



Associations between insomnia, sleep duration and poor work ability



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ABSTRACT

Objective: The aim of this study was to examine the independent and joint effect of insomnia and objective sleep duration on poor work ability.

Methods: In this cross-sectional study, a total of 2820 Chinese manufacturing workers were categorized as insomnia patients and individuals with normal sleeping pattern by interview according to DSM-IV criteria. Sleep duration was classified into four categories: ≥ 7 h, 6–7 h, 5–6 h, and < 5 h according to objective sleep duration of Watch-PAT-200 test. Work ability was assessed using the Chinese Work Ability Index (WAI) questionnaire. Regression analysis examined the independent and joint association of sleep duration and insomnia with poor work ability, after adjusting for various confounding factors.

Results: Insomnia and objective short sleep duration were both independently associated with poor work ability. Compared with the normal sleeping and ≥ 7 h sleep duration group, the highest risk of poor work ability was in the insomnia patients with < 5 h sleep duration [odds ratio (OR) 3.43, 95% confidence interval (CI) 1.87–5.23], followed by the individuals with insomnia who slept 5–6 h (OR 2.03, 95% CI 1.42–2.67).

Conclusions: Insomnia and sleep duration in workers are both separately and together associated with increased risk of poor work ability. Objective sleep duration should be taken into consideration when assessing the work ability of people with insomnia.

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Introduction

Insomnia is one of the most common health problems among the working population: 30%–50% occasionally experience insomnia symptoms, and up to 10% meet the criteria for clinical diagnosis of insomnia [1,2]. Many studies have established that insomnia is associated with deterioration in work ability, including: reduced physical and mental function such as fatigue, anxiety and inability to perform complex tasks; reduced career progression and job satisfaction; excess absenteeism; reduced work performance; and work disability [3–9].

Sleep duration has also been associated with morbidity and mortality in many previous studies [10,11]. However, only a few studies have examined the association between sleep duration and work ability, with ambiguous results [12–15]. For instance, short sleep duration (≤ 5 h) has been shown to predict sickness absence [12] and retirement through disability [13]. Another recent study has found that people who sleep ≤ 6 h have a higher risk of sickness absence than those who sleep for 7 h, with adjustment for age and gender. However, this association disappears after adjustment for covariate factors [14]. In contrast, the Hordaland Health Study has shown that short sleep duration is not

significantly associated with subsequent work disability [15]. Sleep duration in these previous studies was based on self-reports, which may not be representative of habitual sleep duration, and there was no objective sleep measurement. Therefore, some misclassification may have occurred and the effect of sleep duration on risk of poor work ability might have been overestimated. It has been shown that self-reported sleep duration is moderately correlated with sleep duration measured using wrist actigraphy ($r = 0.47$); the former is more likely to overestimate the latter by 0.8 h on average, and this overestimate escalates in particular with short sleep duration [16]. Thus, the question whether short sleep duration is associated with an increased risk for poor work ability remains open to further investigation.

In addition to independent effects of sleep duration and insomnia on health, some studies have examined their joint effect on various health outcomes such as hypertension [17], type 2 diabetes [18], neurocognitive impairment [19] and mortality [20]. This earlier evidence further suggests that short sleep, particularly objectively measured, could serve as a biological marker for severity of insomnia and explain the increased health risks among those suffering from insomnia and short sleep. Thus, when examining sleep duration, its combined effects with insomnia need to be considered. To date, only two studies have examined the joint associations of subjective sleep duration and insomnia symptoms with deterioration in work ability, and the results were inconsistent. The Helsinki Health Study showed that combination of subjective short sleep duration and insomnia symptoms was significantly associated

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with all-cause disability retirement [15]. However, the joint association was not found in another recent report of the study [14].

These previous studies have relied on loose definitions of insomnia, and subjective questionnaires do not include any criteria of frequency or severity, which may have overestimated the impact of insomnia on work ability. Moreover, the concept of work ability is broad, comprising the physical, psychological, and social capability of a worker to perform and interact within their work, and the individual's specific work demands, health conditions, and mental resources [21]. Most of the research on work ability of individuals with insomnia has used variables such as absenteeism and work disability, which are low-incidence events and may not fully capture the nature or scope of work ability deterioration. Other variables, which may give a fuller picture, such as cognitive impairments, mood problems that affect relationships with co-workers, and social functioning, have received less attention. Finnish researchers have constructed the Work Ability Index (WAI) to assess work ability [21,22]. They described work ability as the interaction of individual determinants (health, competence and attitudes) and the work environment. The WAI combines subjective experiences of one's ability to cope with physical and mental requirements at work (performance at work) with information on diseases and consequent functional limitations, sick leave and mental resources at work (enjoying daily tasks, active and vital life, optimism about the future) [22]. Measuring work ability has been developed as a valuable tool to tailor disability interventions at an individual level [23].

Although insomnia and subjective sleep duration both affects work ability, it is not known whether objective sleep duration is associated with poor work ability, and whether both insomnia and objective sleep duration affect work ability to a similar extent. We hypothesized that insomnia is associated with poor work ability and that its effect is exacerbated by objective sleep duration. We therefore aimed to examine the independent and joint association of objective sleep duration and insomnia with poor work ability, adjusting for various social and work- and health-related factors, among Chinese manufacturing workers.

Methods

Participants and procedures

The study is part of the Occupational Health Study of Manufacturing Industry Workers (OHSMIW) in China, and was conducted between October 21, 2011 and July 12, 2012. The target population was all blue-collar employees working in 123 state-owned and 163 private manufacturing companies in Urumqi city, Xinjiang province, China. Using a three-stage stratified sampling method, 10 state-owned and eight private companies were selected first, based on the Chinese Standard Industrial Classification of the nature of the companies. Then, based on the size of company, we randomly selected two large-sized company (>1000 workers), two medium-sized (300–1000 workers) companies and one small-sized company (<300 workers) from selected state-owned companies, and selected one large-sized company, two medium-sized companies and one small-sized company from selected private companies. Finally, we selected 600 workers from large-sized companies, 250 from medium-sized companies, and 100 from small-sized companies by applying computer-generated random numbers to the manager's lists of employees, and workers who had worked in the company for at least 1 year were selected for interview, excluding those employed on a part-time basis or in management roles. A total of 3000 workers were recruited for interview. With the assistance of the company managers, an announcement was sent to employees explaining that the survey was designed "to better understand how sleep problems affect the work ability of people," that respondents were selected randomly, that participation was voluntary, that responses were confidential, that participation would not affect health care benefits, and that an incentive of RMB 20 Yuan was offered for

participation. Finally, 2910 workers agreed to take part (response rate 97.0%). Once an individual was identified and agreed to participate, a face-to-face interview was conducted during annual occupational health screening. All interviews were conducted privately by trained interviewers using a questionnaire including sociodemographics, sleep quality, work ability, behavior risk factors and occupational stress. A common interview protocol was utilized across the nine study companies, in order to achieve homogeneity in interview and data collection procedures. The workers were simultaneously instructed by our research staff to complete sleep duration measurement in home using the Watch-PAT-200® device for three nights. Among the respondents, 90 workers were excluded because of the non-response to one or more of the variables in the interview or missing data in sleep duration. Thus, the final analysis involved 2820 workers.

After the interview, those who were screened positive in the Athens Insomnia Scale (AIS) were asked to undergo clinical reappraisal. Blinded clinical interviewers who were experienced sleep medicine experts carried out structured clinical interviews to establish a diagnosis of insomnia based on the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV). The 2820 employees were classified as 692 insomnia patients and 2128 individuals with normal sleeping patterns. The characteristics of the study participants are presented in Table 1.

Ethical considerations

All the participants gave written informed consent after receiving details of the study aims and protocol. The study was approved by the Ethics Committees of Xinjiang Medical University.

Insomnia

Insomnia was assessed with the AIS, which was developed by Soldatos and colleagues to assess the severity of insomnia based on the International Classification of Diseases 10th Revision (ICD-10) diagnostic criteria [24]. It is a self-reported questionnaire consisting of eight items; the first five assess difficulty with sleep induction, wakening during the night, early morning wakening, total sleep time, and overall quality of sleep; and the last three items pertain to the sense of well-being, overall function, and daytime sleepiness. The usual time frame for responding is the previous month. Each item of AIS can be rated 0–3, with 0 corresponding to no problem at all and 3 to a very serious problem. This gives a total score ranging from 0 to 24. A total score >6 indicates insomnia symptoms. The Chinese version of the questionnaire has good overall psychometric properties and is a reliable screening tool for diagnosis of insomnia [25]. Cronbach's α was 0.81, and the 2-week test–retest reliability was 0.80. The scale had a two-factor structure, and was significantly correlated with sleep–wake variables [25,26].

Clinical reappraisal was carried out with a subsample of respondents who were screened for insomnia symptoms using AIS. Blinded clinical interviewers who were highly experienced sleep medicine experts carried out structured clinical interviews to establish a diagnosis of insomnia with DSM-IV. The DSM-IV criteria for insomnia include difficulty falling asleep, difficulty maintaining sleep, or experiencing nonrestorative sleep for a period of ≥ 1 month. In addition, it is a prerequisite that sleep disturbance significantly impairs daily function. The interviews were conducted by three qualified psychiatrists. The clinical interviews underwent training in clinical diagnosis work at a 3-day workshop. The workshop gave an overview of the project and covered assessment procedures, techniques for diagnosis interviews, potential difficulties in the interview, mock interviews, and quality assessment.

Objective sleep duration

Gold standard measurement for sleep duration was in-laboratory polysomnography (PSG). However, the disadvantages of overnight

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