Insomnia and Absenteeism at Work. Who Pays the Cost?

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Study Objective: To estimate the costs of insomnia-associated work absenteeism and to analyze how these costs are shared between the different payers: the national health insurance system, employers, and employees.

Design: Retrospective cohort study over a 2-year period.

Setting: The Paris Ile de France region.

Patients: Two matched groups of employees: 369 insomniacs and 369 good sleepers.

Measurements: The costs of absenteeism at work associated with insomnia were estimated by comparing the 2 matched groups in terms of the number and duration of work absences. We considered that work absences incurred costs relating to salary replacement and loss of productivity: these were given a monetary value on the basis of the added value per hour worked.

Results: The percentage of employees with at least 1 work absence are 50% and 34% for insomniacs and good sleepers, respectively. The work absenteeism (expressed in days, per employee, per year ± confidence intervals [CI]) differed significantly between insomniacs and good sleepers: 5.8 (± 1.1) and 2.4 (± 0.5), respectively (p < .001). The extra cost (± CI) to the national health insurance system of insomnia-associated absenteeism was estimated at € 77 (±€ 39) per employee, per year. The extra cost (± CI) to employers was estimated at € 233 (±€ 101) for salary replacement and € 1062 (±€ 386) for loss of productivity. Finally, employees themselves bore a cost (± CI) of € 100 (±€ 54).

Conclusions: Employees who suffered from insomnia had a significantly higher rate of absenteeism at work than those who slept well. This absence represents a cost for society: in France, 88% of this amount is shouldered by employers.

Keywords: Insomnia, cost of illness, extra cost, economic analysis

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INTRODUCTION

INSOMNIA IS DEFINED AS THE DIFFICULTY OF INITIATING OR MAINTAINING SLEEP, AND THE CONDITION CAN HAVE TROUBLESOME DAYTIME CONSEQUENCES such as sleepiness or fatigue. It includes a wide range of disturbances in which sleep is judged to be quantitatively or qualitatively insufficient or not refreshing.[1] Estimates of the prevalence of insomnia vary widely from one study to the next, with reported values of between 10% and 40% for the general population, depending on the criteria used and the country in which the research was conducted.[2-6] In 2000, the prevalence of insomnia in France was estimated at 19%, with almost half of these individuals being classified as severe insomniacs.[2] Insomnia-related disorders lead to substantial morbidity[7,8] and engender both individual and social costs—notably, medical costs,[9-12] the payment of daily sickness indemnities in the event of work absence, and loss of productivity.[13]

Most of the published analyses of the costs associated with insomnia[3,9,12-15] have examined the direct medical costs (medical consultations, hospitalization, and treatments). For France, these costs were estimated at around € 1.5 billion ($1.8 billion) in 1999.[14] For the United States, a figure of $13.9 billion has been reported.[15] However, the indirect costs of insomnia have been less well documented in the research literature. These costs relate to (1) workplace, domestic, or traffic accidents (and the ensuing material damage, medical costs, death and injury) as a consequence either of insomnia itself or its treatment[11,13,14]; (2) medical costs generated by insomnia-associated comorbidities (e.g., back pain, depression, alcohol abuse)[16]; and (3) costs of insomnia reflected by lower productivity and work absences. The latter have yet to be fully evaluated.

Within the current context, in Europe, where the costs of daily sickness indemnities to the health insurance system have increased dramatically over recent years (by more than 46% in France—all causes included—between 1997 and 2002[17]), there are good reasons for evaluating the cost to society of insomnia-associated work absenteeism.[18]

Based on the secondary objectives of a study undertaken in a working population in the Paris Ile de France region (PIDFR), the present report estimates the costs of insomnia-associated work absenteeism and analyzes how these costs are shared between the different payers—the national health insurance system (l'Assurance Maladie), employers, and employees. Historically, these 3 payers have been the main stakeholders in joint management of the welfare system in France.

METHODS

We carried out a retrospective cohort study in the PIDFR between September 2002 and July 2003.[19]

Study Population

A total of 1615 occupational physicians ("médecins du travail") in the PIDFR were mailed an invitation to participate in the present study. We randomly selected 32 of the 200 who accepted our proposal. These occupational physicians then approached all employees sequentially until 13 insomniacs and 13 matched good sleepers had been selected for a total of 26 subjects per physician. Employees were recruited among those who were coming for their annual medical check-up. Subjects were matched for age, sex, occupational category (managers, white-collar workers, and blue-collar workers), and type of employer (public or private sector). The insomniacs were selected according to the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* definition, with a 1-month reference period. Subjects were only included if they had had a history of insomnia over at least the previous 2 years.

The participants also had to fill in a self-administered questionnaire. In the first section, the diagnosis and the severity of insomnia were assessed using the Pittsburg Sleep Quality Index Scale[20] and the Spiegel Sleep Inventory.[21] The Pittsburgh Sleep Quality Index contains 19 self-rated questions and 5 questions rated by the bedpartner or the roommate (if one is available). Only self-rated questions are included in the scoring. The 19 self-rated items are combined to form 7 components scores, each of which has a range of 0 to 3 points. In all cases, a score of "0" indicates no difficulty, while a score of "3" indicates severe difficulty. The 7 component scores are then added to yield 1 "global score, with a range of 0 to 21 points, with "0" indicating no difficulty and "21" indicating severe difficulties. Psychometric studies supported internal-consistency reliability and construct validity. Cronbach α were 0.80 across groups, and correlation between global and component scores were moderate to high. Pittsburgh Sleep Quality Index scores were moderately to highly correlated with measures of sleep quality and sleep problems and poorly correlated with unrelated constructs. Individuals with sleep problems, poor sleep quality, and sleep restlessness had significantly higher Pittsburgh Sleep Quality Index scores in comparison with individuals without such problems.

The Spiegel Sleep Inventory is a self administered miniquestionnaire that inquires about the previous 2 nights via 6 questions on sleep initiation, quality, and length; nocturnal awakenings; dreams; and feeling refreshed in the morning. Each question has a 0 to 5 score. A total score of over 18 indicates sleep problems, whereas 24 and over corresponds with severe sleep problems There are fewer data available on the psychometric validity of the Spiegel Sleep Inventory; however, it is a very simple and easy-to-use scale. We used this scale to assess the presence of insomnia in the nights preceding the survey.

Employees were only included in the study if they had worked for the same employer for at least the last 2 years and worked at least a 28-hour week (i.e., 80 % of full-time employment in France). We excluded employees with chronic physical or mental disorders that had led to work absences of more than 3 consecutive months, as well as women who had taken a maternity leave within the last 2 years. It is indeed usually admitted in this country that 3 consecutive months of absence is a reasonable limit to define chronic diseases. We therefore considered that subjects with more than 3 months of absence were more likely to have an impact of the disease itself than an impact due to insomnia. All employees included in the sample gave their written informed consent to participate in the study.

Sample Size

Calculation of the number of subjects required to assess a significant difference between the 2 groups in terms of the number of days off work was made by using $\Delta/\sigma = 0.2$,[22] with $\alpha = .05$ and $1-\beta = .80$. On the basis of these values, the number of subjects required was 400 employees in each group, i.e., 400 insomniacs and 400 good sleepers.[19]

Data Collection

Absences were defined as 1 or more consecutive days during which an individual was not at work. The number and duration of absences at work during the 2 preceding years were reported by the occupational physicians on the basis of personnel files provided by the employer's human resources department.

Cost Calculation

The cost of work absenteeism was calculated by distinguishing between the costs incurred by 3 types of payer—the national health insurance system, the employer, and the employee.[23,24] In France, an individual who is absent from work receives a salary-replacement payment from the national health insurance system and the employer, the amount of which varies according to the sector (public or private) and, within the private sector, the terms of branch-specific labor agreements. Salary replacement does not systematically correspond to 100% of the usual salary; when the replacement is not 100%, the employee incurs the shortfall. An employee who is absent from work is not productive, and, thus, his or her employer incurs a productivity loss.[25] We assumed that when an employee was absent from work, he or she was not replaced by colleagues or temporary staff.

We calculated the amount of the employee's salary-replacement payment in the following way: (1) Employees in the private sector are paid daily sickness indemnities by the national health insurance system after 3 days of absence from work, at a rate of 50% of their gross monthly salary, with a ceiling of € 41.26 per day (Figure 1). Private-sector employers also pay an additional amount defined in branch-specific labor agreements. Since the precise conditions defined by labor agreements were not available, we used a mean estimate of the additional "top-up" payment paid by the employers: the contractual clauses in labor agreements guarantee an average of 80% of the net monthly salary during the first month of absence from work,[26] with the remainder being at

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Figure 1—Salary replacement costs paid by the French national health insurance system (daily sickness indemnities) in the private sector[26] The formula for calculating the daily sickness indemnities is the following:

- If the duration of absenteeism at work ≤ 3 days   then cost = 0
- If the duration of absenteeism at work > 3 days and the daily gross salary ≤ € 82.52 , then the cost per period of absence = (duration of absenteeism at work -3) × daily gross salary × 0.5
- If the duration of absenteeism at work > 3 days and the daily gross salary > € 82.52, then the cost per period of absence = (duration of absenteeism at work -3 days) × € 41.26

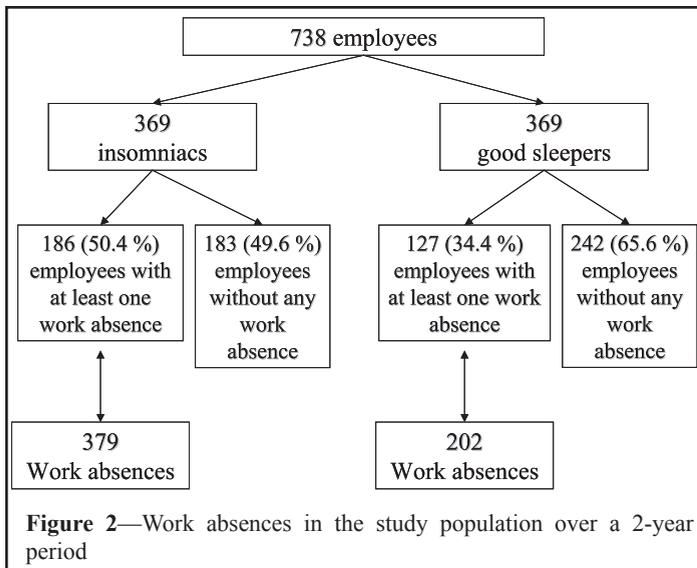**Figure 2**—Work absences in the study population over a 2-year period

Table 1—Work Absences in Insomniacs and Good Sleepers

| | | Work absence[a] | |
	%	Insomniacs (n=369)	Good sleepers (n=369)
Sex			
Men	36.3	5.3 (± 2.1)	1.9 (± 0.8)*
Women	63.7	6.1 (± 1.3)	2.7 (± 0.7)*
Occupational category			
Manager	30.9	4.16 (± 1.8)	1.6 (± 0.8)*
White-collar worker	64.8	6.6 (± 1.5)	2.7 (± 0.7)*
Blue-collar worker	4.3	6.5 (± 4.2)	3.1 (± 3.4)*
Category of employer, sector			
Public	23.3	7.2 (± 2.6)	2.2 (± 1.2)*
Private	76.7	5.5 (± 1.3)	2.5 (± 0.6)*
Age, y			
≤ 35	19.2	5.4 (± 2.3)	1.7 (± 0.7)*
36-50	50.3	5.4 (± 1.6)	2.7 (± 0.8)*
> 50	30.5	6.9 (± 2.2)	2.5 (± 1.1)*

*$p < .05$ by the Wilcoxon test
[a]Data are presented in days per employee per year (confidence interval).

the employee's expense. (2) Employees in the public sector are not paid daily by sickness indemnities but continue to receive a full salary from their employers for the first 90 days of absence, starting from the first day of absence.

Loss-of-productivity costs were calculated using the following formula: Lost productivity = number of days off work × number of hours worked per day × added value per hour worked.[24] The French National Institute of Statistics and Economic Studies (INSEE) regularly publishes statistics on the employment rate,[26] the number of hours worked per week (by sex and occupational category),[27] and the added value per region and per activity branches. The added value is a measure of the wealth generated by a country, a region, or a branch of economic activity. For the PIDFR in 2002 to 2003, the weighted average added value per hour worked was € 38.94.[28] In our calculation, we chose to use this parameter because our sample appeared to be representative of the branches of economic activity that contributed most to the calculation of added value in the PIDFR. We were able to demonstrate (data not shown) that the added value calculated in our sample (€ 39.6) is very close to the figure for the PIDFR[29] (€ 38.94).

Statistical Analyses

We used the Wilcoxon test to compare the 2 groups (insomniacs and good sleepers) in terms of work absenteeism (expressed in days, per employee, per year) and consequential costs (salary replacement and loss of productivity) and according to age (less than 35 years, 36-50 years, over 50 years), sex (male, female), occupational category (managers, white-collar workers, blue-collar workers), and type of employer (public sector, private sector).

By matching the employees in our sample for the main variables likely to influence work absences[30] (age, sex, occupational category, and type of employer) and by excluding those suffering from chronic pathologies that had led to prolonged absences from work, we can reasonably assume that within-pair differences in the number of days of absence reported (and therefore the costs) can be attributed to the fact that an individual suffered from insomnia. These extra costs are expressed as a mean ± the confidence intervals (CI) per employee and per year. The software used was SAS Enterprise Guide Version 2.0 (SAS Institute, Inc., Cary, NC).

RESULTS

Population Included in the Study

A total of 738 employees (369 pairs) were included in the analysis. The mean age was 43.8 years ± 8.9 (range: 21.0 to 63.0 years); 36.3% were men; 4.3% were blue-collar workers; 64.8% were white-collar workers, and 30.9% were managers; 23.3% worked in the public sector.

In terms of the main categories of medication taken by insomniacs and good sleepers, the only significant difference observed was for central nervous system medications: insomniacs took more of this class of medications than did good sleepers. The percentage of employees using central nervous system medications at least once were 11.9% and 0.8% (p < .001) for insomniacs and good sleepers, respectively. The 2 groups were equivalent in terms of child care (i.e., number of children at home). No data were available on elder care.

Absenteeism at Work

The work absences in the study population over a 2-year period are shown in Figure 2. The mean number of episodes of work absence per employee, per year, differed significantly between the 2 groups, with values of 1 ± 0.11 for insomniacs and 0.8 ± 0.08 for good sleepers (p = .001). Insomniacs were significantly more absent from work: 5.8 days ± 1.1 per year per employee for insomniacs, compared with 2.4 days ± 0.5 for good sleepers (p = .001). When considering only employees who were absent at least once, total work absence per employee per year was significantly greater for the insomniacs (11.5 days ± 1.9), compared with good sleepers (7.0 days ± 1.2) (p = .001). In other words, insomniacs were more frequently absent from work, and their absences lasted longer. The results for the different age groups, men and women, occupational category, and type of employer (public or private sector) for days of work absence (per employee per year) in the 2 groups are summarized in Table 1. We found a significant difference between the insomniacs and the good sleepers in all sub-

Table 2—Reported Medical Causes of Work Absence

Medical cause of work absence	Insomniacs (n=369)	Good sleepers (n=369)	p value
Respiratory diseases	18.16	13.82	.108
Trauma	8.94	6.78	.274
Gastrointestinal	9.76	5.96	.055
Visceral surgery	5.69	3.52	.16
Back problems	7.32	3.79	.037
Central nervous system diseases	15.45	5.96	< .001

Data are presented as percentages of subjects with medical cause of work absence. Medication classes with fewer than 5 subjects in each group are not shown. Statistical significance was established using the χ^2 analysis.

groups.

When analyzing the medical causes of work absence, we observed that 2 in particular (central nervous system diseases and back problems) were reported significantly more often by insomniacs. Comparisons between the 2 groups are summarized in Table 2.

The Costs of Absenteeism at Work in Our Sample

The mean (± CI) cost of work absenteeism (all contributors combined) was significantly higher for insomniacs than for good sleepers: € 2,511 (± € 504) and € 1,038 (± € 532), respectively, per employee, per year (p < .0001). For insomniacs, the mean annual cost of work absenteeism per employee per year could be broken down as follows: € 130 (± € 37) for the national health insurance system , € 382 (± € 97) in salary replacement and € 1813 (± € 356) in loss of productivity the employer, and € 184 (± € 50) for the employee. For the good sleepers, the corresponding costs were as follows: € 53 (± € 15) for national health insurance system, € 149 (± € 40) in salary replacement and € 752 (± € 165) in loss of productivity for the employer, and € 84 (± € 24) for the employee.

By subtracting the costs for insomniacs from those for good sleepers, we obtained a breakdown of the mean extra costs of insomnia-associated work absenteeism per employee, per year, for
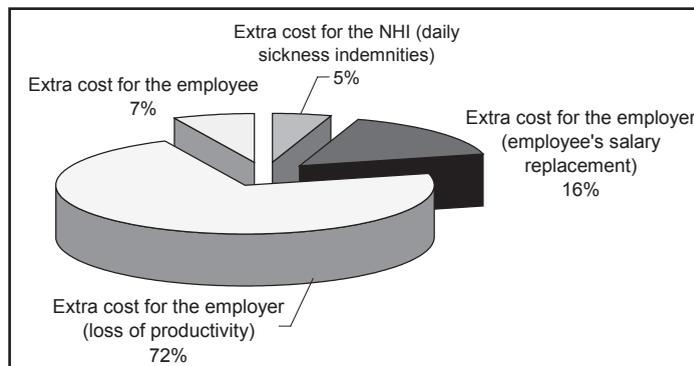

Figure 3—Work absences in the study population over a 2-year period

each of the 3 payers (Figure 3). The mean extra cost of insomnia-associated work absenteeism was estimated at €1,472 (± 545) per employee, per year. For the national health insurance system, the mean extra cost of insomnia-associated work absenteeism was estimated at € 77 (± € 39) per employee, per year. For employers, the extra cost attributable to insomnia was estimated at € 233 (± € 101) per employee, per year. The loss of productivity was evaluated at €1,062 (± € 386) per employee, per year. For employees, the extra cost related to insomnia was estimated at € 100 (± € 54) per employee, per year. These extra costs are presented by subgroup in Table 3.

DISCUSSION

This extra absence represents a cost for society that, in France, is mostly shouldered by employers. We are not aware of other published studies on the cost of insomnia-associated work absenteeism in France. In our research, the mean annual cost of absenteeism for insomniacs was estimated at € 2,511 (± € 504) per employee. To the best of our knowledge, only the now somewhat dated work of Stoller has calculated the cost of such absences (in the United States): $4,800 per insomniac, per year. However, the comparison is difficult, since Stoller included "accident and grievance costs," and "earnings were used to represent productivity."[13]

Table 3—Extra Costs of Insomnia-Associated Work Absenteeism

	%	Extra Cost[a]			
		To national health insurance	To employer, salary	To employer, lost productivity	To the employee
Sex					
Men	36.3	125 (±86)	177 (±166)	1090 (±179)	163 (±128)
Women	63.7	50 (±37)	265 (±129)	1045 (±449)	64 (±42)
Occupational category					
Manager	30.9	43 (±58)	365 (±650)	855 (±135)	105 (±269)
White-collar worker	64.8	96 (±53)	177 (±92)	1166 (±503)	101 (±52)
Blue-collar worker	4.3	46 (±171)	147 (±140)	982 (±1531)	45 (±143)
Category of employer, sector					
Public	23.3	-6 (±7)	648 (±338)	1654 (±828)	-9.3 (±12)
Private	76.7	102 (±51)	133 (±70)	885 (±436)	109 (±82)
Age, y					
≤ 35	19.2	49 (±70)	152 (±184)	937 (±774)	41 (±102)
36-50	50.3	87 (±57)	158 (±134)	899 (±537)	92 (±61)
> 50	30.5	77 (±77)	407 (±221)	1407 (±774)	148 (±131)

[a]Data are presented as mean (95% confidence interval) costs, in € per employee, per year. Conversions from Euros (€) into $US in this article were based on the exchange rate as of September 8, 2004: $1 = €0.83

The originality of our study lies in its analysis of the extra costs of insomnia-associated work absenteeism, estimated at € 1,472 (± € 545) ($1,773 ± [$657]) per employee, per year. By matching the employees in our sample on the main variables likely to influence work absences (age, sex, occupational category, and type of employer) and by excluding those suffering from chronic pathologies that lead to prolonged absenteeism at work, we can reasonably postulate that the difference in the number of days of absence reported (and therefore the costs) between paired individuals could be attributed to the fact that an individual was insomniac. Furthermore, our analysis of the medications taken by the subjects and the medical causes of work absence (Table 2) did not reveal any major, unexpected health-status imbalances between insomniac and good sleepers. Consequently, it seems probable that observed significant differences between insomniacs and good sleepers reflect the impact of insomnia itself, rather than the effects of comorbidities. The extra costs calculated here take into account both the employees' salary replacements and the productivity losses resulting from employees' absence. Although these costs are shared between the 3 main payers (the national health insurance system, the employer, and the employee), our study reveals that the largest share of the costs are assumed by employers, with the national health insurance system paying for only a minor proportion—about 5%. This is due to 2 factors: firstly, the conditions under which the system pays sickness indemnities (the exclusion of employees in the public sector, the 3-day delay before paying indemnities, and reimbursement of only 50% of the gross salary, with an upper limit in the private sector) and, secondly, the fact that 22% of the patients (working in the private sector) seen by occupational physicians are absent from work for less than 3 consecutive days and, therefore, do not incur costs to the national health insurance system. Hence, employers pay a major part of the extra cost (88% in our study). This is mainly because public-sector employees continue to receive their full salary. Since the precise conditions for private-sector workers (defined by labor agreements) were not available, we used a mean estimate of the costs borne by employers when supplementing sickness indemnities.[31] Loss of productivity (representing 72% of the extra costs due to absenteeism at work) was assigned a value using the human capital method, that is to say, by attributing to lost workdays the added value not actually accrued during this period. This method does not take into account the fact that employers can adjust to the absence of their employees, either by assigning the work to others or by hiring temporary staff. With respect to this question, a Dutch study[32] on the social costs of migraine showed that the lost working time due to absences led to a work-productivity reduction that was less than fully proportional to the time lost, with an elasticity of 0.8. This probably means that we overestimated productivity losses in our study.

Our study was conducted in a highly developed economic region of France: the criteria for funding work absenteeism are state specific and therefore not directly applicable to other countries. We estimated the cost of insomnia-associated work absenteeism at € 1,472 per individual per year in a region (Paris – Ile de France) in which the the gross domestic product has been calculated as € 76,024 per employee per year.[33] The costs of insomnia-related work absences therefore constitute approximately 2% of the gross domestic product. Even though our results cannot be applied directly to the whole of France (let alone internationally), this benchmark of 2% of the gross domestic product could be used to make estimates in other countries, with respect to their level of economic activity and the modalities of their national insurance systems.

CONCLUSION

The results of our research show that insomnia-associated work absenteeism is expensive and that, in contrast to the generally held belief, the expense is borne primarily by employers. Moreover, our calculations probably underestimate the real costs, since we did not take into account productivity losses associated with performance impairment (e.g., irritability, fatigue, errors), which pose real problems in terms of measurement and value assignment. If our common objective is to reduce societal costs, occupational health centers and primary care physicians probably have a major role to play in the early detection of sleep disorders and in directing patients toward adequate care provision (medical care and suitable working conditions).

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