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SHORT COMMUNICATION

Musculoskeletal pain and insomnia among workers with different occupations and working hours

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ABSTRACT

Several studies have shown a bidirectional relationship between insomnia and pain. The aim of this study was to evaluate whether working hours and type of occupation are associated with insomnia, pain and insomnia plus pain. Insomnia and musculoskeletal pain symptoms were measured in airline pilots, rural workers and factory workers using validated indexes. Rural and night work were predictors for the outcomes (insomnia and pain). However, musculoskeletal pain was found to be a predictor of insomnia but not vice versa. The current findings suggest that working hours and type of occupation play a role in the sleep–pain relationship.

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insomnia; pain; work; sleep; work hours

Introduction

Insomnia symptoms are the most common sleep complaint in many countries, affecting 10–25% of the general population. In the USA, insomnia affects about a third of the population (Ohayon, 2009). A study based on the National Health Interview Survey data estimated an increase in insomnia of around 8% over a 10-year period (2002–2012) (Ford et al., 2015). Participants with hypertension, chronic obstructive pulmonary disease, asthma and joint pain showed the greatest increase in prevalence (Ford et al., 2015). A recent study suggested that sleep disturbances can augment pain symptoms by changing the modulation of central pain and that treatment of insomnia could reduce pain (Smith et al., 2015).

Nevertheless, it is still unknown whether insomnia precedes pain or not. Ohayon (2009) examined whether pre-existing chronic pain was a predictor for the development of insomnia. The relative risk of developing insomnia was 1.8 among individuals with chronic pain. The authors also investigated the reverse effect, i.e. whether insomnia symptoms were predictors for the development of chronic pain. The results of the study showed that the presence of insomnia was not significantly associated with chronic pain over a 3-year follow-up. On the other hand, another study

found insomnia to be a risk factor for the development of pain in healthy individuals with no evidence of reverse causation (Agmon & Armon, 2014).

Insomnia was also identified as a relevant sleep disturbance among shift workers, having been associated with functional and cognitive impairments generally found among this group (Belcher et al., 2015). In addition, in a study of 418 workers (51 night workers, 158 rotating shiftworkers and 209 day workers), insomnia was one of the predictors for chronic pain in rotating shiftworkers (Vallières et al., 2014). Notwithstanding, there is a lack of studies investigating the reverse effect despite pain complaints being relatively common among shiftworkers. A few studies have noted that shift workers diagnosed with shift-work-related sleep disorder report musculoskeletal symptoms (Waage et al, 2009). Thus, pain may contribute to the insomnia observed in shift workers and/or vice versa. In this context, the aim of the present study was to evaluate the role of working hours and type of occupation in the sleep–pain relationship.

Methods

Population

This cross-sectional study included a sample of Brazilian workers with different occupations

Table 1. Crude and multiple Poisson regression for insomnia, musculoskeletal symptoms and insomnia/musculoskeletal symptoms.

Variables	n (%)	Insomnia		Musculoskeletal symptoms		Insomnia and musculoskeletal symptoms	
		PR (95% CI) Crude	PR (95% CI) Adj ¹	PR (95% CI) Crude	PR (95% CI) Adj ²	PR (95% CI) Crude	PR (95% CI) Adj ³
<i>Work data</i>							
<i>Shift</i>							
Day	378 (23.8)	1	1	1	1	1	1
Night (and irregular work hours)	1213 (76.2)	0.84 (0.77–0.92)	1.49 (1.03–2.16)	0.80 (0.75–0.85)	1.31 (1.02–1.69)	0.73 (0.66–0.81)	1.98 (1.29–3.03)
<i>Occupation</i>							
Factory workers	124 (7.8)	1	1	1	1	1	1
Rural workers	340 (21.4)	1.20 (1.01–1.42)	1.91 (1.32–2.79)	1.19 (1.06–1.33)	1.49 (1.17–1.91)	1.29 (1.06–1.57)	2.62 (1.70–4.03)
Airline pilots	1127 (70.8)	0.94 (0.80–1.11)	n.s.	0.91 (0.81–1.01)	n.s.	0.86 (0.71–1.05)	n.s.
<i>Health</i>							
<i>Musculoskeletal symptoms</i>							
No symptoms	441 (27.7)	1	1	–	–	–	–
1–2 musculoskeletal symptoms	627 (39.4)	1.45 (1.27–1.67)	1.40 (1.22–1.61)	–	–	–	–
3 or more musculoskeletal symptoms	524 (32.9)	1.93 (1.69–2.19)	1.76 (1.54–2.01)	–	–	–	–
<i>Insomnia</i>							
No	670 (42.7)	–	–	1	–	–	–
Yes	899 (57.3)	–	–	1.35 (1.26–1.45)	n.s.	–	–
<i>Organic diseases</i>							
No	1015 (63.8)	1	1	1	1	1	1
Yes	577 (36.2)	1.26 (1.15–1.36)	1.27 (1.03–1.23)	1.25 (1.18–1.33)	1.22 (1.15–1.29)	1.50 (1.35–1.66)	1.41 (1.27–1.57)
<i>Emotional disease</i>							
No	1516 (95.2)	1	1	1	1	1	1
Yes	76 (4.8)	1.40 (1.24–1.59)	1.18 (1.03–1.36)	1.25 (1.15–1.36)	1.14 (1.04–1.25)	1.56 (1.34–1.83)	1.35 (1.13–1.61)

Adj: Age, sex, educational level, lifestyle.

n.s.: non-significant.

¹Pearson goodness-of-fit = 1.00; ROC area = 69%.²Pearson goodness-of-fit = 1.00; ROC area = 68%.³Pearson goodness-of-fit = 1.00; ROC area = 66%.

($n = 1592$), who were individually interviewed. The sample comprised airline pilots ($n = 1127$), rural workers ($n = 340$) and factory workers ($n = 124$). All the airline pilots worked in an irregular schedule, including night work. The rural workers were rubber tappers who worked outdoors from 06:00 to 16:00 h, whereas factory workers were engaged in production line, quality and maintenance activities and worked indoors from 07:00 to 17:00 h or from 23:00 to 07:00 h at a factory located in northern Brazil (31.4% day-shift and 68.6% shiftworkers, including night work).

Variables

The study included three dependent variables: insomnia, musculoskeletal symptoms as well as insomnia and musculoskeletal symptoms.

Insomnia symptoms were measured using a validated index based on seven questions from the Karolinska Sleepiness Questionnaire (KSQ) (Nordin et al., 2013). The seven questions comprising the insomnia index were: “having been bothered by difficulties falling asleep,” “difficulties waking up,” “repeated awakenings with difficulties falling asleep again,” “not well-rested on awakening,” “premature awakenings,” “disturbed and restless sleep,” and “feelings of being exhausted at awakening.” The response alternatives were: “always/every day (5);” “mostly/several days per week (4);” “sometimes/several times per month (3);” “seldom/a few times per year (2);” “never (1).” The response alternatives were adapted of Nordin et al. (2013): “always/ 5 times or more per week (5);” “mostly/3–4 times per week (4);” “sometimes/several times per month (3);” “seldom/a few times per year (2);” “never (1).” The questions were dichotomized between response option 3 (sometimes/several times per month; seldom/a few times per year; never) and option 4 (always/ 5 times or more per week; mostly/3–4 times per week), then summed and dichotomized again between 0 (no symptoms) and 1 (one or more symptoms).

The Nordic Musculoskeletal Questionnaire (Kuorinka et al., 1987) was used to assess musculoskeletal pain symptoms in the past 12 months. Musculoskeletal symptoms were categorized into 0 (no symptoms), 1 (1–2 musculoskeletal symptoms) and 2 (3 or more musculoskeletal symptoms) or dichotomized between 0 (no symptoms) and 1 (with symptoms), according to the statistical analysis.

Self-reported background variables included age (mean \pm SD), sex, educational level (undergraduate or above versus high school versus illiterate) and lifestyle (healthy versus unhealthy). Lifestyle included smoking (no versus yes), alcohol (<2 times per week versus 2 times per week or more) and physical activity (yes versus no). Physical activity was based on one question about practicing (or not) exercise during leisure time. Individuals who smoked, drank two times per week or more and/or were sedentary were classified as unhealthy. Type of shift was divided into diurnal and nocturnal (day versus night).

Information on diagnosed diseases was collected using the work ability index validated for Portuguese (Tuomi et al., 2005): cardiovascular, respiratory, emotional, neurological, digestive, genitourinary, skin disease, tumors and metabolic disorders. The diseases were categorized into a single variable: organic diseases (no versus yes). Emotional disease (no versus yes) was included in the analyses as an independent variable and referred to depression, tension and anxiety (any of these three would imply “yes”).

Statistics

Insomnia, musculoskeletal symptoms as well as insomnia plus musculoskeletal symptoms were treated as three dependent variables. Poisson regression with robust variance analysis yielding prevalence ratios (PRs) was conducted. The predictor variables (shift, occupation, musculoskeletal symptoms for insomnia analysis, insomnia for musculoskeletal symptoms analysis, organic diseases, emotional disease) with a probability level of less than 20% were then entered in a forward stepwise multiple regression analysis with simultaneous adjustment (age, sex, educational level and lifestyle). All tests were considered statistically significant when $p < 0.05$. All data analysis was carried out using Stata, version 12.0 software.

The study was approved by Research Ethics Committees in accordance with the ethical standards laid down in the Declaration of Helsinki and its amendments.

Results

Factory workers were the youngest among the population of workers studied (mean 27.3 years

old (yo), SD 3 7.4 yo) followed by airline pilots (mean 39.1 yo, SD 9.7 yo), and rural workers the oldest (mean 42.0 yo, SD 14.1 yo). Most factory workers were female (54%) versus only 8.8% of rural workers, whereas 100% of airline pilots were male.

Almost 30% of the rural workers were illiterate, 86.3% of factory workers had studied to high school level and 82.2% of airline pilots had undergraduate level education or higher. Most factory workers and airplane pilots, and half of the rural workers, had a healthy lifestyle (83.9%, 78.9% and 50%, respectively).

Prevalence of insomnia was 57.3%, of musculoskeletal symptoms 72.3% and of both outcomes 46.7%. Multiple regression analyses revealed that rural work, night work, organic diseases and emotional diseases were predictors for insomnia, musculoskeletal symptoms and both insomnia/musculoskeletal symptoms (Table 1). In addition, musculoskeletal symptoms in the last 12 months were predictors for insomnia, where the greater the number of symptoms the higher the PR.

Discussion

The study findings revealed a high prevalence of the three outcomes investigated (insomnia, musculoskeletal symptoms, insomnia and musculoskeletal symptoms).

A noteworthy finding of the current study, however, was that the points of prevalence of insomnia and musculoskeletal symptoms were 2.62 higher among rural workers relative to factory workers. Separate examination of outcomes revealed that the airplane pilots did not have significant odds for developing these symptoms, whereas rural workers had high points of prevalence for both symptoms. On the other hand, night work was associated with insomnia and musculoskeletal symptoms. Given that the airplane pilot occupation involved the highest number of workers exposed to night shift (irregular schedule), greater odds of developing insomnia would be expected in this group compared to rural workers. The high demands for physical strength of rural work leading to musculoskeletal pain might affect sleep. Moreover, a few studies have shown that work-related exertion itself is

associated with poor sleep quality, suggesting that high physical demand at work might be related to sleep disturbances (Soltani et al., 2012). The job of an airplane pilot is associated with low physical demands, which could translate to less pain compared to rural workers. In summary, although night work has been associated with musculoskeletal pain, those with higher physical demands at work were more prone to having higher odds of pain in the present study. The presence of organic and emotional diseases may be additional factors for increased musculoskeletal pain. On the other hand, insomnia was not associated with musculoskeletal pain, which has been observed in other studies as in Ødegård et al. (2013), where it was found that headache predicts insomnia.

Notably, organic and emotional diseases were associated with insomnia, corroborating Ohayon (2009) who stated that concurrent diseases were associated with half of insomnia cases. Perhaps these diseases, akin to type of occupation, can alter the odds of developing insomnia. It is important to highlight, however, that this is a cross-sectional study, which does not allow concluding anything regarding the cause-effect relationship. This means it is not possible to draw a direction between pain and insomnia association. On the other hand, working hours and type of occupation appear to play a role in the sleep-pain relationship, which raises the need of having further studies in this field.

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Declaration of interest

The authors declare no conflict of interest.

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