Long-term deleterious effects of night work on sleep

Efeitos a longo prazo do trabalho noturno sobre o sono

Lúcia Rotenberg1, Aline Silva-Costa1, Thiago Bernardes Diniz2, Rosane Harter Griep1

ABSTRACT

Objective: To investigate whether poor sleep quality is related to night work, either currently or in the past. Methods: A cross-sectional study was performed with female nursing workers. Sleep problems were evaluated through questions on difficulty in falling asleep and in maintaining sleep, early morning awakening, insomnia complaint, and unsatisfactory sleep. Experience on night work (past and current experience), night work ‘dose’ in the past (three to nine years, more than nine years), and time left after leaving night work (up to five years, more than five years) were analyzed. Those with no experience on night work were considered as the Reference Group. The association between each independent variable and sleep problems was tested through the binomial logistic regression. Results: Former night workers had a greater chance of reporting difficulty in maintaining sleep (OR=1.72), and a general complaint of insomnia (OR=1.60). Workers who had spent ten years or more on night work had twice more chances to report early morning awakening, difficulty in maintaining sleep, and a general complaint of insomnia. Workers who had left night work for up to five years were at a greater chance of reporting difficulty in maintaining sleep, general complaint of insomnia and nonsatisfactory sleep (OR=1.87, 1.65 and 1.70, respectively). Reporting difficulty in maintaining sleep was also more frequent among those who left night work more than five years before data collection (OR=1.72). Conclusions: Evidence on long-term effects of night work on sleep contributes to the scientific debate on the impact of night work on health and well-being.

Keywords: sleep; occupational health; work schedule tolerance; workload; insomnia.

RESUMO

Objetivo: Investigar se a baixa qualidade de sono está relacionada ao trabalho noturno atual ou no passado. Métodos: Um estudo seccional foi conduzido com profissionais de Enfermagem. Os distúrbios de sono foram avaliados por meio de questões relacionadas à dificuldade de pegar no sono e em mantê-lo, ao despertar precoce pela manhã, a queixa genérica de insônia e ao sono insatisfatório. Foram analisadas: a experiência em trabalho noturno (atual ou pregressa), o tempo de trabalho noturno no passado (três a nove anos; mais de nove anos) e o tempo desde a saída do trabalho noturno (até cinco anos; mais de cinco anos). Aqueles que nunca trabalharam à noite foram considerados como o grupo de referência. A associação entre cada variável independente e problemas de sono foi testada pela regressão logística binomial. Resultados: Os ex-trabalhadores noturnos apresentaram maior chance de reportar dificuldade na manutenção do sono (OR=1,72) e de se queixar de insônia (OR=1,60). Trabalhadores que passaram dez anos ou mais no trabalho noturno tiveram cerca de duas vezes mais chances de mencionar despertar precoce pela manhã, dificuldade na manutenção do sono e queixas genéricas de insônia. Trabalhadores que deixaram os plantões noturnos há até cinco anos apresentaram maiores chances de reportar dificuldade em manterem o sono, queixas genéricas de insônia e sono insatisfatório (OR=1,87, 1,63 e 1,70, respectivamente). Relatos de dificuldade para manter o sono também foram mais frequentes entre aqueles que deixaram o trabalho noturno há mais de cinco anos antes da coleta de dados (OR=1,72). Conclusões: Evidências dos efeitos a longo prazo do trabalho noturno sobre o sono contribuem para o debate científico sobre o impacto do trabalho noturno à saúde e ao bem-estar.

Palavras-chave: sono; saúde do trabalhador; tolerância ao trabalho em turnos; insônia.

INTRODUCTION

Sleep deprivation, resulting from night work, significantly affects the physical and mental welfare of those active at this time1. Generally, the sleep of night workers has a lower duration and quality in comparison with day workers, since day
sleep is less restful and restoring\textsuperscript{23}. By working regularly at night, workers frequently accumulate a significant deficit of sleep time, increasing somnolence and contributing in the long-term to exhaustion\textsuperscript{6}.

A debate in the relevant literature refers to possible long-term effects of night work on sleep, which would be reported after quitting night work. For some authors, there is no evidence that early experience with shift work results in later sleep difficulties\textsuperscript{9}, including Niedhammer, Left and Marne\textsuperscript{8}, who performed longitudinal studies on nurses. Nevertheless, other authors refute this position, showing that transfer to day work does not guarantee a reduction in sleep-related disturbances\textsuperscript{9-10}. In a study on oil workers, Bourdouxhe et al.\textsuperscript{11} stated that the most evident consequences of work schedules were observed in former night workers. Similarly, Dumont, Montpaisir and Infant-Rivard\textsuperscript{10} suggest that night work can have persistent harmful effects on the quality of sleep among nurses, when the experience is long and night shifts are very frequent. Recent findings of longitudinal studies suggested long-term shift work effects on sleep that may persist for a long time after quitting shift work, although they seem not to be permanent\textsuperscript{12}. Similarly, results on a large database did not reveal improved sleep among workers who had left shift work five years before, thus suggesting a process of long-lasting effects\textsuperscript{13}.

Considering the scarcity of data on this relevant topic, the present study contributes to this debate by focusing on nursing workers (registered nurses, nursing aides/assistants). These are occupations often related to hospitals, which operate for 24 uninterrupted hours. The current shift work policy in Brazil (12 hours of work with one or two days off), associated with the double professional status, usual for this group, contribute to diversify the levels of exposition to night work. The varying amounts of night shift experience allow comparisons to be performed, so that this group is particularly considered suitable for analyzing night work issues\textsuperscript{14}.

In this study, the prevalence of sleep-related complaints was investigated among nursing workers seeking to analyze to what extent reporting poor sleep quality is related to night work, either currently or in the past. Furthermore, sleep-related complaints among former night workers will be investigated to further clarify aspects related to how long the exposure to night work was and how recent was the exit from night work.

METHODS

Study design, context and data collection

A cross-sectional study was conducted at three public hospital units in Rio de Janeiro, Brazil. Data collection took place from June 2005 to March 2006. All nursing teams engaged in assistance to patients at hospitals (nurses, nursing aides/assistants) were invited to participate. Only female workers were studied, due to gender differences in sleep complaints\textsuperscript{15}. The procedures used for contacting workers were in compliance with ethical aspects to conduct research with human subjects. The project was approved by the Ethics Committee of the Oswaldo Cruz Foundation, and by the Ethics Committee of each studied hospital; it was also approved by the Brazilian National Committee of Ethics, under the number CONEP-10228.

The questionnaire for data collection considered the complexity involved in defining work hours for those people, due to the high rate of workers engaged in two jobs in Brazilian hospitals, and the permission for informal changes in work schedules among workers themselves in the studied hospitals\textsuperscript{14}. The questionnaire was divided into two parts, the first of which (mostly dealing with work hours) was filled by trained interviewers, and the second one was self-filled by the workers. Interviewers were instructed to assess the actually worked hours, regardless of the official schedules. The question on the number of working nights was based on a recordatory of nights that were really worked. Besides exposure and dependent variables, the following items were considered for the present study: sociodemographic data – age, marital status, children, education degree, monthly family income, body mass index (BMI) –; work variables – professional category, working hours, and number of working nights –; lifestyle and health-related behaviors – smoking, physical activity, and hypertension.

After revision and codification of questions, data from the instrument were typed through double digitations, a procedure that allows the identification of errors by confronting data typed by two distinct professionals. The Epi Info software, version 6.0, was used to make the data bank for further analysis.

Definition of variables and comparison groups

The total sample was divided into four groups so as to allow comparisons as to the experience on night work (Variable 1). Besides, ex-night workers were categorized as regards: how long the exposure to night work was (Variable 2) and how recent was the exit from night work (Variable 3).

Variable 1 – Experience on night work

The following sequence was adopted to define four comparison groups\textsuperscript{14}:

- Classification of workers into current night- or day workers: The first question with respect to this issue was “Do you regularly work (at least once a week/four times a month) night shifts in nursing assistance somewhere?”. The interviewers were instructed to ask
the question focusing on the definition of “regularly” as “at least once a week”. For those who considered their weeks very differently from one another, the interviewers should ask “at least four nights per month”. The format of this question was based on the high variability previously observed in the number of working nights for a given worker, so that they may have difficulty in defining their usual number of working nights. Participants who answered “Yes” were considered “current night workers”, a classification which is similar to the one adopted by Marquie and Foret. The ones who answered “No” were classified as “day workers”.

• Classification of current night workers, according to the number of working nights: Current night workers were invited to recall “What nights did you work over the last two weeks?”. Then, they were asked “Do these work nights in the previous question correspond to your usual amount of work nights?” Those who answered “No” were excluded from the analysis, the ones who answered “Yes” were classified into two groups: who usually work up to five nights per two-week span and those who usually work six or more nights per two-week span, considering the total number of working nights in all jobs.

• Classification of day workers, according to their previous experience in night work: Day workers were asked “Have you ever worked at night?”. The possible answers were: yes, regularly, once a week; yes, regularly, two to three times a week; yes, regularly, four or more times a week; yes, rarely; yes, occasionally; and no. Those who answered the first, second or third answers were classified as “former night workers”, whereas those answering the fourth, fifth or sixth were classified as “day workers, with no experience in night work”.

**Variable 2 - How long the exposure to night work was**
Former night workers were asked “How long have you been working at night in nursing, here or elsewhere?”. They were divided into those who had worked at night for three to nine years, and those who had worked at night for ten or more years. Workers who had worked at night for up to two years were excluded from this analysis, as they were supposed to be intolerant to night work, i.e., normally those who leave night and shift works do it within the two first years.

**Variable 3 – How recent was the exit from night work**
Former night workers were asked “How long ago have you stopped working nights?”. The workers were classified into those who had left night work up to five years before data collection, and those who had left night work six or more years before data collection, based on analysis described by Tucker et al.

The studied sample consisted on 1,221 female workers, of whom 281 had never worked at night, 399 were former night workers, 289 worked up to five nights per two-week span, and 252 worked six or more nights per two-week span. Among former night workers, 149 had worked nights for three to nine years, 99 had worked nights for ten years or more, whereas 151 had worked at night for up to two years, and thus they were excluded from this analysis. A total of 147 workers had left night work up to five years before data collection, 250 had left it six or more years before data collection; missing data on this variable corresponded to two workers.

**Perceived sleep problems**
Sleep problems were evaluated through five variables: (1) difficulty in falling asleep, (2) difficulty in maintaining sleep, (3) early morning awakening, (4) insomnia complaint, and (5) unsatisfactory sleep. Questions 1 to 3 were related to a four-week interval, with the following response alternatives: never, rarely, sometimes, almost always, and always. Workers who answered ‘almost always’ or ‘always’ to any of those questions were classified in the respective sleep-problem group. The variable ‘insomnia complaint’ referred to workers who had any of the previously described sleep problems. Questions 1 to 4 are derived from population studies about insomnia. Nonsatisfactory sleep was analyzed through the question “How satisfied are you with your sleep?”, derived from the Brazilian version of the WHOQOL-brief. The response alternatives were: very unsatisfied, unsatisfied, neither satisfied nor unsatisfied, satisfied, and very satisfied. Workers were classified in the nonsatisfactory sleep group if they reported to be ‘unsatisfied’ or ‘very unsatisfied’ with their sleep.

**Data analysis**
In the analyzes, three independent variables were considered: experience at night work (former and current night workers, compared to those who had never worked nights); exposure to night work in the past (past night work for three to nine years, and past night work ≥10 years were compared to those who had never worked at night); and how recent the exit was from night work (up to five years after leaving night work, and ≥6 years after leaving night work were compared to those who had never worked nights). Age was considered as a confounder in all analyses, which were performed in two steps. Firstly, other potential confounders (related to socio-demographics, work variables and lifestyle factors, defined according to literature on sleep and shift work) were screened by bi-variant Chi-square tests. Those with at least a minimum association (p<0.20) were selected for inclusion in the models. The following variables were tested as confounders.
for analysis: age, education degree, family income, marital status, children at home, professional category, hypertension, BMI, and smoking habits. Secondly, logistic regression analysis was performed to test the association between each independent variable and sleep problems with results presented as Odds Ratios and 95% confidence intervals. Descriptive analyzes of sociodemography as well as variables related to work and lifestyle were based on chi-square tests (significance at 0.05). Statistical analyzes were performed using the SPSS software, version 18.0.

RESULTS
Compared to the group that has never worked at night, former night workers were older and showed a larger proportion of workers that have two or more jobs in nursing, besides showing a larger proportion of smokers, hypertensive, and overweight or obese workers. If compared to those who had never worked at night, night workers (in both groups) showed a higher percentage of workers with two or more jobs (Table 1).

Considering the group of former night workers, those who had worked at night for three to nine years and for ten or more years were older (46.9 years and 52.3 years old, respectively) than those who had never worked nights (37.0 years-old; p<0.001). Workers who had left the night work six or more years before data collection were older (50.5 years-old; p<0.001) and they showed higher proportion of smokers (47.9%; p<0.00), hypertensive (51.4%; p<0.001) and overweight/obese (42.7%; p=0.012), compared to the ones that had never worked nights (37.0 years-old, 31.3, 29.8, and 34.9% for age, smokers, hypertensive and overweight/obese, respectively).

Former night workers had a greater chance of reporting difficulty in maintaining sleep (OR=1.72) and a general complaint of insomnia (OR=1.60), regardless of potential confounders. No significant association was observed in relation to difficulty in falling asleep, early waking and non-satisfactory sleep. The only significant association concerning current night workers was found for working six or more nights per two-week span and reporting non-satisfactory sleep (OR=2.22), as it can be seen in Table 2.

Workers who had spent ten years or more on night work had 2.01 times more chances of reporting early morning awakening, and 2.00 times more chances of showing a general complaint of insomnia in comparison with the group that had never worked at night. Moreover, they had 2.32 times a greater chance of reporting difficulty in maintaining sleep, whereas the corresponding odds for those who had worked at night for three to nine years was 1.84 (Table 3).

People who had left night work for up to five years before data collection were at a greater chance of reporting difficulty, general complaint of insomnia and non-satisfactory sleep (OR=1.87, 1.65 and 1.70, respectively). Reporting difficulty in maintaining sleep was also

<table>
<thead>
<tr>
<th>Variable</th>
<th>Day workers with no experience on night work (n=281)</th>
<th>Former night workers up to 5 nights per 2-week span (n=289)</th>
<th>Night workers 6 or more nights per 2-week span (n=252)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (mean, sd)</td>
<td>37.0;13.6</td>
<td>46.3;10.9</td>
<td>43.2;11.1</td>
<td>&lt;0.001</td>
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<tr>
<td>Marital status (%)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married / live with a partner</td>
<td>22.8</td>
<td>34.7</td>
<td>26.4</td>
<td>16.0</td>
</tr>
<tr>
<td>Divorced / separated / widowed</td>
<td>23.1</td>
<td>31.1</td>
<td>21.4</td>
<td>24.3</td>
</tr>
<tr>
<td>Overweight/ obese (%)</td>
<td>19.2</td>
<td>36.0</td>
<td>28.2</td>
<td>16.6</td>
</tr>
<tr>
<td>Smoking habits (%)</td>
<td>18.4</td>
<td>40.7</td>
<td>27.3</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Hypertension (%)</td>
<td>19.1</td>
<td>45.4</td>
<td>25.3</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Physical activity (%)</td>
<td>22.5</td>
<td>36.2</td>
<td>22.8</td>
<td>18.5</td>
</tr>
<tr>
<td>Education degree (%)</td>
<td></td>
<td></td>
<td></td>
<td>0.353</td>
</tr>
<tr>
<td>Non-college degree</td>
<td>28.8</td>
<td>34.8</td>
<td>26.2</td>
<td>10.1</td>
</tr>
<tr>
<td>College degree</td>
<td>18.4</td>
<td>31.1</td>
<td>21.6</td>
<td>28.9</td>
</tr>
<tr>
<td>Family income (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥391 (USD)</td>
<td>23.6</td>
<td>32.6</td>
<td>24.9</td>
<td>18.9</td>
</tr>
<tr>
<td>900 reais ou mais</td>
<td>22.5</td>
<td>32.6</td>
<td>21.1</td>
<td>23.8</td>
</tr>
<tr>
<td>Engaged in 2 or more jobs (%)</td>
<td>8.9</td>
<td>20.3</td>
<td>33.6</td>
<td>37.1</td>
</tr>
<tr>
<td>Weekly professional work hours (mean, sd)</td>
<td>40.5;12.1</td>
<td>37.4;13.3</td>
<td>53.4;18.8</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Weekly domestic work hours (mean, sd)</td>
<td>15.6;13.9</td>
<td>17.7;13.6</td>
<td>19.1;17.7</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

sd: standard deviation.
Table 2. Results of logistic regression analysis concerning the association between the experience on night work and perceived sleep problems among nursing workers (n=1,221).

<table>
<thead>
<tr>
<th>Perceived sleep problem</th>
<th>Crude OR (CI 95%)</th>
<th>Adjusted OR (CI 95%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficulty in falling sleep¹</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day workers with no experience on night work</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Former night workers</td>
<td>1.58 (1.02-2.43)</td>
<td>1.50 (0.95-2.36)</td>
</tr>
<tr>
<td>Night workers - up to 5 nights/2 week-span</td>
<td>1.06 (0.65-1.72)</td>
<td>0.98 (0.59-1.61)</td>
</tr>
<tr>
<td>Night workers - 6 or more nights/2 week-span</td>
<td>1.19 (0.73-1.93)</td>
<td>1.27 (0.77-2.10)</td>
</tr>
<tr>
<td>Difficulty in maintaining sleep²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day workers with no experience on night work</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Former night workers</td>
<td>1.99 (1.28-3.09)</td>
<td>1.72 (1.09-2.71)</td>
</tr>
<tr>
<td>Night workers - up to 5 nights/2 week-span</td>
<td>1.60 (0.99-2.59)</td>
<td>1.47 (0.90-2.40)</td>
</tr>
<tr>
<td>Night workers - 6 or more nights/2 week-span</td>
<td>1.08 (0.64-1.82)</td>
<td>1.20 (0.70-2.05)</td>
</tr>
<tr>
<td>Early morning awakening²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day workers with no experience on night work</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Former night workers</td>
<td>1.76 (1.11-2.79)</td>
<td>1.61 (0.99-2.59)</td>
</tr>
<tr>
<td>Night workers - up to 5 nights/2 week-span</td>
<td>1.32 (0.80-2.20)</td>
<td>1.26 (0.75-2.12)</td>
</tr>
<tr>
<td>Night workers - 6 or more nights/2 week-span</td>
<td>1.38 (0.82-2.30)</td>
<td>1.53 (0.90-2.59)</td>
</tr>
<tr>
<td>General complaint on insomnia¹</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day workers with no experience on night work</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Former night workers</td>
<td>1.68 (1.16-2.43)</td>
<td>1.60 (1.09-2.71)</td>
</tr>
<tr>
<td>Night workers - up to 5 nights/2 week-span</td>
<td>1.26 (0.84-1.88)</td>
<td>1.19 (0.79-1.80)</td>
</tr>
<tr>
<td>Night workers - 6 or more nights/2 week-span</td>
<td>1.05 (0.69-1.60)</td>
<td>1.11 (0.72-1.71)</td>
</tr>
<tr>
<td>Nonsatisfactory sleep³</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day workers with no experience on night work</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Former night workers</td>
<td>1.16 (0.82-1.65)</td>
<td>1.45 (0.99-2.11)</td>
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<td>Night workers - up to 5 nights/2 week-span</td>
<td>1.02 (0.70-1.49)</td>
<td>1.18 (0.79-1.76)</td>
</tr>
<tr>
<td>Night workers - 6 or more nights/2 week-span</td>
<td>3.02 (2.09-4.38)</td>
<td>2.22 (1.50-3.27)</td>
</tr>
</tbody>
</table>

Analyses were adjusted for 'age and income, 'age and marital status, 'age, income, and education degree.

Table 3. Results of logistic regression analysis for the association between previous dose of night work and perceived sleep problems among nursing workers (n=529).

<table>
<thead>
<tr>
<th>Perceived sleep problem</th>
<th>Crude OR (CI 95%)</th>
<th>Adjusted OR (CI 95%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficulty in falling sleep¹</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No experience on night work</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>3-9 years of experience on night work</td>
<td>1.58 (0.93-2.70)</td>
<td>1.45 (0.82-2.56)</td>
</tr>
<tr>
<td>10 or more years of past experience on night work</td>
<td>1.97 (1.10-3.53)</td>
<td>1.68 (0.87-3.24)</td>
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<tr>
<td>Difficulty in maintaining sleep²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No experience on night work</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>3-9 years of experience on night work</td>
<td>1.95 (1.33-3.71)</td>
<td>1.84 (1.03-3.30)</td>
</tr>
<tr>
<td>10 or more years of past experience on night work</td>
<td>2.60 (1.45-4.68)</td>
<td>2.32 (1.19-4.51)</td>
</tr>
<tr>
<td>Early morning awakening²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No experience on night work</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>3-9 years of experience on night work</td>
<td>1.79 (1.03-3.11)</td>
<td>1.60 (0.89-2.89)</td>
</tr>
<tr>
<td>10 or more years of past experience on night work</td>
<td>2.46 (1.36-4.450)</td>
<td>2.01 (1.03-3.91)</td>
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<td>General complaint on insomnia¹</td>
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<td></td>
</tr>
<tr>
<td>No experience on night work</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>3-9 years of experience on night work</td>
<td>1.66 (1.05-2.62)</td>
<td>1.60 (0.98-2.61)</td>
</tr>
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<td>10 or more years of past experience on night work</td>
<td>2.18 (1.31-3.61)</td>
<td>2.00 (1.13-3.55)</td>
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<tr>
<td>Nonsatisfactory sleep³</td>
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<td></td>
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<tr>
<td>No experience on night work</td>
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<td>1.00</td>
</tr>
<tr>
<td>3-9 years of experience on night work</td>
<td>1.26 (0.82-1.96)</td>
<td>1.28 (0.78-2.09)</td>
</tr>
<tr>
<td>10 or more years of past experience on night work</td>
<td>1.09 (0.65-1.81)</td>
<td>1.14 (0.62-2.07)</td>
</tr>
</tbody>
</table>

Analyses were adjusted for 'age, hypertension, BMI and smoking habits, 'age, hypertension and BMI, 'age, education degree, hypertension, BMI and smoking habits.
Long-term deleterious effects of night work on sleep

Table 4. Results of logistic regression analysis for the association between time left after leaving night work and perceived sleep problems among nursing workers (n=678).

<table>
<thead>
<tr>
<th>Perceived sleep problem</th>
<th>Crude OR (CI 95%)</th>
<th>Adjusted OR (CI 95%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficulty in falling sleep&lt;sup&gt;1,2&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No experience on night work</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Up to 5 years after leaving night work</td>
<td>1.36 (0.82-2.25)</td>
<td>1.25 (0.75-2.08)</td>
</tr>
<tr>
<td>6 or more years after leaving night work</td>
<td>1.89 (1.16-3.08)</td>
<td>1.59 (0.92-2.74)</td>
</tr>
<tr>
<td>Difficulty in maintaining sleep</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No experience on night work</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Up to 5 years after leaving night work</td>
<td>1.77 (1.06-2.96)</td>
<td>1.87 (1.08-3.25)</td>
</tr>
<tr>
<td>6 or more years after leaving night work</td>
<td>2.04 (1.22-3.39)</td>
<td>1.72 (1.01-2.92)</td>
</tr>
<tr>
<td>Early morning awakening&lt;sup&gt;1&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No experience on night work</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Up to 5 years after leaving night work</td>
<td>1.39 (0.81-2.36)</td>
<td>1.30 (0.76-2.23)</td>
</tr>
<tr>
<td>6 or more years after leaving night work</td>
<td>1.85 (1.10-3.09)</td>
<td>1.52 (0.85-2.71)</td>
</tr>
<tr>
<td>General complaint on insomnia&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No experience on night work</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Up to 5 years after leaving night work</td>
<td>1.52 (1.00-2.32)</td>
<td>1.63 (1.03-2.59)</td>
</tr>
<tr>
<td>6 or more years after leaving night work</td>
<td>1.78 (1.17-2.73)</td>
<td>1.47 (0.94-2.29)</td>
</tr>
<tr>
<td>Nonsatisfactory sleep&lt;sup&gt;1,2,3&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No experience on night work</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Up to 5 years after leaving night work</td>
<td>1.46 (0.98-2.17)</td>
<td>1.70 (1.09-2.63)</td>
</tr>
<tr>
<td>6 or more years after leaving night work</td>
<td>0.93 (0.61-1.42)</td>
<td>1.14 (0.70-1.87)</td>
</tr>
</tbody>
</table>

Analyzes were adjusted for age, hypertension and BMI; additional adjustments were: ‘1 professional category; ’2 smoking habits, ’3 education degree.

more frequent among those who left night work more than five years ago (OR = 1.72), as seen in Table 4.

DISCUSSION

Higher prevalence of some sleep problems among former night workers confirms that sleep-related difficulties do not dissipate soon after quitting night work. In the context here analyzed, special emphasis should be given to difficulty in maintaining sleep, which was more likely to be reported by former night workers regardless of the time devoted to night work in the past, and of how recently they had left night work.

In the present investigation, a variation in the Odds Ratio was observed in all, but one sleep variable (nonsatisfactory sleep), in such a way that the largest Odds corresponded to workers who had been exposed to night work for ten or more years. Therefore, despite significance of associations, the Odds Ratio for those who had worked at night for ten years or more was numerically higher than the one for those who worked for three to nine years, suggesting a dose-dependent relationship between the exposure to night work and sleep problems. Those results are not in accordance with the ones found by Ingre and Akerstedt<sup>21</sup>, who observed no dose-dependent effect of night work in their study on monozygotic twins discordant on shift work. It is possible that difference in results may have derived from procedures of data analysis, as we excluded those who had worked at night for up to two years. This group is likely to include workers known as “intolerant” to night and shift work, who usually quit night work in the first two years. Workers with more years of experience at night work are generally the ones with the best tolerance to work schedule<sup>22</sup>. In the first years of experiencing night work, it tends to be a natural selection amongst workers, in which those more sensitive to problems originated by this scheme of work, such as sleep problems, go back to day work<sup>7,23</sup>

As in the present study, where workers with ten or more years of exposition to night work had more complaints (compared to those who have only worked daytime), other studies have also shown former shift workers to report more problems, as compared to their counterparts with no experience at night work<sup>17</sup> as concerns premature awakening<sup>12</sup> or repeated awakenings<sup>7</sup>. Being exposed to night work is associated with the risk increase of developing chronic sleep problems and other related to health<sup>21</sup>. An accumulation process has been suggested to explain results related to former shift workers either retired<sup>21</sup> or not<sup>13</sup>

On the other hand, the present data do not support results by Niedhammer, Left and Marne<sup>8</sup>, according to which sleep disorders decreased strongly after transference to day work in nurses investigated longitudinally. Data found in the present study also disagree with interpretations found by Rouch et al.<sup>21</sup>, in whom deleterious effects of night work may be reversed after four years away from this work scheme. Some characteristics of the studied group, as the extended work period and the dual employment status, may explain, at least in part, dif-
ferences observed between the studies. The age (higher among the former night workers) does not seem to explain the results, once it was included as an adjust variable in all analyzes.

Time since workers left night work was shown to be a relevant factor as concerns sleep-related difficulties, as problems here analyzed were restricted to those who had left night work for up to five years, except for difficulty in maintaining sleep, as previously mentioned. For each sleep-related variable, the Odds corresponding to up to five years after quitting night work were higher than the ones for those who had left night work for six or more years. Those results are in accordance with the ones described by Tucker et al.12, who observed more sleep problems among workers who had most recently given up shift work (less than five years before baseline), compared to those who had given it up more than five years before baseline. Our data seem to corroborate the hypothesis of the deleterious effects of night work along time, especially with regard to sleep problems2. However, according to Cho et al.24, exposition to night work may result in loss of health, but whether consequences are temporary or permanent is not known (as this study shows), since there are complaints of inability to maintain the sleep for six or more years after stopping night work.

Generally, current night workers were not at a higher risk of reporting sleep difficulties, compared to those who had never worked at night, except for the association between working for six or more nights per two-week span and reporting nonsatisfactory sleep. Vidacek et al.25 found a small but significant reduction in total sleep time after a few years of shift work. This disturbance of sleep, even if partial, would be higher among those who worked more nights and could influence the dissatisfaction with sleep, in general26-28.

As regards to current night workers, who did not differ from day workers in four out of five sleep variables, the present results confirm previous data on nursing workers, according to which day and night workers did not differ as to sleep difficulties29. Similarity between night and day workers remits to the discussion proposed by Akerstedt et al.30, as regards a representative sample of the Swedish population. Their results on questionnaire data suggest that “shift work does not appear to be a major source of sleep disturbances and that their complaint levels bear no resemblance to those seen in insomniac patients” (page 333). These authors discuss their data in terms of the perception of shift workers about their sleep, as they may not consider “their sleep to be disturbed”, and that sleep disturbances may partly “be overlooked and or considered part of the job”29. Certainly, the whole understanding of this specific issue would benefit from qualitative techniques, such as those based on individual interviews with workers, seeking to interpret their perceptions about sleep, as the ones performed by Silva-Costa et al.31.

The results identified in the present study should be viewed with caution due to limitations inherent to cross-sectional studies, which identify exposition and outcome at the same time. The results presented here should be better discussed in longitudinal studies on two important queries: complaints related to sleep before exposition to night work and persistence of complaints after stopping night work. Another aspect to be considered is related to data collection, once the questionnaire includes only questions related to insomnia complaints and unsatisfactory sleep, but not related to other sleep disorders.

In sum, data here presented offer evidence of long-term effects of night work on sleep. Former night workers presented higher chances of referring difficulty in maintaining sleep and general complaints of insomnia. Former night workers with three or more years of experience with shifts showed higher chances of reporting difficulty in maintaining sleep. Also, former night workers with ten years or more showed higher chances of referring to early awakening and general complaints of insomnia. The workers who had left night work – at most, five years before – showed higher chances of referring sleep complaints (difficulty in maintaining sleep, complaints of insomnia, and dissatisfaction with sleep). A higher chance of referring difficulty in maintaining sleep was also found among those who had left night work six or more years before.

These results contribute to the scientific debate on long-term consequences of night work on sleep, taking into account the particular characteristics of work schemes adopted in Brazilian hospitals. They can subsidize discussions concerning legislation related to the temporal features of work as, for instance, the limitation of night work or other benefits, considering the impact of this type of work organization on health and well-being.

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REFERENCES
Long-term deleterious effects of night work on sleep


