

BMJ Open Shift work, night work and sleep disorders among pastry cooks and shopkeepers in France: a cross-sectional survey

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ABSTRACT

Objective Most research on night and shift work focuses on employee health in large companies, primarily in the healthcare and transportation sectors. However, many night workers work on their own or in small businesses related to services or food. This survey focuses on sleep habits and disorders concerning night work in pastry production and sales.

Methods An epidemiological telephone cross-sectional survey of night shift workers and their sleep habits was proposed to all employers and employees in the French pastry industry via their insurance health prevention company. Sleep logs allow us to estimate the total sleep time (TST) on workdays and enquire on napping episodes and length. In order to estimate the ideal TST, we added a question on the ideal amount of sleep the subjects need to be in good shape in the morning. We also define sleep debt as the difference between the ideal TST and TST on workdays, and considered a sleep debt when the difference was above 60 min and severe sleep debt above 90 min. Finally we retained subjects as long sleepers for those with a TST of more than 7 hours and short sleepers when TST was under 5 hours. Insomnia, sleepiness and sleep apnoea have been defined based on the International Classification of Sleep Disorders-Third Edition and the classification of mental disorders (Diagnostic and Statistical Manual of Mental Disorders-Fifth Edition). Bivariate and multivariate logistic regression models were applied to investigate the association with short TST, long TST, sleep debt and napping.

Results We analysed 2622 complete questionnaires from 1313 men and 1309 women aged 22–50 years old. 1397 workers began work before 07:00, whereas 1225 began later. The 24-hour TST was 6.7 ± 1.4 hours, whereas the ideal TST was 7.0 ± 1.2 hours. Severe sleep debt (>90 min) was reported by 6% women versus 5% men, whereas moderate sleep debt (>60 min) was reported by 11.5% women versus 9.3% men. Napping is one way to improve 24-hour TST for 58% of pastry producers (75 ± 13 min) and 23% of shopkeepers (45 ± 8 min). Nevertheless, 26.2% of the respondents complained of chronic insomnia, especially women aged 45–54 years old (31%). Finally, 29.6% had evocative criteria for obstructive sleep apnoea, although only 9.1% had a high score on the Berlin Questionnaire.

Strengths and limitations of this study

- The study successfully uses a unique setting of pastry producers and shopkeepers to renew the discussion surrounding the medical impact of night shifts and work schedules on sleep habits and disorders.
- Questionnaires and sleep logs, based on the definitions of the International Classification of Sleep Disorders and the Diagnostic-Third Edition and the Statistical Manual of Mental Disorders-Fifth Edition were used to assess total sleep time and sleep debt, at night and during each 24-hour period.
- The cross-sectional telephone survey did not provide any explanations on how obesity in pastry professionals may be partially attributed (or not) to sleep debt or sleep disorders.
- The survey, based only on questionnaires, lacks objective assessment by polysomnography or actigraphy and contains no clinical interviews.

Conclusion Our study demonstrates that both pastry producers and shopkeepers can have disturbed sleep schedules and a high prevalence of sleep disorders, although many have used napping as a behavioural countermeasure to fight sleep debt. The results of our survey lead us to conclude that, besides the need to take care of night workers in big industries, more information and occupational prevention must be focused on night workers in individual and small businesses.

INTRODUCTION

In France, one in five workers can be categorised as a night and/or shift worker. According to French legislation, an employee is considered as a night worker when he or she works for 3 hours between 21:00 and 06:00, at least twice per week. In 2012, 15.2% of French workers (9% of all working women and 21.4% of all working men) worked at night, which represents an increase in comparison with the 13% working at night in 1991, as well as a higher representation

among working women (9% in 2009 vs 5.8% in 1991).¹ The prevalence of night and shift work is greatest among workers in critical services and public utilities such as healthcare, transportation (42%), and police and fire protection (72%). However, night and shift workers are also found in many small businesses; for example, the proportion has been estimated at 37% for butchers and bakers.¹

These night and shift work schedules lead employees to work during periods usually devoted to rest (ie, eating and sleeping), as well as social and familial activities. These irregular hours can include night work, extended work hours, weekend work, fragmented work hours during the day, and irregular variations in the cycle of the number of workdays and work periods. Both night and shift work complicate lifestyle and are associated with the risks of reduced sleep time, increased circadian disturbances and, frequently, psychosocial stress.² Although there is clear individual variability in night and shift work adaptation (ie, delayed, advanced or absent shift phases),³ the majority of night and shift workers do not adapt their biological rhythms since their work periods occur during the critical hours of melatonin secretion.⁴ This has three implications for such workers: they are active during a period when brain and body functions slow down; they sleep during a period of minimal sleep propensity; and they are subjected to consecutively shorter and less refreshing daytime sleep.

Depending on their age and sociofamilial cues, many night and shift workers also have difficulties keeping regular social lifestyles. This results in a deleterious sleep debt, which may be associated with increased cardiovascular and metabolic risks, as well as breast cancer pathogenesis.^{5–7}

Along with gender or age-related differences in adapting to night and shift work, there are also interindividual differences in the patterns of sleep debt recovery and circadian misalignments that may be related to the particular occupation. Indeed, 'blue collar' night shift workers in an industrial plant do not face the same demands as self-employed pastry producers. In contrast to the numerous surveys that have been conducted in medical settings among night shift nurses or residents, only a few surveys have focused on self-employed manual workers or small business employers. To our knowledge, there is barely any literature about night work in pastry producers, even though this is one of the better known night occupations in our society. More precisely, several surveys have focused on occupational asthma⁸ or health assessment⁹ in pastry producers, but no surveys have addressed sleep.

In the present study, we provide the results from our survey on the sleep habits and disorders in employers and employees of small French pastry businesses. We also report how these workers typically cope with their shifts and night schedules.

MATERIALS AND METHODS

Subjects and sampling design

To be eligible, each subject had to be affiliated with the national pastry producers database, which includes all self-employed French pastry producers as well as employees of small pastry businesses.

We conducted a cross-sectional study based on telephone surveys using a randomised selection of pastry producers from the national database, using a computerised system (CATI) to select unrestricted mobile and home phone numbers. In the event of no answer or a busy line, the interviewees were called again, up to five times at different times of the week. Pastry producers who did not call back were excluded. The contact methodology was designed such that the sex ratio and age groups constituted a representative sampling of pastry producers.

Patient and public involvement statement

The questionnaire has been discussed with the pastry maker trade union referees in order to improve participant comprehension of the survey. All pastry makers affiliated with the national pastry producers database, which includes all self-employed French pastry producers as well as employees of small pastry businesses, had received information on the survey via email or phone calls. Results have been presented to the professionals via the diffusion of a PowerPoint presentation to the trade unions and information on sleep hygiene and management via a webphone application iSommeil (in English iSleeping).

Measurements

Assessing sleep habits and disorders

Previous reports have tested and introduced sleep assessments in several national health surveys on sleep and health.^{10–12} These sleep-specific measurements were based on confirmed sleep logs recommended for sleep assessments in adults¹³ on regular (non-leisure) days. As our survey was designed to be conducted on a single day, we employed several phrases to assess the total sleep time (TST):

Estimating TST and napping on workdays

1. 'When you have to work the following day, at what time do you usually turn off the light to go to sleep?'
2. 'When you have to work the following day, at what time do you usually wake up?'
3. 'How long does it usually take for you to fall asleep?'
4. 'If you have awakenings during the night, how long do they usually last (in minutes)?'
5. 'Do you regularly nap during workdays? If yes, how often and for how long?'

TST during work periods was defined as the difference between the time at which the participant turns off the light and the time at which he/she wakes up, discounting the time needed to fall asleep and the time to awaken.

Estimating ideal sleep and sleep debt

In accordance with the literature, we adapted our definition of sleep debt, which may reflect voluntary (due to

work conditions, transport or leisure) sleep shortening, by adding the following item to the questionnaire. The question aims to quantify the amount of sleep needed by each subject in order to be in good shape during the workday.

1. 'Ideally, if you were able to decide the number of hours of sleep you need to be in good shape, how much time would you wish to devote to sleep? /___/___/ hours/___/___/min'.

We defined sleep debt as the difference between TST 'needed to be in good shape' and TST at night during the work week; this value was referred to as sleep debt when it was >60 min and as severe sleep debt when it was >90 min.

Sleep characteristics and disorders were defined as follows:

- 'Long sleep': according to the International Classification of Sleep Disorders-Third Edition (ICSD-3), 'a long sleeper is an adult who typically sleeps 7 hours or more, but feels well and functions without impairment'.¹²
- 'Short sleep': in adults, sleeping less than 5 hours during workdays is usually considered as the cut-off for 'short sleep' with potential comorbidities.^{10 11} We then strictly defined 'short sleepers' as those workers sleeping less than 5 hours.
- Insomnia: according to the definitions of the Diagnostic and Statistical Manual of Mental Disorders-Fifth Edition, ICSD-3 and the American Academy of Sleep Medicine,^{14 15} insomnia is defined as difficulty initiating sleep, difficulty maintaining sleep, early morning awakening or non-restorative sleep, with a frequency of at least three times per week for at least 1 month and with a negative impact on daytime functioning.

Based on these characteristics, we defined the three following categories: no sleep disorders when no difficulties were mentioned; poor sleep when at least one difficulty was mentioned less than three times per week; and insomnia, when it follows the previous definition.

We also posed a specific question on how frequently the subjects experienced sleep disorders during the past 8 days: not at all, a few times, a lot and 'do not know'.

- Sleep apnoea was assessed subjectively via the Berlin Questionnaire.¹⁶
- Sleepiness was based on the answers to the nine items of the Epworth Sleepiness Scale (ESS).¹⁷ A score above 10 indicates sleepiness and above 16 indicates severe sleepiness.

Other variables assessed

- Chronotype was assessed by one single question from the Horne and Ostberg Questionnaire,¹⁸ which asks whether the subject thinks they are absolutely a morning person, almost a morning person, absolutely an evening person, almost an evening person, and neither a morning nor an evening person or both.
- Transportation time every day, from home to work and back again.

- Sleeping with your mobile phone turned on beside the bed.

Statistical analysis

Bivariate and multivariable logistic regression models were applied to investigate if any risk factors were independently associated with short TST, long TST and napping. Analyses were performed using the R V.2.12.1 software. The statistics presented (percentages, ORs) correspond to weighted and adjusted results. We used Pearson's χ^2 tests in the bivariate analysis; ORs are presented with their 95% CIs.

RESULTS

Sociodemographics

Out of the 7694 phone calls directed to pastry professionals, 11.95% refused to participate while 53% did not complete the full interview. In the end, 2622 complete questionnaires were analysed (comprising 1313 men and 1309 women, with an age range of 22–50 years), yielding a 34% response rate (figure 1). The mean telephone interview duration was 17 min and 45 s. The sex, age and occupation distributions of the participants did not differ significantly within the distribution of respondents and are presented in table 1.

The average declared weight of the participants was 70±15 kg. The participants reported an average change in weight of 4±6 kg over the last 5 years; 9.1% gained 10–14 kg and 6.9% gained ≥15 kg. Furthermore, 27% of the participants were considered overweight (with a body mass index (BMI) of ≥25 but <30), whereas 10% were obese (BMI >30). Men were more obese than women across all age groups ($p<0.001$).

Work characteristics

Of the subjects, 262 were either self-employed or employees, and 1520 (78% men) worked in pastry

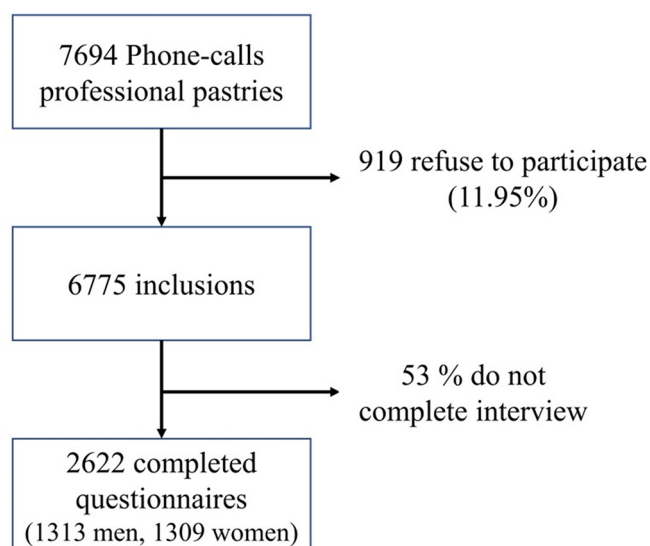


Figure 1 Flow chart of selection of questionnaire respondents.

Table 1 Characteristics of the population interviewed

Characteristics	Men (%)	Women (%)	Total (%)
N	1313 (50)	1309 (50)	2622 (100)
Age (years)			
16–24	426 (59)	302 (41)	728 (28)
25–34	290 (50)	293 (50)	583 (22)
35–44	195 (46)	232 (54)	426 (16)
45–54	269 (48)	294 (52)	563 (21)
55–64	134 (42)	188 (58)	322 (12)
Activity			
Producer	1184 (78)	336 (22)	1520 (58)
Shopkeeper	129 (12)	973 (88)	1102 (42)
Status			
Employers	193 (74)	69 (26)	262 (10)
Employees	1120 (47)	1240 (53)	2360 (90)
Work start			
Before 07:00	1011 (72)	386 (28)	1397 (53)
After 07:00	302 (25)	923 (75)	1225 (47)
Body weight (kg)			
<70	383 (29)	923 (71)	1306 (50)
70–79	390 (63)	232 (37)	622 (24)
80–89	281 (75)	95 (25)	376 (14)
90–99	164 (80)	41 (20)	205 (8)
>100	95 (84)	18 (16)	113 (4)

production, whereas 1562 subjects worked in sales in pastry shops (88% women). The subjects have held the same occupation for 1–15 years. Of the subjects, 84.9% worked full time (table 1).

Work schedules, based on the start of a typical shift hour, are presented in figure 2. Most pastry producers at production sites were night workers, of whom 75% began their shift between 03:00 and 07:00, in comparison with 83% of pastry shopkeepers who began work between 06:00 and 09:00.

Sleep patterns

The average TST at night was 6.3 ± 5.5 hours in the total group, with a minimum of 5.5 hours for men (35–44 years old) and a maximum of 6.9 for women (25–34 years old). The distributions of the ideal TST, 24-hour TST and TST at night among sex, work (producers or shopkeepers) and employee versus employer status, work start time, body weight and napping are detailed in table 2.

The ideal TST was significantly greater in the following groups: women, pastry shopkeepers, employees, subjects who started their job after 07:00, subjects weighing less than 70 kg and subjects who do not regularly nap. This ideal TST was on average 7.0 ± 1.2 hours in duration; 63.6% of the subjects declared needing more than 7 hours, 33.8% declared needing 5–7 hours and 2.6% declared needing less than 6 hours of sleep.

Night TST was smaller than the ideal TST for each category and was significantly lower ($p < 0.01$) in the following groups: male pastry producers, employers, those starting work before 07:00, those weighing more than 100 kg and those who took naps. However, taking into account nap length, 24-hour TST increased significantly in almost all categories and did not differ from the ideal TST in producers and subjects who napped.

The amount of sleep debt in 24 hours was significantly higher in the following groups: women, shopkeepers, employers, subjects weighing less than 70 kg and subjects who did not take naps.

Forty-three per cent of the subjects reported napping on a regular basis, concerning 23% of shopkeepers versus 58% workers at production sites ($p < 0.01$). Napping also increased with age in men and women, in shopkeepers and in production staff. Nap duration was significantly different between production staff (75 ± 13 min) and shopkeepers (45 ± 8 min) ($p < 0.01$). In both groups, nap duration decreased regularly with increasing age groups.

Regarding chronotype, 54.1% considered themselves as ‘absolutely or almost a morning person’, 20.7% as ‘absolutely or almost an evening person’, 19% as ‘both’, 4% as ‘neither’ and the final 2% were uncertain.

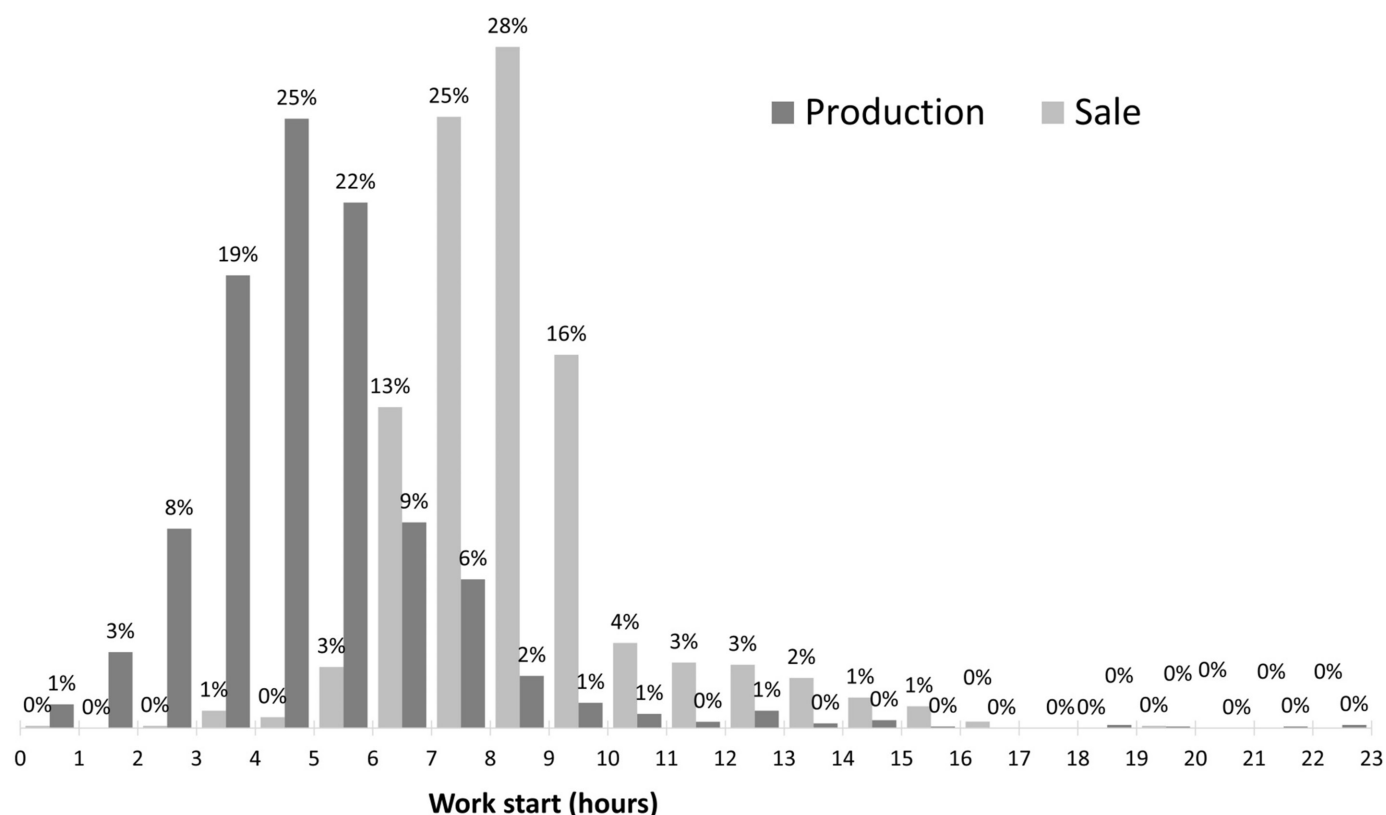


Figure 2 Work start schedule according to the job.

More than one out of two subjects (57%) reported sleeping with their mobile phones turned on next to their bed.

Sleep disorders

Of the respondents, 26.2% complained of chronic insomnia according to the ICSD-3 definition. The highest rate observed was for women in comparison with men, regardless of age group (24.1% vs 19.5%; $p<0.05$), with the highest rate (31%) occurring for women aged 45–54 years old (tables 3, 4 and 5).

Sleep debt did not significantly differ between women and men: 6% of women vs 5% of men reported severe sleep debt (>90 min), while 11.5% of women vs 9.3% of men reported moderate sleep debt (>60 min). In addition, the rate of severe sleep debt did not differ among age groups. Subjects exhibiting obesity had a 14% risk of severe sleep debt, in comparison with 19% of subjects with a normal weight ($p<0.02$).

Out of the total group, 12.4% complained of moderate excessive sleepiness (ESS >10) while 2.9% reported severe excessive sleepiness (ESS >16), with no differences between the sexes. Men aged 45–54 years reported the highest rate (23%), in comparison with 13% in the age group 35–44 years old ($p<0.01$). Of the subjects, 21.1% reported sleeping frequently while driving. Subjects exhibiting obesity had a non-significantly higher risk of excessive sleepiness in comparison with subjects with a normal weight ($p<0.001$).

On the Berlin Questionnaire, 29.6% of the subjects had a score indicating a risk of obstructive sleep apnoea (OSA), which was significantly higher in men than in women ($p<0.01$); out of this group, 40.8% had a low score, 50.1% had a moderate score and 9.1% had a high score. A high risk score of sleep apnoea also increased significantly according to age group, from 5% in the age group 15–24 years old vs 19% in the age group >55 years old ($p<0.001$). Subjects exhibiting obesity had a 50% higher risk of OSA, in comparison with 3% for subjects with a normal weight ($p<0.001$).

Sleep habit disorders and work characteristics

Short sleepers (receiving less than 5 hours of sleep per night) represented 78.8% of the subjects working at production sites (vs 21.2% in pastry shops) ($p<0.001$). This category concerns 28% of subjects who usually begin their shift before 07:00, as compared with 7.4% of subjects with later schedules ($p<0.001$) (tables 2, 3, 4 and 5).

Insomnia was reported at a significantly higher level by shopkeepers (32.8%) than by pastry producers (22.5%) ($p<0.05$) (table 3), as well as by participants who begin work after 07:00. Severe sleep debt was significantly higher in employees and shopkeepers than in employers and producers, and increased for workers with earlier schedules. Severe sleepiness was significantly higher in producers, employers and subjects who begin work after 07:00, as compared with the other categories. OSA cannot explain these differences, since

Table 2 Distribution of ideal TST, 24-hour TST, night TST, 24-hour sleep debt and night sleep debt among sociodemographics, body weight categories and the habit of napping regularly (mean and SD)

	N	Ideal TST (hours)	24-hour TST (hours)	Night TST (hours)	24-hours sleep debt (min)	Night sleep debt (min)
All participants	2622	7.0±1.2	6.7±1.4	6.3±5.5	12.6±88.7	41.5±90.2
Sex						
Women	1309	7.4±1.1	Ref	Ref	22.6±91.7	Ref
Men	1313	6.7±1.2	***	***	2.7±87.0	***
Work						
Producer	1520	6.7±1.2	Ref	Ref	6.1±90.7	Ref
Shopkeeper	1102	7.4±1.1	***	***	22.8±87.9	***
Status						
Employer	262	6.7±1.2	Ref	Ref	24.4±82.2	Ref
Employee	2360	7.0±1.2	**	**	11.9±90.7	*
Work start						
Before 07:00	1397	6.7±1.2	Ref	Ref	15.2±91.0	Ref
After 07:00	1225	7.4±1.2	***	***	10.9±88.2	***
Body weight (kg)						
<70	1306	7.2±1.2	Ref	Ref	18.2±93.6	Ref
70–79	622	6.9±1.3	6.7±1.5	*	13.2±87.1	
80–89	376	6.8±1.1	*	**	6.9±87.4	*
90–99	205	6.7±1.2	**	***	2.7±74.5	**
>100	113	6.5±1.3	***	***	3.5±92.5	**
Nap						
Yes	1474	6.8±1.3	Ref	Ref	2.6±92.0	Ref
No	1148	7.1±1.2	***	***	25.3±86.3	***

Values are mean±SD.
24-hour sleep debt=ideal TST–24-hour sleep; night sleep debt=ideal TST–night TST.
Difference vs ref: *p<0.05, **p<0.01, ***p<0.001.
Difference vs ideal TST: †p<0.05, †† p<0.01.
Ref, reference; TST, total sleep time.

Table 3 Distribution of sleep disorders (no troubles, poor sleep, insomnia) among sociodemographics, body weight categories and the habit of napping regularly (mean and SD)

	N	No sleep troubles (%)	OR (95% CI)	Poor sleep (%)	OR (95% CI)	Insomnia (%)	OR (95% CI)
All participants	2622	1042 (39.7)		614 (23.4)		704 (26.7)	
Sex							
Women	1309	433 (33.1)	Ref	304 (23.2)	Ref	447 (24.1)	Ref
Men	1313	609 (46.4)	1.8 (1.5 to 2.1)*	310 (23.6)	1.0 (0.9 to 1.2)	257 (19.5)	0.5 (0.4 to 0.6)*
Activity							
Producer	1520	661 (43.5)	Ref	360 (23.7)	Ref	342 (22.5)	Ref
Shopkeeper	1102	381 (34.6)	0.7 (0.6 to 0.8)	254 (23.0)	0.9 (0.8 to 1.2)	362 (32.8)	1.7 (1.4 to 2.0)*
Status							
Employers	262	105 (40.1)	Ref	47 (17.9)	Ref	83 (31.7)	Ref
Employee	2360	937 (39.7)	1.0 (0.8 to 1.3)	567 (24.0)	1.5 (1.0 to 2.0)	621 (26.3)	0.8 (0.6 to 1.0)
Work start							
Before 07:00	1397	600 (42.9)	Ref	332 (23.7)	Ref	317 (22.7)	Ref
After 07:00	1225	442 (36.1)	0.8 (0.7 to 0.9)*	282 (23.0)	0.9 (0.8 to 1.2)	387 (31.6)	1.6 (1.3 to 1.9)*
Body weight (kg)							
<70	1306	482 (36.9)	Ref	313 (23.9)	Ref	393 (20.1)	Ref
70–79	622	261 (41.9)	1.2 (1.0 to 1.5)	147 (23.6)	1.0 (0.8 to 1.3)	157 (25.2)	0.8 (0.6 to 1.0)
80–89	376	162 (43.1)	1.3 (1.0 to 1.6)	78 (20.7)	0.8 (0.6 to 1.1)	86 (22.8)	0.7 (0.5 to 0.9)
90–99	205	93 (45.4)	1.4 (1.1 to 1.9)	42 (20.4)	0.8 (0.6 to 1.2)	40 (19.5)	0.6 (0.4 to 0.8)
>100	113	44 (38.9)	1.1 (0.7 to 1.6)	34 (30.0)	1.4 (0.9 to 2.1)	20 (17.7)	0.5 (0.3 to 0.8)
Nap							
Yes	1474	570 (39.7)	Ref	327 (22.2)	Ref	433 (29.3)	Ref
No	1148	472 (41.1)	1.1 (0.9 to 1.3)	287 (25.0)	1.2 (0.5 to 1.4)	271 (23.6)	0.7 (0.6 to 0.9)

According to the definitions of the Diagnostic and Statistical Manual of Mental Disorders-Fifth Edition, the International Classification of Sleep Disorders-Third Edition and the American Academy of Sleep Medicine, insomnia is defined as difficulty initiating sleep, difficulty maintaining sleep, early morning awakening or non-restorative sleep, with a frequency of at least three times per week for at least 1 month and with a negative impact on daytime functioning. We retained the three following categories based on these items: no sleep disorders when no difficulty at all was mentioned, poor sleep when at least was mentioned less than three times a week and insomnia when it follows the previous definition.

*Difference vs ref.

Ref, reference.

Table 4 Distribution of sleep debt (moderate and severe) and hypersomnolence among sociodemographics, body weight categories and the habit of napping regularly (mean and SD)

	N	Moderate sleep debt >60 min, severe sleep debt >90 min			Hypersomnolence based on ESS score				
		>60min (%)	OR (95% CI)	>90min (%)	OR (95% CI)	ESS >10 (%)	OR (95% CI)	ESS >16 (%)	OR (95% CI)
All participants	2622	268 (10.2)		145 (5.5)		323 (12.3)		77 (2.9)	
Sex									
Women	1309	146 (11.5)	Ref	79 (6.0)	Ref	145 (11.1)	Ref	31 (2.3)	Ref
Men	1313	122 (9.3)	0.8 (0.6 to 1.1)	66 (5.0)	0.8 (0.6 to 1.2)	178 (13.5)	1.3 (0.1 to 1.6)	46 (3.5)	1.5 (0.9 to 2.4)
Activity									
Producer	1520	132 (8.6)	Ref	67 (4.4)	Ref	224 (14.7)	Ref	57 (3.8)	Ref
Shopkeeper	1102	136 (12.3)	1.5 (1.1 to 1.9)*	78 (7.1)	1.7 (1.2 to 2.3)*	99 (8.9)	0.6 (0.5 to 0.7)*	20 (1.8)	0.5 (0.3 to 0.8)*
Status									
Employer	262	13 (4.9)	Ref	6 (2.3)	Ref	43 (16.4)	Ref	15 (5.7)	Ref
Employee	2360	255 (10.8)	2.3 (1.3 to 4.1)*	139 (5.9)	2.7 (1.2 to 6.1)*	280 (11.8)	0.7 (0.5 to 1.0)	62 (2.6)	0.4 (0.2 to 0.8)*
Work start									
Before 07:00	1397	80 (5.7)	Ref	45 (3.2)	Ref	215 (15.4)	Ref	57 (4.0)	Ref
After 07:00	1225	188 (15.3)	2.9 (2.3 to 3.9)*	100 (8.2)	2.7 (1.9 to 3.8)*	108 (8.8)	0.5 (0.4 to 0.7)*	20 (16.3)	0.4 (0.2 to 0.7)*
Body weight (kg)									
<70	1306	147 (11.2)	Ref	84 (6.4)	Ref	151 (11.6)	Ref	33 (2.5)	Ref
70–79	622	54 (8.6)	0.8 (0.5 to 1.0)	23 (3.7)	0.6 (0.3 to 0.9)	85 (13.7)	1.2 (0.9 to 1.6)	18 (2.9)	1.2 (0.7 to 2.2)
80–89	376	37 (9.8)	0.9 (0.6 to 1.3)	19 (5.1)	0.8 (0.5 to 1.3)	45 (11.9)	1.0 (0.7 to 1.5)	17 (4.5)	1.9 (1.0 to 3.4)
90–99	205	16 (7.8)	0.7 (0.4 to 1.1)	12 (5.8)	0.9 (0.5 to 1.7)	26 (12.7)	1.1 (0.7 to 1.7)	6 (2.9)	
>100	113	13 (11.5)	1.0 (0.6 to 1.9)	7 (6.2)	1.0 (0.4 to 2.1)	16 (12.2)	1.3 (0.7 to 2.2)	2 (2.8)	
Nap									
Yes	1474	75 (6.5)	Ref	41 (2.7)	Ref	152 (10.3)	Ref	46 (3.2)	Ref
No	1148	193 (13.1)	1.5 (1.4 to 1.6)*	104 (9.1)	3.5 (2.4 to 5.0)*	171 (14.9)	1.5 (1.2 to 1.9)*	31 (2.7)	0.9 (0.5 to 1.4)

Sleep debt is the difference between TST 'needed to be in good shape' and TST at night during week days and referred to sleep debt when it was >60min and to severe sleep debt >90min. Hypersomnolence was based on the answers to the nine items of the Epworth Sleepiness Scale (ESS)¹⁷; a score above 10 indicating hypersomnolence and above 16 severe hypersomnolence.

*Difference vs ref.

Ref, reference; TST, total sleep time.

Table 5 Distribution of obstructive sleep apnoea (OSA) risk (low, medium and high) among sociodemographics, body weight categories and the habit of napping regularly (mean and SD)

	N	OSA risk (Berlin Questionnaire)				
		Low (%)	OR (95% CI)	Medium (%)	OR (95% CI)	High (%)
All participants	2622	1069 (40.8)		1314 (50.1)		239 (9.1)
Sex						
Women	1309	575 (43.9)	Ref	629 (48.1)	Ref	105 (8.0)
Men	1313	494 (37.6)	0.8 (0.7 to 0.9)*	685 (52.2)	1.2 (1.1 to 1.4)*	134 (10.2)
Activity						
Producer	1520	584 (38.4)	Ref	788 (51.8)	Ref	148 (9.7)
Shopkeeper	1102	485 (44.0)	1.3 (1.1 to 1.5)	526 (47.7)	0.9 (0.7 to 1.0)	91 (8.5)
Status						
Employer	262	75 (28.6)	Ref	142 (54.2)	Ref	45 (0.17)
Employee	2360	994 (42.1)	1.8 (1.4 to 2.4)*	1172 (49.7)	0.8 (0.6 to 1.1)	194 (0.82)
Work start						
Before 07:00	1397	542 (38.8)	Ref	717 (51.3)	Ref	138 (9.9)
After 07:00	1225	527 (43.0)	1.2 (1.1 to 1.4)*	597 (48.7)	0.9 (0.8 to 1.1)	101 (8.2)
Body weight (kg)						
<70	1306	677 (51.8)	Ref	584 (44.7)	Ref	45 (3.4)
70–79	622	253 (40.7)	0.6 (0.5 to 0.8)*	331 (53.2)	1.4 (1.2 to 1.7)*	38 (6.2)
80–89	376	107 (28.4)	0.4 (0.3 to 0.5)*	219 (58.2)	1.7 (1.4 to 2.2)*	50 (23.3)
90–99	205	31 (15.2)	0.2 (0.1 to 0.3)*	111 (54.1)	1.5 (1.1 to 2.0)	63 (30.7)
>100	113	1 (0.8)		69 (61.0)	2.0 (1.3 to 2.9)*	43 (38.6)
Nap						
Yes	1474	634 (43.1)	Ref	727 (49.3)	Ref	113 (7.6)
No	1148	435 (37.9)	0.8 (0.7 to 0.9)	587 (51.1)	1.1 (0.9 to 1.3)	126 (10.9)

Sleep apnoea risk was assessed subjectively via the Berlin Questionnaire.¹⁶

*Difference vs ref.

Ref, reference.

the rate of OSA did not differ among the various work characteristics.

DISCUSSION

This study examines the unique setting of pastry producers and shopkeepers, providing a valuable opportunity to revisit the medical impact of work schedules on sleep habits and disorders. It is well reported that night work or irregular shifts have consequences on sleep, sleepiness and health, notably including metabolism, cardiovascular diseases^{19 20} and even breast cancer.²¹ These disorders have been attributed to the biological desynchronisation that affects melatonin and other hormonal cycles around the 24-hour cycle,²² as well as the amount of sleep debt that is associated with numerous metabolic and cardiovascular disorders. Night and shift work sleep disorders have been described and classified in the ICSD-3.¹⁴

Prior to this study, most of the literature devoted to shift work disorders was based on studies conducted on employees of large companies, especially in industry, transportation, energy, police and health.^{23 24} The latter occupations concern civil servants, who can be compensated for their night work with less hours of work per week than regular workers, early retirement or even pay that is on average 20% more than regular workers.²⁵

To our knowledge, few studies have been devoted to small business workers and shopkeepers. For this reason, we chose to focus on pastry producers and shopkeepers, who are well known for their night-shifted business. Indeed, we observed in our survey that a large number of professionals in the pastry industry had disturbed sleep schedules and sleep disorders. However, the subjects differ from one group to the other, depending on their autonomy and ability to cope with their shifts and schedules.

In comparison with the total group, pastry producers at production sites exhibited the most reduced TST at night (5.9 ± 1.5 hours vs 6.9 ± 5.9 hours). These workers were mostly men who began their work at the earliest hours (in the middle of the night). Therefore, it should not be surprising that they declared the most important sleep debt in our survey. However, we also observed that this group reported the longest, most frequent periods of napping among our study groups (62.2 min vs 25.4 min).

With the help of napping, subjects were able to situate their 24-hour TST closer to the 7 hours recommended for regular workers. This group of independent professionals has therefore applied the recommendations that are given for night and shift workers.²⁶ Indeed, napping is recognised as an excellent means to increase TST in night workers.²⁷ Specifically, it may help them to improve daytime alertness,^{28 29} to reduce the risk of accidents while driving, and even to reduce the metabolic and cardiovascular risks associated with chronic short sleep.^{30 31}

In our subgroup of pastry producers, the proportion of respondents who experienced sleepiness while driving was clearly high (21.1%). Furthermore, the percentage of obesity and overweight workers was greater than in

the general population.^{32 33} It must be noted that this is a cross-sectional survey and we cannot conclude on the relationship between TST, napping and being overweight. Certainly, pastry producers can be susceptible to other possible causes of obesity, but these were not investigated in this survey. Aside from reduced TST and weight issues, we also observed a high risk of OSA in our participants (10.2% in men vs 8% in women, $p < 0.05$). It is important to assess this risk, since surveys of night and shift work have mainly drawn conclusions on the effect of sleep debt on sleepiness, without assessing OSA. Indeed, OSA is a major cause of sleepiness, and it is important, even within the workplace, to not overlook the possibility of sleep disorders such as OSA that are associated with other causes of sleepiness.

It is important to note that the definition of 'sleep debt' that we have applied in this study is based on the difference between TST on work days and an 'ideal sleep' (according to the interviewed subjects). However, it was previously demonstrated that sleep duration beliefs may augment and bias the ideal sleep duration reported by subjects, in particular in individuals with symptoms of insomnia.³⁴ Thus, there is the possibility that this may have artificially increased the amount of 'sleep debt' reported in our survey responses.

Aside from the previous findings, pastry shopkeepers had the highest rate of insomnia. These subjects were mainly women, and a high percentage also had early work hours, even if this is not similar to pastry producers who must rise in the middle of the night.³⁵ An early work schedule, including opening a shop at 06:00 or 07:00, ideally requires going to bed not too late, which can be difficult when the worker must close the shop at 19:00 or 20:00. This group of shopkeepers is also affected by a short sleep period (21.2% of respondents had a TST less than 5 hours) and by sleep debt (7.1% of respondents). In addition to early morning work, a number of working conditions can influence insomnia, including stress induced by the management of personal affairs and occasionally difficult relationships with clients. However, our survey was not concerned with these possible causes. Moreover, it may be possible that when considering ideal sleep, subjects should not think of it in terms of occurring within a 24-hour period, but rather as ideal sleep in one single episode of night sleep. This point may have also biased the concept of sleep debt.

Finally, we acknowledge that our study has several limitations. First, this is a questionnaire study, and sleep habits and disorders assessed by questionnaires and phone calls can only reflect the subjective feelings of the people interviewed. By comparison, objective measurements of sleep such as polysomnography or actigraphy are considered the gold standards for assessing sleep and sleep disorders.¹⁴ In addition to these complementary assessments, some clinical diagnoses, such as insomnia, must be confirmed by clinical interviews. Nevertheless, the participants in our study completed questionnaires that were based on consensual international

classifications^{14 15} and that have previously been used in many studies in the general population.^{10–12} Second, the response rate to our survey was quite low; thus, it is not possible to consider the sample as a representative group of pastry producers and shopkeepers. However, the sociodemographic characteristics of the subjects who accepted to be interviewed, which comprised a reasonable group of workers, did not differ from pastry professionals in the broader population.

In conclusion, our study demonstrates that both pastry producers and shopkeepers can have disturbed sleep schedules and a high prevalence of sleep disorders, although many have used napping as a behavioural countermeasure to fight sleep debt. The results of our survey lead us to conclude that, besides the need to take care of night workers in big industries, more information and occupational prevention must be focused on night workers in individual and small businesses.

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Competing interests DL is or has been consulted as the main investigator in studies sponsored by Actelion, Agence Spatiale Européenne, AG2R, Bioprojet, CNES, DGA, iSommeil, Jazz, Vanda, Merck, NASA, Philips, ResMed, Sanofi, Rhythm, Vinci Fondation and VitalAire in the last 5 years. He declares no COI regarding this manuscript. PG has received funding from AG2R to interview subjects with Maxilane. None of the other authors declared any conflict of interest.

Patient consent Not required.

Ethics approval Participation was anonymous and voluntary. As an epidemiological survey, the study protocol was approved by the French Commission on Information Technologies and Liberties (CNIL, Commission nationale informatique et libertés) on condition of the anonymous nature of the study and the guarantee that the selected phone numbers would be erased from the database after the study, as well as by the delegate council of the National Pastry Makers Union with guarantee that the results would not be used to identify any of the subjects.

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REFERENCES

- Algava E. Le travail de nuit en 2012. Essentiellement dans le tertiaire. DARES Analyses, août 2014, N°62; 2014. <http://dares.travail-emploi.gouv.fr/IMG/pdf/2014-062.pdf> (cited 2017 Jun 17).
- Metlaine A, Sauvet F, Gomez-Merino D, et al. Association between insomnia symptoms, job strain and burnout syndrome: a cross-sectional survey of 1300 financial workers. *BMJ Open* 2017;7:e012816.
- Juda M, Vetter C, Roenneberg T. Chronotype modulates sleep duration, sleep quality, and social jet lag in shift-workers. *J Biol Rhythms* 2013;28:141–51.
- Gibbs M, Hampton S, Morgan L, et al. Adaptation of the circadian rhythm of 6-sulphatoxymelatonin to a shift schedule of seven nights followed by seven days in offshore oil installation workers. *Neurosci Lett* 2002;325:91–4.
- Knutsson A. Health disorders of shift workers. *Occup Med* 2003;53:103–8.
- Pan A, Schernhammer ES, Sun Q, et al. Rotating night shift work and risk of type 2 diabetes: two prospective cohort studies in women. *PLoS Med* 2011;8:e1001141.
- Wang X-S, Armstrong MEG, Cairns BJ, et al. Shift work and chronic disease: the epidemiological evidence. *Occup Med* 2011;61:78–89.
- Rémen T, Acouetey D-S, Paris C, et al. Early incidence of occupational asthma is not accelerated by atopy in the bakery/pastry and hairdressing sectors. *Int J Tuberc Lung Dis Off J Int Union Tuberc Lung Dis* 2013;17:973–81.
- Lesage F-X, Deschamps F. Évaluation de l'état de santé d'une population d'artisans et de commerçants. *Arch Mal Prof Environ* 2005;66:456–64.
- Léger D, Roscoat E, Bayon V, et al. Short sleep in young adults: Insomnia or sleep debt? Prevalence and clinical description of short sleep in a representative sample of 1004 young adults from France. *Sleep Med* 2011;12:454–62.
- Léger D, Beck F, Richard JB. Sleep Loss in the Homeless-An Additional Factor of Precariousness: Survey in a Group of Homeless People. *JAMA Intern Med* 2017;177:278–9.
- Léger D, Beck F, Richard JB, et al. The risks of sleeping "too much". Survey of a National Representative Sample of 24671 adults (INPES health barometer). *PLoS One* 2014;9:e106950.
- Natale V, Léger D, Bayon V, et al. The consensus sleep diary: quantitative criteria for primary insomnia diagnosis. *Psychosom Med* 2015;77:413–8.
- American Academy of Sleep Medicine. *International Classification of Sleep Disorders. Diagnostic and Coding Manual. Darien, Ill.* 3rd edn: American Academy of Sleep Medicine, 2014.
- American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. 5th Edition. Arlington, VA: American Psychiatric Association, 2013.
- Netzer NC, Stoohs RA, Netzer CM, et al. Using the Berlin Questionnaire to identify patients at risk for the sleep apnea syndrome. *Ann Intern Med* 1999;131:485–91.
- Johns MW. A new method for measuring daytime sleepiness: the Epworth sleepiness scale. *Sleep* 1991;14:540–5.
- Horne JA, Ostberg O. A self-assessment questionnaire to determine morningness-eveningness in human circadian rhythms. *Int J Chronobiol* 1976;4:97–110.
- Sridhar GR, Sanjana NS. Sleep, circadian dysrhythmia, obesity and diabetes. *World J Diabetes* 2016;7:515–22.
- Faraut B, Touchette E, Gamble H, et al. Short sleep duration and increased risk of hypertension: a primary care medicine investigation. *J Hypertens* 2012;30:1354–63.
- Wegrzyn LR, Tamimi RM, Rosner BA, et al. Rotating Night-Shift Work and the Risk of Breast Cancer in the Nurses' Health Studies. *Am J Epidemiol* 2017;186:532–40.
- Haus E, Smolensky M. Biological clocks and shift work: circadian dysregulation and potential long-term effects. *Cancer Causes Control* 2006;17:489–500.
- Waage S, Moen BE, Pallesen S, et al. Shift work disorder among oil rig workers in the North Sea. *Sleep* 2009;32:558–65.
- Asaoka S, Aritake S, Komada Y, et al. Factors associated with shift work disorder in nurses working with rapid-rotation schedules in Japan: the nurses' sleep health project. *Chronobiol Int* 2013;30:628–36.
- Knauth P, Jung D, Bopp W, et al. Compensation for unfavorable characteristics of irregular individual shift rotas. *Chronobiol Int* 2006;23:1277–84.
- ANSES. *Évaluation des risques sanitaires pour les professionnels exposés à des horaires de travail atypiques notamment de nuit*. Maisons-Alfort: Rapport d'expertise collective, 2016.
- Arora V, Dunphy C, Chang VY, et al. The effects of on-duty napping on intern sleep time and fatigue. *Ann Intern Med* 2006;144:792–8.
- Centofanti SA, Hilditch CJ, Dorrian J, et al. The impact of short night-time naps on performance, sleepiness and mood during a simulated night shift. *Chronobiol Int* 2016;33:706–15.
- Ruggiero JS, Redeker NS. Effects of napping on sleepiness and sleep-related performance deficits in night-shift workers: a systematic review. *Biol Res Nurs* 2014;16:134–42.

30. Faraut B, Boudjeltia KZ, Dyzma M, *et al.* Benefits of napping and an extended duration of recovery sleep on alertness and immune cells after acute sleep restriction. *Brain Behav Immun* 2011;25:16–24.
31. Faraut B, Andrillon T, Vecchierini MF, *et al.* Napping: A public health issue. From epidemiological to laboratory studies. *Sleep Med Rev* 2017;35:85–100.
32. Charles M-A. Obésité : que nous dit l'épidémiologie ? *Cahiers de Nutrition et de Diététique* 2011;46:167–72.
33. Charles MA, Basdevant A, Eschwege E. Prévalence de l'obésité de l'adulte en France La situation en 2000. 2008 <http://www.em-consulte.com/en/article/75473> (cited 2017 Jul 12).
34. Carney CE, Edinger JD, Morin CM, *et al.* Examining maladaptive beliefs about sleep across insomnia patient groups. *J Psychosom Res* 2010;68:57–65.
35. Korompeli A, Chara T, Chrysoula L, *et al.* Sleep disturbance in nursing personnel working shifts. *Nurs Forum* 2013;48:45–53.