



THEORETICAL REVIEW

The effect of the work environment on future sleep disturbances: a systematic review



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SUMMARY

Workers often attribute poor sleep to factors at work. Despite the large number of workers with sleep disturbances, there is a lack of consensus on the relationship between the work environment and sleep. The purpose of this systematic review therefore was to conduct a comprehensive evaluation. To this end, we employed standardized methods to systematically locate, review, and tabulate the results of prospective or randomized studies of the impact of work factors on sleep disturbances. From the 7981 articles located in five databases, 24 fulfilled our inclusion criteria and formed the base of the review including meta-analyses of the effect sizes. Results showed that the psychosocial work variables of social support at work, control, and organizational justice were related to fewer sleep disturbances, while high work demands, job strain, bullying, and effort-reward imbalance were related to more future sleep disturbances. Moreover, working a steady shift was associated with disturbances while exiting shift work was associated with less disturbed sleep. We conclude that psychosocial work factors and the scheduling of work have an impact on sleep disturbances and this might be utilized in the clinic as well as for planning work environments. Future research needs to employ better methodology and focus on underlying mechanisms.

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Introduction

Sleep disturbances are a primary health concern for workers in industrialized countries. Epidemiological surveys reveal that about one-third of the general adult population report difficulties sleeping and about 6–10% fulfill the DSM-IV (Diagnostic and Statistical Manual) criteria for insomnia [1–3]. In the US for example, 9.3% of the population suffer from chronic insomnia with a higher prevalence for women (12.9%) than for men (6.2%) [2]. Disturbed sleep, as used in this paper, includes the core symptoms of insomnia, including difficulty initiating or maintaining sleep,

waking up too early, non-restorative sleep and overall dissatisfaction with sleep [4]. Recent evidence suggests that the prevalence of insomnia has increased over the last decade, and is now the second most frequent health complaint after pain, affecting almost everybody at some point in life [5–7]. Moreover, insomnia has grave consequences as it is associated with a host of symptoms e.g., decreased function, increased fatigue, and decreased well-being and it may also be associated with a range of health problems including heart disease, mental health, and diabetes [1,3].

Sufferers often attribute their sleeping problem to factors in the work environment. These factors include stress, organizational factors, work schedules, psychosocial factors and exposure to various physical factors like chemicals or physical loading. In Sweden every fifth worker reports that work has affected their ability to sleep [8] and work stress is the most frequent self-reported cause of sleeping difficulties [9].

Indeed, work stress is an important risk factor for poor sleep [10]. Psychosocial work factors resulting in stress have been implicated in the development of sleep problems and the implicit

Abbreviations: CI, confidence interval; DSM, Diagnostic and Statistical Manual of Mental Disorders; exp, exposed; f, females; ICD, International Classification of Diseases; m, males; ns, not significant; OR, odds ratio; SBU, Swedish Council for Health Technology Assessment; REM, rapid eye movement.

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assumption is that adverse psychosocial work factors are related to poor sleep [11]. Similarly, the corollary is that favorable psychosocial work factors should be linked to good sleep. Variables such as work demands, pace, level of control, social support, organizational justice, workload, job strain, and job security are conceptualized as psychosocial work factors [12,13]. Models have been developed that tap into how the work environment exerts stress on employees. The demand-control theory [14] proposes that an imbalance between the demands placed on the worker and that person's decision latitude or control results in stress, especially so-called job strain (i.e., high demands, low control). An overlapping conceptualization is the effort-reward model where an imbalance between the effort to do the job and the reward it provides is said to create stress [15,16]. More recent concepts like organizational justice and job security have also been introduced to describe the work environment [17].

A second notion is that work schedules, such as working shifts, or nights influence sleep. Because sleep is closely tied to circadian rhythms, disruptions (night work) and the changing of work times disrupt sleeping patterns and may cause disturbed sleep. The idea that work schedules impact on sleep is not new [18,19]. However, today when only about one fourth of the work force have a regular daytime work schedule [20] the possible effects of work scheduling on sleep is pervasive.

A third area of interest for sleep is the physical work environment. Workers may be exposed to an array of working conditions including bacterial agents, chemicals, vibrations, noise, or heavy work. Any one of these might influence sleep e.g., by impacting on the nervous system.

Despite the prevalence of sleep complaints among workers and the implication of the work environment bearing on sleep, there is no current consensus on the relationship between the work environment and sleep. While some reviews have focused on specific work environment factors, populations, or sleep outcomes [11,18,20,21], there is a need for a comprehensive review that provides the "big picture" of our current knowledge. Moreover, while a good deal of research has focused on the effects of sleep deficits on work, examining the opposite direction of impact, i.e., the effects of work on sleep, is warranted given the large changes in working conditions that have occurred over the past 25 y.

Methodological challenges have however plagued and compromised the investigation of the effects of the work environment on sleep. First, a host of studies have employed cross-sectional designs. However, cross-sectional studies do not provide information about the temporal relationship between cause and effect and are thus prone to "reverse causation", i.e., the possibility that a sleep disturbance affects the experience of the work environment. In prospective studies, data on study subjects are assessed over a period of time. This allows establishment of the temporal sequence of events and thus facilitates the interpretation of cause and effect. Additional methodological issues include accurate measurement of both the exposure and outcome variables, control for confounders, timeframes that capture the latency of the work place variables, and appropriate statistical analyses. In this review, we have therefore chosen to focus on prospective studies, most with a follow up of at least 12 mo, case-control and intervention studies. Furthermore, in light of the methodological concerns, we have employed a systematic method for judging the relevance and scientific standard of each study to ensure that all of the studies provide worthwhile information based on strong designs.

The aim of this paper then, is to review systematically the literature on the effects of work on sleep. It is a comprehensive review that includes investigations of physical, organizational, and psychosocial factors at work that may impact on sleep using a

longitudinal design. In addition to using systematic methods to locate the literature, we also employed standardized procedures for judging the relevance and quality of each study.

Methods

This systematic review was conducted and funded within the framework of the Swedish Council on Health Technology Assessment (SBU), a public agency (www.sbu.se) with the charge of providing impartial and scientifically reliable information to decision makers health care providers. The review was conducted according to the guidelines stated by PRISMA (i.e., the Preferred Reporting Items for Systematic Reviews and Meta-Analyses) [22]. A systematic literature search for all available research on the topic was performed by an information specialist in five computerized data bases (PubMed, Embase, PsycInfo, Cochrane library, NIOSHTIC-2) with October 2012 as the latest search date. We focused on a broad range of known work environment variables (physical load, organizational and psychosocial factors, chemical and biological factors, noise, vibrations, contagious substances and other factors) and any measure of sleep disturbance including all ICD-10 sleep diagnoses and a combination of controlled search words (e.g., MeSH) and free-text words. Although objective measures are commonly preferred in clinical treatment settings, we also choose to include subjective measures since they encompass many different types of sleep problems and are commonly employed by researchers in this field. The search strategy for PubMed is available at www.sbu.se/work_sleep; we used a similar strategy for the other data bases.

Inclusion criteria were a prospective or randomized design; occupational focus; sleep disturbances not directly related to another illness such as depression; age and sex of participants reported; at least 30 people in the exposure group; and published between 1990 and 2012 in English, Swedish, Norwegian or Danish (although all articles included in the final review were published in English).

All steps of the selection process (Fig. 1 and Table 1) were based on detailed and predetermined appraisal forms (available on request). Abstract screening and full-text assessment for inclusion criteria were conducted by two people, a specialist in occupational medicine and a psychiatrist and an article was included if one assessed it as fulfilling the inclusion criteria. Assessment of relevance and quality was made by experts (e.g., in sleep medicine, psychiatry, psychology, occupational medicine, and epidemiologic methods), working in pairs. Before the assessments began, experts were trained to criteria by practicing and discussing ratings made using the forms until a satisfactorily high inter-rater reliability was achieved. Especially, we emphasized detecting potential bias in the methodology. The selection process resulted in 24 relevant studies fulfilling the inclusion and quality criteria. A detailed table showing the full results of the data extraction is available at www.sbu.se/work_sleep.

The included studies were tabulated and stratified according to occupational risk factor (Table 2) after the quality assessment process. Extracting data into the tables was done by two experts and subsequently scrutinized by the authors. Conclusions concerning relationships between work factors and sleep were made using all relevant data from all of the included studies. To assist in illustrating the results, and as a contribution to the overall assessment, meta-analyses were conducted when at least two studies analyzed the same risk factor and provided mathematically comparable data using the Comprehensive Meta Analysis software package (www.meta-analysis.com/index.php). Since the participants in the various studies might be construed as coming from the same population (workers) or from different populations (i.e.,

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