

## Prevalence and consequences of sleep disorders in a shift worker population

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### Abstract

**Introduction:** Irregular work schedules often results in a disruption of the normal circadian rhythm that can cause sleepiness when wakefulness is required and insomnia during the main sleep episode. **Method:** Two physicians using the Sleep-EVAL system interviewed 817 staff members of a psychiatric hospital. The interviews were done during the working hours. In addition to a series of questions to evaluate sleep and mental disorders, the evaluation included a standard questionnaire assessing work conditions, work schedule and their consequences. Three work schedules were assessed: (1) fixed daytime schedule ( $n=442$ ), (2) rotating daytime shifts ( $n=323$ ) and (3) shift or nighttime work ( $n=52$ ). **Results:** Subjects working on rotating daytime shifts were younger than the two other groups and had a higher proportion of women. Participants working on rotating daytime shifts reported more frequently than the fixed daytime schedule workers to have difficulty initiating sleep (20.1% vs.

12.0%). The sleep duration of shift or nighttime workers was shorter than that of the two other groups. Furthermore, subjects working rotating daytime schedule reported to have shorter sleep duration of about 20 min when they are assigned to the morning shift. Work-related accidents were two times more frequent among the rotating daytime workers (19.5%) compared with the fixed daytime schedule workers (8.8%) and the group of nighttime or shift workers (9.6%). Sick leaves in the previous 12 months were also more frequently reported in the rotating daytime schedule group (62.8%) as compared with the daytime group (38.5%,  $P<.001$ ); 51.9% of nighttime or shift workers took sick leave. **Conclusions:** Working on a rotating daytime shifts causes significant sleep disturbances. As consequences, these workers are more likely to feel sleepy at work and are more likely to have work-related accidents and sick leaves. © 2002 Elsevier Science Inc. All rights reserved.

**Keywords:** Epidemiology; Daytime sleepiness; DSM-IV diagnoses; Insomnia; Work conditions

### Introduction

A well-known risk factor for insomnia and excessive daytime sleepiness complaints are working conditions, especially shift work. The rate of sleep complaints in this specific population is higher than rates found in the general population. These problems are mainly due to a disruption of the normal sleep/wake rhythm, of the normal circadian REM sleep rhythm and of the rhythm of REM/non-REM sleep patterns. Thus, the sleep problems of shift workers are partly a circadian one. Several studies have reported that the total sleep duration is related to the body temperature rhythm at

bedtime [1–3]. Studies using a sleep diary of workers as well as laboratory studies have shown that the main sleep period at an unusual time is 1–4 h shorter than night sleep [4,5]. However, other factors are also involved in the deterioration of sleep quality: fatigue, stress, daylight, health and age.

Whether these disorders are causing more sick leaves in shift workers is unclear: Previous studies have reported contradictory results in this respect. Some found a lower absence rate in shift workers than in day workers [6,7], while others found higher rates of sick leave and a higher number of visits to work site clinics in shift workers [8].

These contradictory results have led some researchers [9,10] to hypothesize that there may be a natural selection process among shift workers: Those having difficulties adapting to shift work usually transfer to day work. The rare studies that have tested this hypothesis tend to confirm it. The results of the Lavie et al.'s study [9] indicated that the

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occurrence of sleep disturbances appeared to be a good marker of the adjustment level to shift work.

One of the main consequences of having the main sleep period at an unusual time is an excessive sleepiness during wakefulness. This phenomenon is often evoked when attempting to explain human catastrophes occurring at night such as the Chernobyl nuclear accident, airplane crashes and road accidents. Furthermore, decreased vigilance may cause the individual to be more vulnerable to work-related accidents.

We investigated the effects on sleep of three different work schedules among the staff of a psychiatric hospital: fixed daytime schedule, rotating daytime schedule and shift or night working.

## Methods

### Participants

All staff members of the Vinatier Hospital, a large psychiatric institution located in Bron (France), were invited to participate in the study. There were 2007 staff members at the hospital. Overall, 817 employees volunteered to participate in the study. The distribution of the sample was quite similar to that of the entire staff of the hospital. Administrative staff members were overrepresented in the final sample (Table 1). Medical staff composed the majority of the sample. Employees were interviewed at the staff medical clinic of the hospital or at the ward during work hours. Two physicians performed the face-to-face interviews.

For the medical staff, the work schedule was mainly divided into two shifts:

- Morning shift: 6:30 a.m. to 2:30 p.m.
- Afternoon shift: 1:30 p.m. to 21:30 p.m.

About 25% of the maintenance staff worked on rotating morning and afternoon shifts or on a 24-h shift schedule.

Social services employees mostly worked on the daytime shift (8:00–9:00 a.m. to 4:00–5:00 p.m.); 7% of them were assigned to rotating morning and afternoon shifts.

Administrative staff worked only on the daytime shift.

### Instrument

The interviews were done using the Sleep-EVAL system [11,12], a computer program written by M.M.O. and

designed to conduct interviews about sleep habits and sleep disorder diagnoses according to two classifications: the DSM-IV [13] and the International Classification of Sleep Disorders [14].

The interviews began with information about sociodemographics and descriptions of the working schedules followed by sleep/wake schedule, sleeping habits, medical treatments and physical illnesses. Once these data were collected, the system used this information to formulate diagnostic hypotheses of sleep and mental disorders. Further questions were asked during this process. The inference engine (or knowledge processor) performed this dynamic reasoning process. This engine based its differential diagnosis process on a series of key rules allowing or prohibiting the co-occurrence of two (or more) diagnoses. A “neural network” managed any uncertainty in the subject’s answers as well as in diagnoses. Once all diagnostic possibilities were exhausted, the system closed the interview. The system has been validated in various contexts and has been demonstrated to be reliable and valid [15,16].

### Variables

The standard questionnaire was composed of (1) socio-demographic information, (2) sleep/wake schedule information, (3) sleep habits, (4) sleep symptoms (insomnia, hypersomnia, snoring, restless legs symptoms, etc.), (5) health (eating habits, diseases), (6) medical consultations and hospitalizations in the previous year, (7) medications taken at the time of the interview, (8) social network, (9) work-related injuries in the previous year and (10) DSM-IV and ICSD diagnoses.

For the purpose of this study, a questionnaire about work conditions and work schedule and their consequences on health, social and professional life was added into the Sleep-EVAL system. This specific questionnaire included (1) a description of current shift (duration, number of days worked with the same shift, number of days of rest between each shift change); (2) a description of shifts in the previous month. For each shift, the subject answered if there was more than one sleep period, the sleep duration and whether sleep problems (insomnia or daytime sleepiness) occurred; (3) a description of advantages and disadvantages of shift working; (4) those who were on a fixed schedule were asked if they ever have been shift workers and, if so, for how many years, when they stopped working on shifts and what were the reasons they stopped being shift workers.

### Definition of groups

The participants were divided according to their work schedule:

1. Fixed daytime work group ( $n = 442$ ): these employees always worked during the daytime and always kept the same work schedule;

Table 1  
Distribution of the sample and hospital staff members by yards

Staff	Sample (%)	Hospital (%)
Administrative	15.9	9.3
Medical	68.7	69.2
Maintenance	7.5	11.2
Social services	3.7	5.0

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