Screening for Sleep Disordered Breathing in an Occupational Setting

RONALD FILOMENO*1,2), AI IKEDA*1, TAKESHI TANIGAWA*1)

*1 Department of Public Health, Juntendo University Faculty of Medicine, Tokyo, Japan, *2 Department of Public Health Sciences, Office of Public Health Studies, University of Hawaii at Mānoa, Honolulu, USA

Sleep disordered breathing (SDB) is a condition resulting in overall decreased sleep quality. Many people worldwide continue to be undiagnosed and untreated for SDB, a major public health issue that leaves them at increased risk for accidents and cardiovascular disease. Evaluation of the efficacy of various survey methods to identify those at increased risk for SDB highlights the benefits of screening. It is highly recommended that early identification and treatment be carried out. The beneficial effects of maintaining the overall health of the population by focusing on prevention and identification through screening in the present decrease the risk of life-threatening situations resulting from SDB in the future.

Key words: sleep disorders breathing, occupational health, risk factors

Introduction

Sleep disordered breathing (SDB), such as obstructive sleep apnea, is a highly prevalent condition that affects everyone all over the world. Studies conducted in the United States, Europe, Australia, and Asia have confirmed the prevalence of SDB in each of those respective areas. The data from those studies show approximately 1 in 5 adults having at least mild OSA and 1 in 15 adults having moderate or severe OSA1). Patients with OSA have overall decreased sleep quality and are linked with an increased risk for motor vehicle accidents, industrial disasters, medical, and other occupational errors2). Sleep disordered breathing, such as OSA, is implicated in the development of cardiovascular risk factors and diseases such as hypertension, diabetes mellitus, arrhythmias, myocardial infarction and congestive heart failure3,4). Due to the high prevalence of sleep disordered breathing, screening seems to be the best method for the identification and subsequent prevention of accidents and development of cardiovascular diseases.

Screening

Screening for sleep disordered breathing in occupational settings must be done appropriately. Screening protocols tailored to appropriately identify those at increased risk for sleep disordered breathing without endangering their livelihoods and autonomy should always be considered prior to actual screening. The important issues that commonly surround screening are the maintenance of work safety, privacy protection, and a prognosis and rearrangement for reinstatement of workers with SDB. Questionnaire based screening for SDB can obtain a self-reported understanding of the general populations overall health conditions. While self-reporting can create bias, it is the easiest and inexpensive method to assess one’s health.

The initial SDB screening questionnaire should include items regarding snoring, excessive daytime sleepiness, witnessed breathing pauses during sleep and perceived insufficient sleep at the morning, which are the most common identifiable risk factors associated with SDB. The following questionnaire...
entitled the Epworth Sleepiness Scale (ESS), which measures daytime sleepiness, has often been used in epidemiological and clinical studies worldwide. While not being a diagnostic tool in itself, ESS measures one important aspect of a person’s sleep-wake health status. High ESS scores shift the focus from trying to identify biological aspects to instead identifying lifestyle as a reason for sleepiness, such as hard work and waking up late at night. If those lifestyles are not related to the reasons for their perceived sleepiness, further examination will need to be done to better identify the cause for their high ESS score and subsequent sleep disorder. Furthermore, low ESS scores do not eliminate persons from potentially having a sleep disorder due to several factors such as lack of perception regarding sleepiness due to frequent short naps, diminished sleepiness perception due to chronic sleep loss, and intentional underreporting to avoid occupational repercussions.

Screening may also draw attention to health related behaviors that may aggravate SDB. The health related behaviors such as smoking and increased caffeine (coffee, tea, soft drinks, green tea) and/or alcohol intake are known to be important factors to assess the extent of sleepiness. These behaviors, have been shown to result in lower quality of sleep, measured by nighttime awakenings and decreased time spent in REM sleep. Furthermore, smoking has also been identified as a cause for increased inflammation and fluid retention in the upper airway. Alcohol has been identified as impairing breathing by relaxing throat muscles subsequently resulting in low oxygen levels in the bloodstream.

In regards to maintaining autonomy, the pulse-oximetry is a good measure of early detection and treatment for SDB as it allows person to maintain as much self-independence as possible while at the same time preventing self-reporting bias; a common problem with using questionnaires. While the gold standard for screening is polysomnography (PSG), it is not a realistic approach for screening large populations. PSG is expensive, intrusive, and requires overnight stay in a hospital or sleep center in order to formulate a diagnosis. On the other hand, pulse-oximetry is affordable, fairly non-invasive, and available for general physician and occupational physician to use as an accessible and portable method of screening. The oxygen desaturation per hour value (oxygen desaturation index; ODI), indicator for SDB through pulse-oximetry provides a feasible and more realistic estimation of the prevalence and severity of SDB.

However, pulse-oximetry inherently underestimates respiratory disturbance events during sleep in non-obese persons compared to PSG. To overcome this issue, a novel screening system for OSA has been developed. This system includes a single-channel air flow monitor using polyvinylidene fluoride (PVDF) and an original algorithm was developed to allow for the analysis of thermal flow sensor signals. The system determines the flow-respiratory disturbance index (flow-RDI), which shows a relatively high agreement with the apnea hypopnea index (AHI) assessed with concurrent full PSG recording. The sensitivity and specificity of the in-laboratory flow-RDI to diagnose SDB were 0.96 and 0.82, 0.91 and 0.82, and 0.89 and 0.96, for AHI ≥ 5, ≥ 15 and ≥ 30 events/h, respectively. The oximetry-derived ODI agreed less closely with the AHI in normal weight subjects than in overweight subjects, but this was not the case for the flow-RDI; in non-obese subjects, the correlation between the AHI and ODI was poorer than between the AHI and flow-RDI (r = 0.87 versus r = 0.93). A patent was granted on the automatic apnea/hypopnea detection device, detection method, and software and recording medium (Japanese Patent No. 4642626, December 10, 2010). Therefore, flow sensor use has shown to be effective more so than pulse-oximetry on non-obese individuals (shown in figure 1, 2, and 3) and is subsequently recommended.

Risk factors for SDB

SDB is a recognized health problem due to its association with hypertension and population-based studies have helped to further reinforce that connection. Therefore, it is important to recognize common risk factors that lead to SDB. The male sex, aging, craniofacial morphology, upper airway abnormalities, and obesity are found to be established risk factors for SDB. Males have been identified as being at higher risk than females due in large part to the uneven distribution in research regarding SDB between the sexes. Further-
ermore, males are commonly associated with an increased partaking in health related behaviors that lead to aggravated SDB and or the development of SDB in some cases. Age has shown to be a factor by the fact SDB is more prevalent in the 20-49 age range.  

The craniofacial morphology is also identified as a risk factor, primarily for Asians, due in large part to Asians being classified as not obese through international BMI standards. Studies have shown that Caucasians and Asians suffered the same degree of SDB severity despite the differences in BMI. Caucasians with SDB are more affected by obesity, Asians were noted to have more skeletal restriction and subsequently adversely affect their overall breathing quality while sleeping.
In epidemiological studies, nocturnal intermittent hypoxia (NIH) has been used as a surrogate marker for OSA. Studies have found that alcohol consumption was associated with the severity of NIH during sleep among occupational drivers. The significant association between alcohol consumption and NIH severity suggests the need for OSA screening and alcohol intake modification as well as weight control to prevent and control OSA among occupational and the general population.

Reference to craniofacial morphology and body weight on SDB, the association between the severity of NIH was stronger among overweight men than non-overweight men.

### Pros and Cons for screening

The overall cost is always a major factor when it comes to healthcare treatment or early detection. Most life and property insurance companies in Japan do not have clear policies in place for accepting or rejecting contracts of clients with SDB. Since insurance companies may reject or require elevated co-pay for clients diagnosed with SDB, such as OSA, patients with SDB are not willing to seek diagnosis and/or treatment. Treatment such as continuous positive airway pressure (CPAP) can be viewed as troublesome and financially burdening however, the effectiveness of CPAP is recognized worldwide despite it being an expensive form of treatment for OSA. There is also fear that screening results in a temporary loss of autonomy. For example, PSG requires that persons cannot be in their own bed and must have electrodes and other various sensors placed on their body, resulting in a very uncomfortable and expensive experience. However, if screening is employed the low cost and fairly non-invasive methods as well as the feasibility of screening, the person may be subsequently given early treatment. The screening methods such as pulse-oximetry and flow sensor, are feasible and yield realistic results for SDB that result in a more precise diagnosis along with data gathered from questionnaires. The use of pulse-oximetry and flow sensor as means of early detection for SDB as well as questionnaires for screening, early treatment can be subsequently be administered.

Although treatment will require an immediate but slight loss of autonomy as well as financial burden, it is important to emphasize the benefits of early detection and treatment. Early detection and treatment will help to prevent current health problems related to SDB from potentially worsening. Given SDB's association with hypertension, diabetes, and other cardiovascular diseases, ignor-
ing possible treatment as a result from screening for SDB may prove to be not beneficial in the long term. Preventing hypertension and other SDB related health problems from worsening would extend one’s life expectancy and keep overall health costs down and health insurance co-payments low in the future. Furthermore, early detection and treatment may potentially decrease the chances of SDB related occupational and personal accidents from occurring.

Conclusion

Screening for SDB results in early detection and treatment at low financial and psychological stress to the individual, their respective working company, and the people they interact with on a daily basis. With increased incidences of sleep-related accidents leading to death, injury, and/or property damage, the utilization of screening may very well indeed help to reduce similar incidences from occurring in the future. Screening provides a very realistic and feasible approach to identifying those with SDB or at an increased risk of SDB. Thus, early detection and treatment may lead to lower insurance premiums and overall SDB related health care costs in the future and possibly decrease the risk of SDB related accidents.

References

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