

Insomnia Severity Index (ISI) was developed by Morin et al. to evaluate insomnia according to the diagnostic criteria of Diagnostic and Statistical Manual of Mental Disorders, 4th edition and ICSD [15]. ISI consists of 7 self-reported items (severity of sleep onset, severity of sleep maintenance, severity of early morning awakening problems, sleep dissatisfaction, interference of sleep difficulties with daytime functioning, noticeability of sleep problems by others, distress caused by the sleep difficulties) that assess the nature, severity, and impact of insomnia over the previous month. ISI is rated on a five-point Likert scale from 0 to 4 points per item with a total score of 0–28 points. A score below 7 indicates no insomnia, that between 8 and 14 indicates insomnia below threshold, that between 15 and 21 means moderate insomnia, and that over 22 indicates severe insomnia. It was translated into a Korean version [16]. This questionnaire can be applied to individuals of all ages and is useful for psychiatric patients who have insomnia symptoms.

HYPERSOMNOLENCE DISORDERS

Epworth Sleepiness Scale

Epworth Sleepiness Scale (ESS) is a self-rating scale of sleepiness in eight situations developed by Johns [17] and sensitively reflects a person's sleepiness. In each situation, the degree of sleepiness is assessed from 0 to 3 points, and the total score ranges from 0 to 24 points. A total score of 10 or above indicates a serious case of EDS. It was translated into a Korean version and is widely used in Korean hospitals [18]. Although correlation studies with MSLT are diverse, there are questions about whether ESS can be used as a measure of drowsiness. Because of the Korean unique lifestyle, modifications are necessary to improve the measurement accuracy of the ESS. Most of the respondents were either confused or hesitant to answer certain questions that refer to situations involving sitting and driving. Very recently, Jung et al. [19] developed and validated a modified Korean ESS that reflects the Korean lifestyle.

Stanford Sleepiness Scale

Stanford Sleepiness Scale (SSS) was developed by Hoddes et al. [20] and is useful for evaluating acute sleepiness through the day.

It evaluates the degree of sleepiness and alertness on a scale of 1 to 7 (1=feeling active, vital, alert, and wide awake, 7=almost in reverie and cannot stay awake. Sleep onset is imminent). SSS is very easy to apply, and it can be used several times a day.

BREATHING-RELATED SLEEP DISORDERS

Berlin Questionnaire

Berlin Questionnaire (BQ) was developed by respiratory and primary care physicians through consensus to evaluate OSA, and it was validated in 1996. BQ consists of 10 questions in three categories related to snoring, daytime sleepiness, and obesity or hypertension [21,22]. If positive more than two of the three categories fall into the OSA high-risk group. Category 1 consists of five questions related to snoring and apnea during sleep. It is considered positive when answering yes to 2 or more questions. Category 2 consists of four questions related to sleepiness and tiredness. It is considered positive when answering yes to 2 or more questions. Category 3 is considered positive when the individual has high blood pressure or a BMI >30 kg/m². BQ was translated into a Korean version [23].

STOP questionnaire

STOP questionnaire was developed by the University of Toronto for screening OSA in 2008 [24]. The eight items including snoring, tiredness during daytime, observed apnea, and high blood pressure are rated as yes or no. Combined with BMI, age, neck size, and gender (STOP-Bang), this questionnaire is useful for patients with moderate to severe OSA.

Calgary Sleep Apnea Quality of Life Index

Calgary Sleep Apnea Quality of Life Index (Calgary SAQLI) was developed by Flemons and Reimer [25] in 1998, and it is a disease-specific quality of life scale for patients with OSA. It evaluates four domains, namely daily functioning (11 questions), social interactions (13 questions), emotional functioning (11 questions), and symptoms of the quality of life (5 questions) that are important to OSA patients. It was designed to be administered to patients by a trained interviewer. It is rated on a 7-point Likert scale from 1 to 7 points (1=very severe, 7=not at all severe). Calgary SAQLI was translated into a Korean version [26].

CIRCADIAN RHYTHM SLEEP-WAKE DISORDERS

Morningness-Eveningness Questionnaire

Morningness-eveningness refers to individual differences in preferred time of activity during daily life, including circadian rhythm, sleep-wake times, and active time zones. Morningness-Eveningness Questionnaire (MEQ) is the most commonly used self-assessment questionnaire to evaluate individual differences in circadian rhythms and was developed by Horne and Osteberg [27] in 1976. The MEQ is a 19-item questionnaire and the scores range from 16 to 86. A score

of 59 or above indicates morningness and a score below 41 indicates eveningness. MEQ was translated into a Korean version.

Composite Scale of Morningness

Composite Scale of Morningness (CSM) was developed by Smith et al. [28] by combining MEQ and Diurnal Type Scale for assessing morningness and eveningness. It consists of 13 questions evaluating an individual's preferred sleep onset time, wake-up time, and extent of morning or evening activity. Three items are rated from 1 to 4, 10 items are rated from 1 to 5, and the total score ranges from 13 to 55. A score over 49 indicates morning type, and a score less than 26 indicates evening type. CSM was translated into a Korean version in 1997 [29].

Sleep Timing Questionnaire

Sleep Timing Questionnaire (STQ) was developed by Monk et al. [30] to obtain a patient's precise sleep schedule and to obtain the individual's sleep patterns and habits. The questionnaire consists of 18 items; the questions include good night and morning time, number and duration of wake-up during the night, and stability of sleep schedule. STQ has been reported to have a high correlation with actigraphy [30].

RESTLESS LEGS SYNDROME

International Restless Leg Syndrome Study Group Rating Scale

International Restless Leg Syndrome Study Group Rating Scale (IRLS) was developed by the International Restless Legs Syndrome Study Group and consists of 10 items to evaluate restless leg syndrome (RLS) symptoms over the previous week [31]. It is designed to evaluate the frequency and severity of RLS, their association with sleep disturbance, daytime functioning, and mood disorder. The degree of severity rated as mild (0 to 10), moderate (11 to 20), severe (21 to 30), and very severe (31 to 40). IRLS was translated into a Korean version in 2010 [32].

Restless Leg Syndrome Quality of Life Questionnaire

The Restless Leg Syndrome Quality of Life Questionnaire (RLS-QoL) was designed to assess the quality of life in the patients with RLS over the previous four weeks. It consists of 18 items including daily activities, social activities, concentration, and sexual activities [33]. RLS-QoL was also translated into a Korean version in 2010 [32].

CONCLUSION

Modern societies are characterized by 24-hour work operations, trans-meridian travel, and exposure to a variety of electronic devices such as televisions, computers, and mobile phones, all of which affect the quality, quantity, and timing of sleep in human beings [34,35]. Therefore, sleep disorders may gradually increase over time. Early diagnosis and intervention of sleep

problems or disorders are important. Sleep questionnaires are useful for assessing sleep problems or disorders and for planning treatment, as well as for following up the effect of treatment.

In this paper, we reviewed the characteristics and benefits of some sleep questionnaires that are used in clinical settings. There are some things to be mindful of when using sleep questionnaires. First, sleep questionnaires may not be accurate because almost of them are self-reported and therefore depend on the memory of a particular point in time. Second, some questionnaires have so many items that the rater may evaluate them unintentionally. Third, sleep questionnaires cannot measure sleep stages; they only assess the sleep and awake states [36,37]. Physicians should know about the characteristics and limitations of different sleep questionnaires, and they should combine sleep questionnaires with other evaluation tools when diagnosing patients. Recently, various sleep questionnaires and sleep diaries have been developed into mobile app versions, and consumer wearable devices for easier use [38,39].

In conclusion, if physicians use sleep questionnaires combined with other diagnostic tools, they will be very helpful in identifying sleep problems or disorders of their patients.

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Conflicts of Interest

The authors have no potential conflicts of interest to disclose.

Author Contributions

Conceptualization: Wan Seok Seo. Investigation: Wan Seok Seo, Nayeong Kong, Jinhui Choi. Data curation: Nayeong Kong, Jinhui Choi. Project administration: Wan Seok Seo. Resources: Wan Seok Seo. Supervision: Wan Seok Seo. Writing—original draft: Wan Seok Seo. Writing—review & editing: Wan Seok Seo, Nayeong Kong, Jinhui Choi.

ORCID iDs

Wan Seok Seo

<https://orcid.org/0000-0002-5122-5360>

Nayeong Kong

<https://orcid.org/0000-0002-9095-1701>

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