**Title page**

**Title**

**Poor sleep is associated with work environment among 10,087 French healthcare workers: results from a nationwide survey.**

# Running title: Poor sleep is associated with work environment

**Manuscript category:** Original research

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**Authorship statement:**

All authors listed meet the authorship criteria according to the latest guidelines of the International Committee of Medical Journal Editors and agree with the manuscript.

**Word count**: **4779/5000** (*including acknowledgments, abstract, and main text)*

**Keywords:** Sleep; mental health; health services; burnout; depression.

# Disclosure

# *No external funding. No conflict of interest.*

**Ethical approval statement**

# *The study was performed in accordance with the Declaration of Helsinki and the French Jardé law. The study was approved by the National Ethical Committee (IRB n°C08 / 21.01.06.93911, CNIL). The data were collected anonymously. Because participation in this study was voluntary and anonymous, written informed consent was not obtained. The participants were informed that clicking on the first page of the questionnaire indicated consent to participate, and that they could withdraw their participation at any time.*

**Acknowledgments.** We express all our thanks to the institutions and professional associations, which participated in the diffusion of the survey. We thank the following institutions/facilities for their participation in the dissemination of the study : regional health agencies: Provence Alpes Côte d'Azur, Brittany, Ile de France, GHT : Alps, Dauphiné, Rhône center, South Drôme, Ardèche, Western Brittany, South Brittany, Upper Brittany, South Corsica, South Val d'Oise, North Hauts-de-Seine, Ile de France, South Vaucluse, Var, Alpes-de-Haute-Provence, Bouches-du-Rhône, Alpes Maritimes, Southern Alps, Academic hospitals: Assistance publique Hôpitaux de Marseille, Assistance publique Hôpitaux de Paris, Hospices civils de Lyon, CHU d 'Amiens, CHU d 'Angers, CHU de Besancon, CHU de Bres,t CHRU de Caen, CHU de Clermont-Ferrand, CHU de Dijon, CHU de Grenoble, CHU of Lille, CHU of Limoges, CHU of Martinique, CHU of Montpellier, CHRU of Nancy, CHU of Nantes, CHU of Pointe-à-Pitre/Les Abymes, CHU of Reims, CHU of Rennes, CHU of La Reunion, CHU of Rouen, CHU of Saint-Étienne, CHU of Toulouse, CHRU of Tours, Private hospitals: Angers: Institut de cancérologie de l'Ouest Bordeaux: Institut Bergonié Caen: Centre François Baclesse Clermont-Ferrand: Centre Jean Perrin Dijon: Centre George-François Leclerc Lille: Centre Oscar Lambret Lyon: Centre Léon Bérard Marseille: Institut Paoli-Calmettes Nice: Centre Antoine Lacassagne, Associations : French National Association of Occupational Therapists, National Association of Graduate Nurses and Students, French association of dieticians nutritionists, French association of care managers, Professional association of midwives, Committee of agreement of the nursing training and executives, National College of Physiotherapy Fédération hospitalière de France, Fédération nationale des associations d'aides-soignants, Syndicat national des infirmiers anesthésistes, Syndicat national des infirmiers de bloc opératoire.

# Abstract (250/250)

Poor sleep is common in healthcare workers and may have detrimental effects on their health. Individual and professional factors, including the work environment, may be related to poor sleep but few studies considered both in the same analysis. Thus, the aim of this study was to determine the prevalence of poor sleep in healthcare workers and the associated work environment factors while taking into account other factors. We conducted a nationwide survey among graduated healthcare workers in French public and private healthcare facilities. Poor sleep was assessed using the Pittsburgh Sleep Quality Index (>5). The work environment was evaluated using the Job Content Questionnaire. Multivariate logistic regression analysis was performed to explore the relationships of poor sleep with individual and professional factors. The STROBE statement was used for the report. This study included 10,087 healthcare workers, 6540 (64.8%) of whom had poor sleep. Nurses, health executives, nursing assistants and other allied health care professionals were more likely to have poor sleep than physicians. In the multivariate analysis, high speed and quantity, high complexity and intensity, high fragmentation and unpredictability, low decision-making latitude, low use of skills, low emotional support by colleagues and sustained workplace bullying were associated with increased rates of poor sleep. This study is therefore the first to identify work environment as a risk factor of poor sleep independently of individual factors. Sleep hygiene practices and healthy work environment may limit the consequences of poor sleep on the mental and physical health, and work performance, of healthcare workers.

**Keywords:** Sleep; mental health; health services; burnout; depression.

# Introduction

Poor sleep, defined as an alteration of quality or quantity of sleep, is a major public health problem. Several scales are available to subjectively evaluate poor sleep, including the Pittsburgh Sleep Quality Index (PSQI) (Buysse et al., 1989). The reliability and validity of this worldwide tool have been demonstrated in various languages and populations. Long-term poor sleep is associated with increased mortality, depression, anxiety, obesity, metabolic disturbances, and cardiovascular diseases (Alvaro et al., 2013; Garbarino et al., 2016). Individuals with poor sleep often use hypnotic drugs, which are expensive and can have adverse effects (e.g., dependence and increased risk of accidents) (Votaw et al., 2019). Therefore, it is essential to improve the sleep of the general population. Some individual factors are associated with poor sleep, including sociodemographic, health, and behavioral characteristics. Non-modifiable individual factors include old age, female sex, caregiver responsibilities, and chronic diseases (Ferrie et al., 2011). Some modifiable factors have a bidirectional relationship with poor sleep, including depression, obesity, tobacco smoking, alcohol and coffee consumption, and a low physical activity level (Alvaro et al., 2013; Amiri and Behnezhad, 2020; Clark and Landolt, 2017; Hu et al., 2020; Kredlow et al., 2015; Ogilvie and Patel, 2017).

Some professionals may be at an increased risk of poor sleep, including healthcare workers, particularly during the coronavirus 2019 (COVID-19) pandemic (Litwiller et al., 2017; Lucas, Sébastien Colson, et al., 2022). The rate of poor sleep among healthcare workers varies between 9.3% and 95.4% (Marvaldi et al., 2021). Poor sleep in healthcare workers is associated with an increased risk of medical errors (Léger et al., 2002) and poorer work performance (Alvaro et al., 2013; Garbarino et al., 2016) due to disturbances of attention, concentration, energy, and motivation. Furthermore, poor sleep may lead to increased absenteeism, resulting in large economic losses and the breakdown of healthcare systems (Hafner et al., 2017).

**Background**

Some of the aforementioned individual factors are also associated with poor sleep in healthcare workers, including old age, female sex, chronic illness, and tobacco smoking (Stewart et al., 2021). However, professional factors, including profession, work environment, and workplace well-being, may also influence the rate of poor sleep in healthcare workers. Of these factors, burnout, nighttime work, shift work and sustained workplace bullying were associated with poor sleep in studies with small sample sizes (n = 52-963) (Ganesan et al., 2019; Leo et al., 2021; Stewart et al., 2021). However, these results require validation. Poor sleep was found to be associated with work environment characteristics in several studies of non-healthcare workers (Dutheil et al., 2022; Rydstedt and Devereux, 2013) and healthcare workers (Dong et al., 2020; Li et al., 2019; Zhang et al., 2016). Among the work environment characteristics, psychological demands, decisional latitude, and job support, as measured using the Job Content Questionnaire (JCQ), which is an instrument for comparative assessment of psychosocial job characteristics (Karasek et al., 1998), are associated with depression, low life satisfaction, burnout (Karasek, 1979; Karasek et al., 1998; Van der Doef and Maes, 1999), and potentially poor sleep. It is important to identify subdimensions of characteristics (e.g., speed and quantity, complexity and intensity, and fragmentation and unpredictability) that are associated with poor sleep to guide organizational interventions. We identified several modifiable work environment factors that may affect sleep, including nighttime work, fixed schedule and schedule known in advance. We performed a literature search on August 22, 2022 but did not identify any study that determined the effects of both individual and professional factors on the sleep of healthcare workers.

Our primary objective was to determine the prevalence of poor sleep in healthcare workers using the PSQI, and to identify associated individual and professional factors, including the work environment assessed using the JCQ. Our secondary objectives were:

- to explore the associations of sleep dimensions with individual and professional factors, to improve the understanding of the mechanisms linking poor sleep with these factors.

- to explore these associations in the different healthcare workers professions, to aid the development of organizational interventions.

# Methods

*Study design*

The AMADEUS cross-sectional study was performed between May 2, 2021 and June 30, 2021 (i.e., during the third wave of COVID-19, when no lockdown was implemented but the country was under curfew) in French public and private healthcare facilities at a national level. This online survey was supported by professional healthcare workers associations and approved by the participating healthcare centers. The detailed protocol has previously been published (Lucas, S. Colson, et al., 2022). Social networks were used to recruit participants and limit selection bias, particularly for unemployed healthcare workers. To increase participation rates, the professional associations were contacted by email, whereas regional health agencies and public hospitals were contacted by phone (see Acknowledgments for details). The reporting of the study was handled according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines (von Elm et al., 2014) (see Appendix I).

*Inclusion criteria*

The study included graduate healthcare workers working in a French public or private healthcare facility.

*Poor sleep*

Poor sleep was evaluated using the French validated version of the PSQI (Blais et al., 1997; Buysse et al., 1989). This self-report scale contains 18 items spread over seven dimensions: sleep satisfaction, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, use of sleep medication, and daytime dysfunction. Each dimension is scored from 0-3, with scores of 1-3 indicating mild, moderate, and severe disturbances, respectively. The total score for the seven dimensions thus ranges from 0 to 21. Sleep was considered poor in participants with a total score on the PSQI of > 5 (Buysse et al., 1989). The French PSQI has a Cronbach’s α of 0.73 (Blais et al., 1997). The Cronbach’s α of the PSQI in our study was 0.76.

*Individual factors*

Non-modifiable factors include sociodemographic characteristics (age [continuous] and sex [male or female]), family caregiver responsibilities (yes or no), history of recurrent major depression (yes or no), and chronic illness (yes or no).

Modifiable individual factors include overweight/obesity (body mass index ≥ 25 kg/m2; yes or no), hard smoking (smoking ≥ 20 cigarettes per day; yes or no), hazardous drinking (score ≥ 2 on the CAGE questionnaire; yes or no) (Rueff et al., 1989), and high coffee intake (≥ 5 cups per day; yes or no) (Clark and Landolt, 2017). Physical activity was measured using the French version of the International Physical Activity Questionnaire (Hagströmer et al., 2006), which is widely used and recommended by the World Health Organization. Physical activity was defined as low if it was less than the recommended minimum activity (≥ 75 min of vigorous-intensity physical activity and ≥ 150 min of moderate-intensity physical activity per week), moderate if it was above the recommended minimum activity, and high if it was above the recommended activity for additional health benefits (≥ 150 min of vigorous-intensity physical activity and ≥ 300 min of moderate-intensity physical activity per week) (WHO, 2021).

*Professional factors*

Professions

Professions with < 200 participants were categorized as “other professions”. The professions included physician, nurse, health executive, nursing assistant, physiotherapist, occupational therapist, midwife, administrative agent, pharmacist, psychologist, and other professions.

Work environment

- Public or private sector, work experience of ≤ 12 months (yes or no), nighttime work (yes or no), fixed schedule (yes or no), known schedule at least 2 weeks in advance (yes or no).

- The Job Content Questionnaire (JCQ) (Niedhammer, 2002). The JCQ provides a continuous score for 26 items spread among 10 dimensions: speed and quantity (3 items), complexity and intensity (3 items), fragmentation and unpredictability (3 items), decision-making latitude (3 items), use of skills (3 items), skill development (3 items), professional support by superiors (2 items), professional support by colleagues (2 items), emotional support by superiors (2 items), and emotional support by colleagues (2 items). Higher scores indicate a better work environment, except for quantity, complexity, and unpredictability (Karasek et al., 1998). The scores for each dimension were rescaled (1-4) so that the odds ratios were comparable and corresponded to a quarter increase. All factors had a satisfactory Cronbach’s α (≥ 0.65) (Niedhammer et al., 2006).

- Sustained workplace bullying according to French law and a previous study (Messiaen et al., 2021) (yes or no).

Workplace well-being

- Burnout was defined as the presence of at least one of the three dimensions of burnout (emotional exhaustion, depersonalization, and low personal accomplishment) of the Maslach Burnout Inventory (MBI) (Maslach et al., 2001). All factors had a satisfactory Cronbach’s α (≥ 0.70).

- Absenteeism was defined as ≥ 8 unworked days during the previous 12 months. The cutoff of 8 days was used to account for unworked days due to other transient illnesses.

*Statistical analysis*

Categorical variables are presented as counts (n) and percentages (%), and continuous data as means (x̄) and standard deviations (SDs). The chi-squared test and Student’s t-test were used to analyze the univariate associations of poor sleep with categorical and continuous variables, respectively. P < 0.05 was considered statistically significant.

Multivariate logistic regression analysis was performed to explore the relationships of poor sleep with individual and professional factors in the main analysis and in sensitivity analyses, with poor sleep as the dependent variable and individual and professional factors as explicative/independent variables. All factors associated with poor sleep in the univariate analysis at the threshold of 0.20 were included in the main model (age, sex, family caregiver responsibilities, overweight/obesity, history of recurrent major depression, chronic illness, hard smoking, hazardous drinking, high coffee intake, physical activity, profession, private sector, work experience of ≤ 12 months, nighttime work, fixed schedule, known schedule, the scores on the 10 dimensions of the JCQ, sustained workplace bullying, burnout, and absenteeism). Collinearity in the model was assessed using the variance inflation factor (threshold of 2.5) (Kim, 2019).

To identify factors associated with the seven dimensions of poor sleep, multivariate analyses were performed for each individual subscore. For each dimension, scores ≥ 2 indicated moderate to severe abnormality.

Additionally, we analyzed these associations in each profession. We limited these analyses to professions categories with > 800 participants (i.e., physicians, nurses, health executives, and nursing assistants) to ensure sufficient statistical power.

Because this was a hypothesis-driven study, correction for multiple testing was not performed (Bender and Lange, 2001). Statistical analyses were performed using R software (version 4.1.2.; R Foundation for Statistical Computing, Vienna, Austria).

*Ethical considerations*

The study was performed in accordance with the Declaration of Helsinki and the French Jardé law. The study was approved by the National Ethical Committee (IRB n°C08 / 21.01.06.93911, CNIL). The data were collected anonymously. Because participation in this study was voluntary and anonymous, written informed consent was not obtained. The participants were informed that clicking on the first page of the questionnaire indicated consent to participate, and that they could withdraw their participation at any time.

# Results

This study included 10,087 healthcare workers with a mean age of 42.2 years (SD = 10.8 years, range = 19-70 years). Of the 10,087 participants, 8144 (80.7%) were females, 1820 (18.0%) were family caregivers, 1455 (14.4%) had a history of recurrent major depression, 1629 (16.2%) had a chronic illness, 3623 (35.9%) were overweight/obese, 241 (2.4%) were hard smokers, 1883 (18.7%) were hazardous drinkers, 1692 (16.8%) had a high coffee intake, 7204 (71.4%) had a low level of physical activity, and 1456 (14.4%) had a moderate level of physical activity.

The participants included physicians (n = 1931; 19.1%), nurses (n = 2755; 27.3%), health executives (n = 1719; 17.0%), nursing assistants (n = 801; 7.9%), physiotherapists (n = 418; 4.1%), occupational therapists (n = 396; 3.9%), midwives (n = 328; 3.3%), administrative agents (n = 288; 2.9%), pharmacists (n = 257; 2.6%), psychologists (n = 215; 2.1%), and other allied healthcare workers (n = 979; 9.7%). In total, 8700 healthcare workers (86.2%) worked in the public sector, 644 (6.4%) had work experience of ≤ 12 months, 598 (5.9%) engaged in nighttime work, 5303 (52.6%) worked according to a fixed schedule, 8997 (89.2%) had known schedule, 3998 (39.6%) experienced sustained workplace bullying, 5567 (55.2%) experienced burnout, and 2071 (20.5%) had absenteeism. The professional characteristics of the participants are presented in Table 1.

*Prevalence of poor sleep and associated factors*

In total, 6540 (64.8%) healthcare workers had poor sleep. The factors associated with poor sleep are presented in Figure 1.

The multivariate analyses showed that poor sleep was associated with individual non modifiable factors (old age, female sex, family caregiver responsibilities, history of recurrent major depression, and chronic illness), individual modifiable factors (overweight/obesity, hard smoking, hazardous drinking, high coffee intake, and low physical activity level), professional non-modifiable factors (work as a nurse, health executive, nursing assistant, physiotherapist, occupational therapist, midwife, or administrative agent, and working in a public sector organization), and professional modifiable factors (nighttime work, high speed and quantity, high complexity and intensity, high fragmentation and unpredictability, low decision-making latitude, low use of skills, low emotional support by colleagues, sustained workplace bullying, burnout, and absenteeism). Known schedule was associated with lower rates of a poor sleep.

These results were independent of work experience of ≤ 12 months, fixed schedule, skill development, professional support by superiors and colleagues, and emotional support by superiors. Collinearity was identified between professional and emotional support by colleagues was found (variance inflation factor > 2.5); each factor was significantly associated with poor sleep after excluding the other factor from the model.

*Prevalence of sleep dimension abnormalities and associated factors*

The most common sleep dimension abnormality was poor sleep satisfaction (n = 4437; 44.0%), followed by short sleep duration (n = 3940; 39.1%), sleep disturbances (n = 3729; 37.0%), prolonged sleep latency (n = 3410; 33.8%), daytime dysfunction (n = 2678; 26.5%), poor sleep efficiency (n = 1948; 19.3%) and use of sleep medication (n = 1191; 11.8%). These seven dimensions showed high consistency in the associations with individual and professional factors (Figure 2), except for use of sleep medication and daytime dysfunction. By contrast to other sleep dimensions, daytime dysfunction was more common in younger than older workers. Work as a nurse, health executive, or nursing assistant was not associated with increased daytime dysfunction. No profession was associated with increased use of sleep medication. Nursing assistants had a lower rate of sleep medication use than physicians, who were used as reference because they had a lower rate of poor sleep.

*Associations of individual and professional factors with poor sleep in different healthcare workers professions*

Factors associated with poor sleep in professions with sample sizes > 800 (i.e. nurses, physicians, health executives and nursing assistants) are presented in Figure 3. Data for physicians are presented in Supplementary Figure 1.

In nurses, poor sleep was associated with (individual non-modifiable factors) a history of recurrent major depression, (individual modifiable factors) overweight/obesity, hard smoking, and high coffee intake, (professional modifiable factors) nighttime work, high complexity and intensity, high fragmentation and unpredictability, low decision-making latitude, burnout, and absenteeism.

In physicians, poor sleep was associated with (individual non-modifiable factor) old age, history of recurrent major depression, and chronic illness, (individual modifiable factor) overweight/obesity, hazardous drinking, and high coffee intake, (professional modifiable factors) work with high speed and quantity, sustained workplace bullying, burnout, and absenteeism. Nighttime work was associated with a lower rate of poor sleep in physicians.

In health executives, poor sleep was associated with (individual non-modifiable factor) a history of recurrent major depression, (individual modifiable factor), hazardous drinking, and low physical activity, (professional modifiable factors) work with high speed and quantity, low decision-making latitude, sustained workplace bullying, burnout, and absenteeism. Known schedule was associated with a lower rate of poor sleep in health executives.

In nursing assistants, poor sleep quality was associated with (individual non-modifiable factor) family caregiver responsibilities, history of recurrent major depression and (professional modifiable factor) sustained workplace bullying.

# Discussion

Poor sleep is common in healthcare workers and was present in almost 65% of our study participants. This is the first study to show that a large number of professional factors, including detailed work environment characteristics (assessed by the JCQ), are associated with poor sleep, independently of individual factors. Our findings may aid the development of personalized preventive strategies targeting modifiable individual and professional factors associated with poor sleep.

Among individual factors, poor sleep was more common in elderly individuals, females, and those with family caregiver responsibilities, a history of recurrent major depression, chronic illness, overweight/obesity, hard smokers, hazardous drinkers, individuals with high coffee intake, and with a low level of physical activity. However, these factors did not fully explain the high prevalence of poor sleep. We identified several professional factors associated with poor sleep, including non-modifiable (working as a nurse, health executive, nursing assistant, physiotherapist, occupational therapist, midwife, or administrative agent, and working in a public sector organization) and modifiable (nighttime work, work with high speed and quantity, high complexity and intensity, high fragmentation and unpredictability, sustained workplace bullying, burnout, and absenteeism) factors. Known work schedule, work with high decision-making latitude, high use of skills, and high emotional support by colleagues were associated with good sleep. These factors were associated with all sleep dimensions, except for use of sleep medication and daytime dysfunction, which had the opposite association with age and no statistically significant association with profession. Most of the associations of individual and professional factors with poor sleep varied among professions, suggesting that interventions should be tailored according to the profession.

In the present study, 64.8% of healthcare workers had poor sleep, in line with a survey conducted over the same period in which 63-67% of the French general population had disrupted sleep (Santé Publique France [Public Health France], 2021). An Italian study found that 75% of nurses had poor sleep, as measured by the PSQI, during the COVID-19 pandemic (Simonetti et al., 2021), similar to our results (69.9%). Therefore, our results are in line with those of previous studies performed on other populations. The present study also confirmed several novel associations between work environment characteristics and poor sleep suggested in previous preliminary studies (Dutheil et al., 2022; Portela et al., 2015; Rydstedt and Devereux, 2013) with methodological limitations. It is essential to improve sleep of healthcare workers, to in turn improve the health outcomes and work performance. Our results suggest that certain subgroups of healthcare workers should be targeted by interventions to improve sleep, including healthcare workers aged ≥ 31 years, females, and those with family caregiver responsibilities, a history of recurrent major depression, and chronic illness. The sleep, including sleep hygiene and sleep complaints, of healthcare workers with recurrent major depression of chronic illness should be systematically evaluated by occupational medicine specialists. Ensuring at least a moderate level of physical activity (≥ 75 min of vigorous-intensity physical activity and ≥ 150 min of moderate-intensity physical activity per week) (Banno et al., 2018), weight reduction (Alfaris et al., 2015), active tobacco smoking cessation at work (Fond et al., 2021) and moderate consumption of alcohol (Hu et al., 2020) and coffee (Clark and Landolt, 2017) may improve sleep.

Nurses, heath executives, nursing assistants, physiotherapists, occupational therapists, midwives, and administrative agents are at particularly high risk of poor sleep. The provision of emotional support by colleagues may also improve sleep. Similar results were reported previously for depression, suggesting that emotional support by colleagues plays a major role in promoting mental health at work (Lucas, Sébastien Colson, et al., 2022). Burnout and sustained workplace bullying were associated with poor sleep in this study, suggesting that the work environment play a major role in sleep, and that interventions to improve sleep should also address psychosocial factors. Some studies have suggested bidirectional relationships of poor sleep with burnout and absenteeism, suggesting that screening for poor sleep may be useful for the prevention of burnout and absenteeism.

Work schedules also play a role in poor sleep. Nighttime work increases the risk of poor sleep. Although nighttime work cannot be completely eliminated, its effects may be reduced by improving sleep hygiene at work, including promoting naps and providing spaces for recuperative sleep for nighttime workers. Schedules naps may improve work performance and decrease fatigue in emergency medical service workers (Martin-Gill et al., 2018), while active breaks from work may enhance physical and mental well-being, motivational outcomes, and performance (Wendsche et al., 2017).

Our findings suggest that the associated factors for each individual profession should be taken into account. For example, work speed and quantity were associated with poor sleep in health executives, while complexity and intensity, and fragmentation and unpredictability were associated with poor sleep in nurses. Work complexity and intensity involve paradoxical injunctions and the need for continuous concentration. The impact on the sleep of nurses may be reduced by limiting work interruptions, providing consistent instructions, and preventing work fragmentation and unpredictability. We found that hazardous drinking was associated with poor sleep in health executives, while high coffee intake and hard smoking were associated with poor sleep in nurses. Our findings may provide a basis for the development of specific prevention programs. A high level of physical activity was associated with low rates of poor sleep only in health executives. Additionally, each sleep dimension should be considered individually when measuring or intervening to improve sleep in healthcare workers (e.g., daytime dysfunction is more frequent among younger than older healthcare workers). The “sleep health framework” constitutes a new approach for improving sleep to provide general health benefits (Buysse, 2014) and could be considered in future studies.

# *Limitations*

The cross-sectional design of this study prevents the establishment of causal relationships. The direction of the relationship between poor sleep and work environment has been explored in three longitudinal analyses that drew inconsistent conclusions (Garefelt et al., 2020; Halonen et al., 2016; Van Laethem et al., 2015). In two studies with 3706 Swedish workers and 24,873 Finnish adults, the work environment predicted poor sleep but not vice versa (Garefelt et al., 2020; Halonen et al., 2016), whereas a Danish study suggested that poor sleep predicted job stress more than the reverse (Van Laethem et al., 2015). Therefore, our results should be confirmed in longitudinal and intervention studies. Our findings for nursing assistants had certain caveats; only two factors were associated with poor sleep in this group (history of recurrent major depression and sustained workplace bullying). It is possible that other factors may play a role, similar to other professions, and that the statistically nonsignificant results are due to the small sample size of nursing assistants (n = 847; about 2-fold lower than that of nurses, health executives, and physicians). As we have included almost 30 adjustment factors, this requires a high number of participants, and this is also one of the strengths of the AMADEUS survey. Our results indicate the need to target nursing assistants with a history of recurrent major depression, to improve their sleep and prevent sustained workplace bullying (this in fact applied to all healthcare workers). We cannot exclude a risk of participation bias in the present study. To limit such bias, we enrolled participants without mentioning sleep in the questionnaire title or description. The participants were only told that the study would explore the work environment and identify changes required therein for healthcare workers. Healthcare workers were invited to participate in the study over 2 months to increase the chances of including those who were absent from work (i.e., those with absenteeism); however, we could not include participants with absenteeism > 2 months or those who had quit their job. Therefore, it is possible that the rates of poor sleep, sustained workplace bullying, burnout, and absenteeism were underestimated. However, these rates were comparable to those reported previously, which ensure the robustness of our findings. We could not calculate the participation rate because the study information was disseminated by the health directors of each facility, as well as by social networks. Nursing assistants were under-represented because most of them had no access to a professional mailing system. We recommend that all healthcare workers be granted access to a professional mailing system to improve future research and care. Private sector organizations were also underrepresented, possibly because of lower dissemination rates in these facilities due to a poor research culture or less time dedicated to research, or because private facilities conduct their own confidential surveys among their employees.

# Conclusion

Most healthcare workers reported poor sleep. The rate of poor sleep in the present study was comparable to that in the general French population. This is the first study to identify individual (sociodemographic, health, and behavioral characteristics) and professional (profession, work environment, and workplace well-being) factors associated with poor sleep. Older individuals, females, and family caregivers are at high risk of poor sleep and should be targeted by interventions to improve sleep. Occupational medicine specialists should screen healthcare workers with a chronic illness and/or history of recurrent major depression to improve their sleep. This is the first study to confirm that professional factors are associated with poor sleep independently of individual factors.

**Relevance for clinical practice**

Promoting sleep hygiene at work, for example by allowing naps and active breaks from work, and through the provision of emotional support by colleagues, may reduce the effects of poor sleep on the mental and physical health and work performance of healthcare workers. Improving the work speed and quantity, complexity and intensity, fragmentation and unpredictability, decision-making latitude, and use of skills, as well as promoting smoking cessation, weight loss, and physical activity, and reducing of alcohol and coffee consumption, may improve sleep in healthcare workers.

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**List of tables**

*Table 1. Individual and professional modifiable and non-modifiable factors associated with poor sleep in healthcare workers: univariate analyses.*

*Table 2. Individual and professional modifiable and non-modifiable factors associated with poor sleep in healthcare workers: summary of multivariate analyses.*

**List of figures**

*Figure 1. Adjusted associations between individual and professional factors and poor sleep*

*Figure 2. Adjusted associations between individual and professional factors and each sleep dimension*

*Figure 3. Adjusted associations between poor sleep and individual and professional factors according to professional activity*

Table 1. Individual and professional modifiable and non-modifiable factors associated with poor sleep in healthcare workers: univariate analyses.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variables | Total | Poor sleep† | Good sleep† | p |
| n (%) | n (%) |
| **All** | 10,087 | 6540 (64.8%) | 3547 (35.2%) |  |
| **Individual non-modifiable factors** |  |  |  |  |
| **Age** (mean ± SD) | 42.2 ± 10.8 | 42.8 ± 10.8 | 41.2 ± 10.9 | <10-4 |
| **Sex**   * Male * Female | 1943 (19.3%)  8144 (80.7%) | 1185 (61.0%)  5355 (65.8%) | 758 (39.0%)  2789 (34.2%) | <10-4 |
| **Family caregiver responsibilities:** Yes | 1820 (18.0%) | 1330 (73.1%) | 490 (26.9%) | <10-4 |
| **History of recurrent major depression:** Yes | 1455 (14.4%) | 1198 (82.3%) | 257 (17.7%) | <10-4 |
| **Chronic illness:** Yes | 1629 (16.2%) | 1206 (74.0%) | 423 (26.0%) | <10-4 |
| **Individual modifiable factors** |  |  |  |  |
| **Overweight/obesity**: Yes | 3623 (35.9%) | 2540 (70.1%) | 1083 (29.9%) | <10-4 |
| **Hard smoking**: Yes | 241 (2.4%) | 208 (86.3%) | 33 (13.7%) | <10-4 |
| **Hazardous drinking:** Yes | 1883 (18.7%) | 1341 (71.2%) | 542 (28.8%) | <10-4 |
| **High coffee intake:** Yes | 1692 (16.8%) | 1259 (74.4%) | 433 (25.6%) | <10-4 |
| **Physical activity:**   * Low * Medium * High | 7204 (71.4%)  1456 (14.4%)  1427 (14.2%) | 4834 (67.1%)  856 (58.8%)  850 (59.6%) | 2370 (32.9%)  600 (41.2%)  577 (40.4%) | <10-4 |
| **Professional non-modifiable factors** |  |  |  |  |
| **Professions**   * Physician * Nurse * Health executive * Nursing assistant * Physiotherapist * Occupational therapist * Midwife * Administrative agent * Pharmacist * Psychologist * Other professions | 1931 (19.1%)  2755 (27.3%)  1719 (17.0%)  801 (7.9%)  418 (4.1%)  396 (3.9%)  328 (3.3%)  288 (2.9%)  257 (2.6%)  215 (2.1%)  979 (9.7%) | 1083 (56.1%)  1926 (69.9%)  1177 (68.5%)  587 (73.3%)  235 (56.2%)  226 (57.1%)  218 (66.5%)  204 (70.8%)  159 (61.9%)  108 (50.2%)  617 (63.0%) | 848 (43.9%)  829 (30.1%)  542 (31.5%)  214 (26.7%)  183 (43.8%)  170 (42.9%)  110 (33.5%)  84 (29.2%)  98 (38.1%)  107 (49.8%)  362 (37.0%) | <10-4 |
| **Sector:**   * Public * Private | 8700 (86.2%)  1287 (13.8%) | 5714 (65.7%)  826 (59.6%) | 2986 (34.3%)  561 (40.4%) | <10-4 |
| **Experience of ≤ 12 months:** Yes | 644 (6.4%) | 365 (56.7%) | 279 (43.3%) | <10-4 |
| **Professional modifiable factors** |  |  |  |  |
| **Nighttime work**: Yes | 598 (5.9%) | 454 (75.9%) | 144 (24.1%) | <10-4 |
| **Fixed schedule:** Yes | 5303 (52.6%) | 3329 (62.8%) | 1974 (37.2%) | <10-4 |
| **Known schedule:** Yes | 8997 (89.2%) | 5749 (63.9%) | 3248 (36.1%) | <10-4 |
| **JCQ dimensions** (rescaled from 1 to 4)   * Speed and quantity * Complexity and intensity * Fragmentation and unpredictability * Decision-making latitude * Use of skills * Skill development * Professional support by superiors * Professional support by colleagues * Emotional support by superiors * Emotional support by colleagues | 2.89 ± 0.68  3.00 ± 0.55  2.93 ± 0.69  3.04 ± 0.58  2.84 ± 0.5  3.22 ± 0.52  2.61 ± 0.87  3.17 ± 0.59  2.62 ± 0.90  3.14 ± 0.63 | 2.98 ± 0.67  3.06 ± 0.54  3.01 ± 0.66  2.96 ± 0.60  2.80 ± 0.51  3.18 ± 0.53  2.53 ± 0.87  3.12 ± 0.60  2.54 ± 0.91  3.09 ± 0.65 | 2.74 ± 0.67  2.87 ± 0.55  2.78 ± 0.70  3.18 ± 0.53  2.92 ± 0.48  3.30 ± 0.50  2.77 ± 0.84  3.26 ± 0.56  2.78 ± 0.87  3.25 ± 0.59 | <10-4  <10-4  <10-4  <10-4  <10-4  <10-4  <10-4  <10-4  <10-4  <10-4 |
| **Sustained workplace bullying**: Yes | 3998 (39.6%) | 2933 (73.4%) | 1065 (26.6%) | <10-4 |
| **Burnout**: Yes | 5567 (55.2%) | 4133 (74.2%) | 1434 (25.8%) | <10-4 |
| **Absenteeism:** Yes | 2071 (20.5%) | 1565 (75.6%) | 506 (24.4%) | <10-4 |
| *†Measured with the Pittsburgh Sleep Quality Index (PSQI) with poor sleep defined as a score > 5* | | | | |

Table 2. Individual and professional modifiable and non-modifiable factors associated with poor sleep in healthcare workers: summary of multivariate analyses.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Variables | All Healthcare workers | Physician | Nurse | Health executive | Nursing assistant |
| **Individual non-modifiable factors** |  |  |  |  |  |
| Age | + | + | ns | ns | ns |
| Sex (female) | + | ns | ns | ns | ns |
| Family caregiver responsibilities | + | ns | ns | ns | ns |
| History of recurrent major depression | + | + | + | + | + |
| Chronic illness | + | + | + | ns | ns |
| **Individual modifiable factors** |  |  |  |  |  |
| Overweight/obesity | + | + | + | ns | ns |
| Hard smoking | + | ns | + | ns | ns |
| Hazardous drinking | + | + | ns | + | ns |
| High coffee intake | + | + | + | ns | ns |
| Physical activity | - | ns | ns | ns | ns |
| **Professional non-modifiable factors** |  |  |  |  |  |
| Public sector | + | ns | ns | ns | ns |
| **Professional modifiable factors** |  |  |  |  |  |
| Nighttime work | + | ns | + | ns | ns |
| Fixed schedule | ns | ns | ns | ns | ns |
| Known schedule | - | ns | ns | - | ns |
| Speed and quantity | + | ns | ns | + | ns |
| Complexity and intensity | + | ns | + | ns | ns |
| Fragmentation and unpredictability | + | ns | + | ns | ns |
| Decision-making latitude | - | ns | ns | - | ns |
| Use of skills | - | ns | ns | ns | ns |
| Skill development | ns | ns | ns | ns | ns |
| Professional support by superiors | ns | ns | ns | ns | ns |
| Professional support by colleagues | ns | ns | ns | ns | ns |
| Emotional support by superiors | ns | ns | ns | ns | ns |
| Emotional support by colleagues | - | ns | ns | ns | ns |
| Sustained workplace bullying | + | + | ns | + | + |
| Burnout | + | + | + | + | ns |
| Absenteeism | + | + | + | + | ns |
|  | |  |

+ : factor statistically significantly associated with increased rates of poor sleep.

– factor statistically significantly associated with lower rates of poor sleep.

ns: statistically non-significant (p<0.05)

*Figure 1. Adjusted associations between individual and professional factors and poor sleep*

*Une image contenant texte, reçu, capture d’écran

Description générée automatiquement*

*Forest plot of the association between individual and professional factors and poor sleep (PSQI > 5) adjusted for age, sex, family caregiver responsibilities, history of recurrent major depression, chronic illness, overweight/obesity, hard smoking, hazardous drinking, high coffee intake, physical activity, professions, private sector, experience of ≤ 12 months, nighttime work, fixed schedule, known schedule, the 10 dimensions of the JCQ, sustained workplace bullying, burnout and absenteeism.*

*Figure 2. Adjusted associations between individual and professional factors and each sleep dimension*

Daytime dysfunction

2678 (26.5%)

Sleep medication

1191 (11.8%)

Sleep disturbance

3729 (37.0%)

Poor sleep efficiency

1948 (19.3%)

Short sleep duration

3940 (39.1%)

High sleep latency

3410 (33.8%)

Poor sleep satisfaction

4437 (44.0%)

*Une image contenant table

Description générée automatiquement*

*Forest plot of the associations between individual and professional factors and each sleep component adjusted for age, sex, family caregiver responsibilities, history of recurrent major depression, chronic illness, overweight/obesity, hard smoking, hazardous drinking, high coffee intake, physical activity, professions, private sector, experience ≤ 12 months, nighttime work, fixed schedule, known schedule, the 10 dimensions of the JCQ, sustained workplace bullying, burnout and absenteeism.*

*Figure 3. Adjusted associations between poor sleep and individual and professional factors according to professional activity*

Health executive (n=1719)

Nurse (n=2755)

Nursing assistant (n=801)

assistant (n=801)

*Une image contenant texte

Description générée automatiquementUne image contenant texte, reçu

Description générée automatiquement*

*Forest plot of the associations between individual and professional factors and poor sleep (PSQI > 5) in nurses, health executives and nursing assistants adjusted adjusted for age, sex, family caregiver responsibilities, history of recurrent major depression, chronic illness, overweight/obesity, hard smoking, hazardous drinking, high coffee intake, physical activity, private sector, experience ≤ 12 months, nighttime work, fixed schedule, known schedule, the 10 dimensions of the JCQ, sustained workplace bullying, burnout and absenteeism.*

**Supplementary materials**

*Supplementary figure 1. Adjusted associations between individual and professional factors and poor sleep in physicians (n=1931)*

*Une image contenant table

Description générée automatiquement*

*Forest plot of the association between individual and professional factors and poor sleep (PSQI > 5) in physicians adjusted adjusted for age, sex, family caregiver, history of recurrent major depression, chronic illness, overweight/obesity, hard smoking, hazardous drinking, high coffee intake, physical activity, private sector, experience ≤ 12 months, nighttime work, fixed schedule, known schedule, the 10 dimensions of the JCQ, sustained workplace bullying, burnout and absenteeism.*