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Low leisure-time physical activity, but not shift-work, contributes to the development of sleep complaints in Swedish health care workers

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ABSTRACT

Problem: Regular physical activity (PA) can prevent sleep complaints and improve sleep among people with sleep disorders, whereas nocturnal shift work is linked with a higher risk of sleep problems. The present study examines the prospective contribution of PA and nocturnal shift work to the development of subjective sleep complaints.
Methods: Data is based on 1406 health care workers ($M = 45.67$ years, 88% women). Physical activity and sleep complaints were assessed via self-reports twice across a 2-year period. To address the issue of reverse causation, only participants without initial sleep difficulties were included in the prospective analyses.
Results: Moderate-to-vigorous PA (MVPA) was associated with a lower risk of developing difficulties falling asleep at the 2-year follow-up. Both light PA and MVPA were associated with a lower risk of developing feeling of exhaustion upon waking. The prospective association between PA and these two sleep complaints persisted after controlling for covariates. No significant prospective association was found between PA and night time awakenings. Shift work was not related to any of the sleep complaints.
Conclusions: The findings suggest that regular PA contributes to the prevention of new sleep complaints, independent of whether participants engage in nocturnal shift work. Promoting PA can be a promising strategy to prevent sleep problems, both in shift-workers and non-shift-workers.

1. Introduction

Disturbed sleep has been associated with a series of medical conditions, including chronic pain (Mork et al., 2014), obesity (Franquelo-Morales et al., 2016), and cardiovascular diseases (Aiello, Mookadam, & Mookadam, 2015), whereas regular physical activity (PA) is linked with a lower risk of lifestyle-associated diseases (Sattelmair et al., 2011).

During recent years, evidence has accumulated showing that regular PA has the potential to prevent sleep complaints, and to improve sleep among people with sleep disorders. In a meta-analytic study, Kredlow, Capozzoli, Hearon, Calkins, and Otto (2015) reviewed the effects of acute and regular exercise on sleep. Based on 66 studies, the authors concluded that acute exercise has beneficial effects on total sleep time, sleep onset latency, sleep efficiency, stage 1 sleep, slow wave sleep, and time awake after sleep onset. Additionally, regular exercise was associated with beneficial effects on a series of sleep parameters. Similar relationships between regular PA and higher sleep quality were reported in a meta-analysis focusing on younger populations, suggesting that the association was independent of whether PA and/or sleep were assessed via objective or subjective methods (Lang et al., 2016).

Meanwhile, the association between PA and sleep has been examined in several population-based studies (Dishman et al., 2015; Farnsworth, Kim, & Kang, 2015; Loprinzi & Cardinal, 2011). For example, in the National Health and Nutrition Examination

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Survey (NHANES) 2005–2006 (N = 3′081 adults from 18 to 85 years), regular PA was associated with a reduced likelihood of feeling overly sleepy during the day, even after controlling for age, BMI, health status, smoking status, and depression (Loprinzi & Cardinal, 2011). In a further study based on the NHANES 2005–2006 data, the findings revealed that the level of moderate-to-vigorous PA (MVPA) was associated with a decreased risk of self-reported sleep disorders (Farnsworth et al., 2015). Prospective evidence stems from the Aerobics Center Longitudinal Study, which consisted of a cohort of 7368 men and 1155 women, aged 20–85 years, who were followed between 1971 and 2006. The results of this study suggest that participants who maintained their cardiorespiratory fitness (an indirect measure of PA) were less likely to report sleep complaints to a physician at the 3-year follow-up (Dishman et al., 2015).

Taken together, these findings suggest that people who engage in at least some form of leisure time PA have a lower risk of reporting insufficient and/or disturbed sleep. Importantly, this relationship was observed across most of the existing (epidemiological) studies, despite major differences in the assessment methods. Prior research also highlighted that being physically inactive in combination with poor sleep puts individuals at increased risk of developing non-communicable diseases, and of premature death (Bellavia, Akerstedt, Bottai, Wolk, & Orsini, 2014).

Shift work, defined as a work schedule involving irregular or unusual hours, compared to the schedule of normal daytime work (Wang, Armstrong, Cairns, Key, & Travis, 2011), is common in today's society (Bohle, Quinlan, Kennedy, & Williamson, 2004). In Europe, for instance, it has been estimated that approximately 20% of the total working population is involved in some type of shift work (Parent-Thirion, Fernández Macías, Hurley, & Vermeylen et al., 2007), with the number of nocturnal shift workers being particularly high in some occupations, such as health care (Violanti et al., 2008). Nocturnal shift work has been associated with an increased risk of developing several chronic conditions including cancer, metabolic syndrome and cardiovascular diseases (Wang et al., 2011). Furthermore, nocturnal shift work has also been associated with a series of unhealthy sleep parameters. For instance, a study with female shift nurses showed that mean sleep duration was higher in nurses working during the day compared to those working at night (Grundy et al., 2009). Moreover, researchers have argued that the rearrangement of waking and sleep time required by nocturnal shift work can cause a disruption of the circadian rhythm, which in turn may lead to internal desynchronization and subsequent psychological and physiological disturbances (Violanti et al., 2008). Accordingly, nocturnal shift work has been associated with lower subjective sleep quality (Akerstedt, 2003). In nurses, for instance, the prevalence of shift work related sleep disorders ranged between 32 and 38% (Flo et al., 2012).

Despite the evidence that regular PA is related to improved sleep, few studies have examined the relationship between PA and sleep in combination with participants' shift work status. Given this background, the aim of this study was two-fold: (i) to study the prevalence of sleep complaints in a sample of Swedish health care workers with a high percentage of nocturnal shift workers, and (ii) to investigate the simultaneous impact of PA and nocturnal shift work on the development of sleep complaints prospectively over a two-year period.

2. Method

2.1. Study design and study population

Data from a prospective cohort study were used in the present paper. The main goal of this cohort study was to examine the impact of different psychosocial factors and stress perceptions on various health indicators in two human service organizations in the South-western part of Sweden (Västra Götaland Region). For the baseline assessment (in spring 2004), a random sample of 5300 out of 48600 health care workers and 700 out of 2200 workers at the social insurance offices were initially invited to complete a postal questionnaire. Participants were invited to complete the questionnaire again after two years (in 2006). Participants were eligible if they had a least one year of employment and were working at least 50%. After two reminders, 3717 employees participated in the baseline data assessment. For the purpose of the present study, only health care workers were considered, as social insurance officers did not engage in shift work. Furthermore, since this paper focuses on shift-work, only professional groups made up of more than 5% nocturnal shift workers were included. Accordingly, 1845 participants who took part in the baseline assessments were eligible for this study. Of these, 1485 participants (80.5%) took part in the 2-year follow-up. Additionally, 77 individuals were excluded because they had at least one missing value in the independent or dependent variables. Altogether, a total number of 439 participants (8.8%) dropped out of the study, or were excluded. The final sample (N = 1406) consisted of 753 nurses (53.6%), 403 nursing auxiliaries (28.7%), 175 physicians (12.4%), and 75 caregivers (5.3%). Analyses of variance and crosstabs revealed that participants who took part in the baseline assessment did not differ significantly with regard to any of the study variables compared to the follow-up sample ($p > 0.05$). Only participants who did not report a specific sleep complaint at baseline were considered in the prospective analyses. Therefore, the number of participants included in the prospective analyses varied depending on the nature of the sleep complaint (difficulties falling asleep: 1171 participants; repeated awakenings: 1191 participants; feeling of being exhausted upon waking: 1026 participants). A participant flow chart is presented in Fig. 1, while a description of the study population at baseline is presented in Table 1.

Detailed information about the purpose of the study and about the voluntary basis of the survey was given to all participants. Participants were assured of the confidentiality of their responses and provided written informed consent. The regional ethical review board in Gothenburg, Sweden approved the study, and the study was carried out according to the ethical principles of the 1964 Declaration of Helsinki.

2.2. Measures

2.2.1. Leisure-time physical activity

Saltin's and Grimby's widely used 4-level scale (Rödjer et al., 2012) was used to assess self-reported leisure time PA. This instrument classifies participants into groups of individuals who are mostly physically inactive (level 1; labelled physically inactive), who participate in light PA (LPA) for at least two hours a week (e.g. light gardening, walking or bicycling: level 2; labelled LPA), who report at least two hours per week of moderate PA (e.g. aerobics, dancing, swimming, playing soccer, heavy gardening: level 3), or who engage in at least five hours of vigorous activity several times per week (level 4). This scale discriminates between physically inactive and active individuals regarding their maximal oxygen uptake (Rödjer et al., 2012). Moreover, significant relationships were identified between high levels of PA and lower risks for morbidity and premature death (Byberg et al., 2009). In the present study, we merged participants at levels 3 and 4 to build a moderate-to-vigorous PA (MVPA) category. This was due to the fact that relatively few participants reported PA level 4 (n = 36, 2.6%).