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Job demands, lack of support and choice, job stress and shift working have been the main occupational risk factors for insomnia considered in previous research. Our findings suggest that these contribute less to the population burden of insomnia among older workers than other workplace factors such as inability to cope at work, job insecurity, having difficult colleagues and lacking work friendships.

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Sleep disturbance and the older worker: findings from the Health and Employment after Fifty study

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Objectives The aim of this study was to characterize the descriptive epidemiology of insomnia in midlife and explore the relative importance of different occupational risk factors for insomnia among older workers.

Methods A questionnaire was mailed to all adults aged 50–64 years registered with 24 English general practices. Insomnia was defined as having at least one of four problems with sleep severely in the past three months. Subjects were also asked about employment conditions, feelings concerning work, and their health. Associations were assessed by logistic regression and population attributable fractions (PAF) calculated.

Results Analysis was based on 8067 respondents (5470 in paid work), 18.8% of whom reported insomnia. It was more common among women, smokers, obese individuals, those living alone, and those in financial hardship, and less prevalent among the educated, those in South-East England, and those with friendships and leisure-time pursuits. Occupational risk factors included unemployment, shift working, lack of control and support at work, job insecurity, job dissatisfaction and several of its determinants (lacking a sense of achievement, feeling unappreciated, having difficult work colleagues, feeling unfairly criticized). Population burden of insomnia was associated more strongly with difficulties in coping with work demands, job insecurity, difficult colleagues, and lack of friendships at work [population attributable fraction (PAF) 15–33%] than shift work and lack of autonomy or support (PAF 5–7%). It was strongly associated with seven measures of poorer self-assessed health.

Conclusions Employment policies aimed at tackling insomnia among older workers may benefit from focusing particularly on job–person fit, job security and relationships in the workplace.

Key terms insomnia; occupational; psychosocial.

Chronic insomnia is common. The complaint is often defined in terms of sustained difficulties in falling and staying asleep, early morning waking, awakening unrefreshed, dissatisfaction with sleep, and consequent daytime tiredness (1). Estimates of its prevalence vary substantially by definition and setting. However, in population surveys, about 30% of adults report sleep

problems at a given time (2–4), while 6–15% meet formal criteria for an insomnia disorder (4). The high prevalence extends to the subset of the population who are in work (5, 6), a substantial minority of whom take hypnotic medication (5).

Sleep disturbance has been linked with adverse health, including anxiety, depression and widespread

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pain (1, 3, 7, 8), coronary heart disease (7, 9), and mortality (10). In the workplace, it has also been linked with impaired productivity (7, 11, 12), absenteeism (7, 13) occupational accidents (7, 13) and health-related job loss (14). In the province of Quebec alone, annual indirect costs of insomnia-related absenteeism and lost productivity in 2008 were estimated at almost CAN\$6 billion (15). Thus, the economic burden of the condition is considerable, and it is important to prevent.

Established personal risk factors for insomnia include female sex, poor mental health, physical comorbidity and pain, financial worries, and low education (1, 3, 4, 7, 16). Among risk factors in the workplace, attention has focused principally on shift working (7, 12, 17, 18) and combinations of workplace demands, support, control and job stress (7, 12, 17, 19–22).

Only occasionally, however, have estimates been made of the population attributable fractions (PAF) associated with different occupational risk factors for insomnia to assess their relative importance (22). Moreover, some potentially avoidable risk factors, such as co-worker relationships, have received little attention. Also, studies have rarely focused on older workers, among whom the occupational causes of sleep disturbance may vary from younger colleagues. One of the few such investigations, a study of French utility workers (23) reported improved sleep quality after planned normal retirement, notably in workers retiring from jobs that carried high demands and low rewards. As demographic trends in developed countries now require people to work longer rather than retire, research on avoidable occupational determinants of insomnia among older workers is all the more pertinent.

In this report, we provide new data on the descriptive epidemiology of sleep disturbance in midlife, explore the relative importance of different occupational risk factors for insomnia among older workers, and also assess associations with self-reported ill-health.

Study population and methods

Our analysis used baseline data from the Health and Employment after Fifty (HEAF) study, a large population-based cohort of older adults resident in England. A report on design, methods, and recruitment has been published elsewhere (24). In short, 8134 adults born between 1948–1962 (target age range 50–64 years) were recruited from 24 geographically-dispersed English general practices contributing data to a research database, the Clinical Practice Research Datalink (CPRD). Subjects who returned an initial questionnaire are being followed up annually through further questionnaires and by record linkage. Ethical approval was received from the NHS Research Ethics Committee North West-Liverpool East.

At baseline, the questionnaire included items on personal circumstances, employment conditions and the work environment, sleep disturbance, sickness absence from work and self-assessed health.

We assessed sleep disturbance through a four-part question based on work by Jenkins et al (25) and used in another population-based British study (3): "How much have you been troubled by sleep problems in the past 3 months? (a) Difficulty falling asleep? (b) Difficulty staying asleep? (c) Waking up too early? (d) Not feeling refreshed in the morning?" Response categories were "no problem", "mild problem", "moderate problem" and "severe problem". Individual items were reclassified to create a series of binary variables for analysis (severe problem versus not), and insomnia overall was defined as a severe problem with any of (a) to (d). The scale has been shown to have acceptable psychometric properties in terms of internal consistency, test–retest repeatability, and convergent and predictive validity (26–28).

Demographic characteristics included: age and sex; height and weight [used to derive body mass index (BMI)]; smoking habits (classified here as current versus ex/never smoker); highest educational qualification (in three bands); social class (in three bands, higher managerial, intermediate, manual and routine); household composition (living alone versus not), location of the participant's general practice (used as an area-based index of deprivation) (29); weekly personal caring responsibilities (any versus none); weekly unpaid work as a volunteer (any versus none); weekly leisure-time activities and weekly social engagement (meeting or doing things with friends or relatives outside the home versus not); home ownership (owned/owned with a mortgage versus other); pension entitlement (state pension only versus private pension); and financial hardship (two items on difficulty managing financially and on many things being unaffordable).

Regarding employment conditions, we asked about: work status (employed, self-employed, unemployed, retired) and for those in paid work: size of employing organization; hours worked per week (≤ 20 , >20 –40, >40); rotating or variable shift working and night shift working (often versus sometimes/rarely); type of contract (permanent versus temporary/renewable); whether or not a second paid job was held; entitlement to paid holiday; and whether the job provided a choice over what, when and how to do things (rarely/never versus often/sometimes), support from colleagues, a supervisor or manager (rarely/never versus often/sometimes), and payment by output versus fixed salary.

We also asked about respondents' feelings concerning their work and working relationships – their overall job satisfaction (dissatisfied/very dissatisfied versus satisfied/fairly satisfied/very satisfied); whether they felt appreciated at work by others (rarely/never versus

often/sometimes); whether their job gave a feeling of achievement (rarely/never versus often/sometimes); whether they had a work colleague who was very difficult to get on with (yes versus no); or had been criticized unfairly at work (often versus sometimes/rarely/never); or felt insecure in employment, overall and in the event of illness (rather insecure/very insecure versus secure/very secure); and whether they had friends at work with whom they also spent time outside work (yes versus no). We further asked about total sickness absence in the past 12 months, analyzed as "any absence versus none" and ">20 versus <20 days of absence"; whether they had needed to cut down at work in the past 12 months because of health (analyzed as "any versus none" and "a lot versus not"); whether they felt they were coping with work's physical and mental demands (with some/great difficulty versus easily); and whether they expected to be physically and mentally able still to carry out the same kind of work in two years' time (no/not sure versus yes).

Finally, several validated measures of health were assessed: (i) self-rated health, measured with a single question (30) and dichotomized as "fair/poor" versus "at least good"; (ii) low mood, assessed by the Centre for Epidemiologic Studies Depression scale (CES-D) (≥ 16 was considered a cut-point for depression) (31); (iii) well-being, measured using the Warwick-Edinburgh Mental Well-being Scale (WEMWBS), with participants in the lowest quintile of scores classified as having "poor" well-being (32); (iv) frailty, assessed using the criteria of Fried et al (33); (v) somatizing tendency, assessed using elements of the Brief Symptom Inventory (34) and graded according to the number of somatic symptoms out of 5 that had been at least moderately distressing during the past week (0, 1, >1); (vi) memory problems (serious versus none/not serious); and (vii) persistent troublesome musculoskeletal pain (lasting a month or longer in the past 12 months in the back/neck, arms/shoulders or legs, and making it difficult/impossible to get washed or dressed or do household chores (yes versus no).

Analysis was restricted to respondents who completed the question on sleep disturbance ($N=8067$) and, for the occupational analyses, to those who were also in paid work ($N=5470$). Associations with demographic factors and employment conditions were estimated by logistic regression, with results expressed as odds ratios (OR) with 95% confidence intervals (95% CI). All risk estimates were adjusted for age and sex. Additionally, PAF were computed for certain potentially avoidable occupational determinants of insomnia to establish the proportions of cases (people with insomnia/sleep disturbance) that might be eliminated in the population if no one had been exposed to that specific factor – ie, if all people had the same risk as those in the reference category.

In a sensitivity analysis, to explore whether employment status (employed versus self-employed), educational attainment (university/higher professional degree versus other), and financial well-being (finding it difficult to manage financially these days versus other) acted as effect modifiers of relationships, we looked for significant interactions and where necessary repeated analysis stratifying by these factors.

Finally, we used logistic regression to estimate associations between sleep disturbance and our measures of poor self-assessed health. In this analysis, OR were adjusted for age, sex and social class. Statistical analyses were carried out with Stata (version 14.0) software (StataCorp LP, College Station, TX, USA).

Results

In all, 1516 (18.8%) of respondents reported a least one severe sleep problem, including 430 (5.3%) with severe difficulty in falling asleep, 862 (10.7%) with severe difficulty in maintaining sleep, 858 (10.6%) with early wakening, and 979 (12.1%) severely affected by awakening unrefreshed.

Table 1 summarizes associations of various personal characteristics with insomnia and also with specific symptoms of sleep disturbance. Insomnia was more common among women, the less educated, those of lower social class, current smokers, the obese ($BMI > 30 \text{ kg/m}^2$), those living alone, those lacking regular leisure time activity and those who had no friends with whom they regularly socialized (OR 1.6–1.9). Even stronger associations were found with various indices of financial hardship (lack of home ownership, reported difficulties in managing financially and affording things, lack of a private pension to supplement the state pension), with OR 2.0–4.7. All of these associations were significant at the 5% level. By contrast, insomnia was less common in the oldest age band and those living in London and the South-East of England. Associations with specific aspects of sleep disturbance showed a similar pattern to insomnia overall, being strongest for difficulty falling asleep. Further adjustment for social class reduced associations only slightly (data not shown).

Table 2 summarizes associations between employment conditions and sleep disturbance. Insomnia and its component symptoms were significantly more common among the unemployed than employees (OR 2.3–4.2), while severe problems falling asleep and maintaining sleep were somewhat more common among retired people (OR 1.2–1.5). However, among those in paid work, weekly working hours, size of employer and permanency of contract had little impact on sleep. As expected, frequent rotating or variable shift working

Table 1. Associations between sleep disturbance and personal characteristics. [OR=odds ratio; 95% CI=95% confidence interval]

Risk factor	Severe difficulty falling asleep		Severe difficulty staying asleep		Severe problem waking early		Feeling unrefreshed		Insomnia	
	OR ^a	95% CI	OR ^a	95% CI	OR ^a	95% CI	OR ^a	95% CI	OR ^a	95% CI
Sex										
Male	1		1		1		1		1	
Female	2.2	1.8–2.7	1.7	1.5–2.0	1.4	1.2–1.6	1.8	1.5–2.0	1.6	1.4–1.8
Age (years)										
50–54	1		1		1		1		1	
55–59	1.1	0.9–1.5	1.1	0.9–1.3	0.9	0.8–1.1	0.9	0.7–1.0	0.9	0.8–1.1
60–64	0.8	0.6–1.1	0.8	0.7–1.0	0.7	0.5–0.8	0.6	0.5–0.7	0.7	0.6–0.8
Area of practice										
North East & North West	1		1		1		1		1	
West Midlands	0.9	0.6–1.2	0.9	0.7–1.1	1.0	0.8–1.3	0.9	0.7–1.2	1.0	0.8–1.2
East	0.9	0.7–1.2	0.9	0.7–1.1	0.8	0.6–1.0	0.8	0.7–1.0	0.8	0.7–1.0
South Central & West	1.0	0.8–1.3	1.0	0.8–1.2	1.0	0.8–1.2	1.0	0.9–1.2	1.0	0.9–1.2
London & South East	0.6	0.4–1.0	0.7	0.5–1.0	0.8	0.6–1.1	0.7	0.5–0.9	0.7	0.6–0.9
Educational level										
University degree or higher professional	1		1		1		1		1	
Vocational training certificate	1.7	1.3–2.3	1.7	1.4–2.0	1.6	1.3–2.0	1.7	1.4–2.0	1.6	1.4–1.9
School only	2.3	1.8–2.9	1.9	1.6–2.3	2.1	1.8–2.5	2.1	1.8–2.5	1.9	1.6–2.2
Social class										
Higher managerial	1		1		1		1		1	
Intermediate occupations	1.4	1.1–1.9	1.3	1.1–1.5	1.3	1.1–1.6	1.2	1.0–1.5	1.4	1.2–1.6
Routine and manual occupations	2.1	1.7–2.7	1.6	1.4–1.9	1.9	1.6–2.2	1.9	1.6–2.2	1.7	1.5–2.0
Living alone										
No	1		1		1		1		1	
Yes	1.8	1.4–2.2	1.4	1.2–1.7	1.5	1.3–1.8	1.6	1.3–1.8	1.5	1.3–1.7
Being a personal carer										
No	1		1		1		1		1	
Yes	1.0	0.8–1.3	1.1	0.9–1.3	1.3	1.1–1.5	1.1	1.0–1.3	1.2	1.0–1.3
Voluntary work										
Yes	1		1		1		1		1	
No	1.5	1.1–1.9	1.6	1.3–1.9	1.7	1.4–2.2	1.5	1.2–1.8	1.4	1.2–1.6
Leisure activity										
Yes	1		1		1		1		1	
No	2.2	1.8–2.6	1.7	1.5–2.0	1.7	1.5–2.0	1.9	1.7–2.2	1.7	1.5–1.9
Socializing with friends										
Yes	1		1		1		1		1	
No	2.2	1.8–2.8	1.8	1.5–2.2	1.6	1.4–2.0	2.0	1.7–2.4	1.8	1.6–2.1
Home ownership										
Owned/owned with mortgage	1		1		1		1		1	
Other	3.3	2.7–4.1	2.6	2.2–3.0	2.4	2.1–2.9	2.7	2.3–3.2	2.4	2.1–2.8
Managing financially these days										
Doing alright	1		1		1		1		1	
Difficult	5.7	4.6–7.2	3.9	3.2–4.6	3.6	3.0–4.3	5.0	4.2–6.0	4.7	4.1–5.6
Things you can no longer afford										
No/a few things	1		1		1		1		1	
Many things	4.2	3.4–5.3	3.3	2.7–4.0	3.2	2.6–3.8	4.4	3.7–5.2	4.0	3.4–4.7
Pension										
Private pension as well as state	1		1		1		1		1	
Only state pension	2.8	2.3–3.5	2.0	1.7–2.3	1.9	1.7–2.3	2.1	1.8–2.5	2.0	1.7–2.3
Body mass index (kg/m ²)										
<18.5 (underweight)	3.3	1.7–6.2	1.7	0.9–3.2	2.0	1.1–3.6	2.5	1.5–4.2	2.1	1.3–3.4
18.5–25 (normal)	1		1		1		1		1	
25–30 (overweight)	1.1	0.9–1.5	1.2	1.0–1.4	1.2	1.0–1.4	1.2	1.0–1.4	1.1	0.9–1.3
>30 (obese)	1.8	1.4–2.3	1.9	1.5–2.2	1.7	1.4–2.0	1.9	1.6–2.2	1.7	1.4–1.9
Smoking										
Never/ex-smoker	1		1		1		1		1	
Current smoker	2.3	1.8–2.9	1.4	1.2–1.7	1.4	1.2–1.8	2.1	1.7–2.5	1.7	1.4–1.9

^aAdjusted for age and sex.

Table 2. Associations between sleep disturbance, terms of employment, and employment status. [OR=odds ratio; 95% CI=95% confidence interval]

Risk factor	Severe difficulty falling asleep		Severe difficulty staying asleep		Severe problem waking early		Feeling unrefreshed		Insomnia	
	OR ^a	95% CI	OR ^a	95% CI	OR ^a	95% CI	OR ^a	95% CI	OR ^a	95% CI
All subjects (N=8067)										
Employed	1		1		1		1		1	
Self-employed	0.9	0.6–1.3	0.8	0.6–1.0	0.7	0.6–1.0	0.8	0.6–1.0	0.9	0.7–1.0
Unemployed	4.2	3.2–5.6	2.6	2.1–3.3	2.3	1.8–2.9	3.2	2.6–4.0	3.1	2.6–3.8
Retired	1.5	1.1–2.0	1.2	1.0–1.5	1.1	0.9–1.4	1.0	0.8–1.2	1.1	0.9–1.2
Those in work (N=5470)										
Employment status										
Self-employed	1		1		1		1		1	
Small employer (<500 staff)	1.1	0.8–1.7	1.3	1.0–1.8	1.4	1.0–1.8	1.3	1.0–1.6	1.1	0.9–1.4
Large employer (≥500 staff)	0.9	0.6–1.4	1.2	0.9–1.6	1.3	1.0–1.7	1.3	1.0–1.7	1.2	0.9–1.4
Weekly working hours										
<20 hours	1		1		1		1		1	
>20–40	1.0	0.7–1.5	1.0	0.8–1.3	1.0	0.8–1.3	1.1	0.9–1.4	1.0	0.8–1.3
>40	1.3	0.8–2.1	0.9	0.7–1.3	1.0	0.8–1.4	1.0	0.8–1.4	1.0	0.8–1.3
Having a second paid job										
No	1		1		1		1		1	
Yes	0.6	0.3–1.1	0.9	0.6–1.2	1.0	0.7–1.3	0.9	0.7–1.3	1.0	0.7–1.3
Type of contract										
Permanent	1		1		1		1		1	
Temporary/renewable	0.5	0.2–1.1	1	0.7–1.5	0.7	0.4–1.1	0.9	0.6–1.3	0.8	0.6–1.1
Not applicable (self-employed)	1.0	0.6–1.5	0.8	0.6–1.1	0.7	0.5–1.0	0.8	0.6–1.0	0.9	0.7–1.1
Variable/rotating shift work										
Sometimes/rarely/never	1		1		1		1		1	
Often	1.9	1.4–2.6	1.3	1.1–1.7	1.3	1.0–1.6	1.5	1.3–1.9	1.4	1.2–1.7
Night shift work										
Sometimes/rarely/never	1		1		1		1		1	
Often	2.8	1.8–4.3	1.5	1.0–2.1	1.3	0.9–1.9	2.0	1.4–2.7	1.6	1.2–2.1
Holiday entitlement										
Some	1		1		1		1		1	
None	4.7	1.3–16.4	1.8	0.5–6.4	1.7	0.5–5.9	1.5	0.4–5.3	1.7	0.6–4.8

^a Adjusted for age and sex.

was a risk factor for insomnia and symptoms of sleep disturbance (OR 1.3–1.9), as was night shift working (OR 1.3–2.8). Lack of holiday entitlement also appeared to be a risk factor, although findings were based on few subjects without entitlement and were not statistically significant.

Table 3 shows relationships between sleep disturbance and people's feelings about their work and their colleagues. As expected, poor sleep was associated with adverse psychosocial working conditions including lack of choice over work (OR 1.5–2.1), lack of support from colleagues (OR 1.7–2.3), and perceived job insecurity (OR 1.5–1.7). Job dissatisfaction was associated with about four-fold higher odds of sleep disturbance, and several potential determinants of dissatisfaction showed stronger associations than did choice/support/demand: these included feeling unappreciated at work (OR 2.4–3.4), lacking a sense of achievement at work (OR 2.6–3.2), finding colleagues to be difficult (OR 1.7–2.2), feeling criticized unfairly at work on a regular basis (OR 3.9–5.2), and not having friendships established at work and pursued outside it (OR 1.3–1.5). Those who reported difficulties in coping with work's demands were significantly more likely to report severe sleep dis-

turbance (OR 2.9–4.3). Findings from table 3 changed little after adjusting for social class, shift working, BMI, socializing with friends and home ownership, as well as age and sex. [Using forward-backward selection, these variables emerged from those in table 1 (and shift working) as being associated with insomnia ($P<0.2$) while improving the model's fit; data not shown].

PAF for insomnia were notable for struggling to cope with work's physical demands (33%), its mental demands (33%), job insecurity (18%), working with difficult colleagues (17%), and lacking friendships at work (15%) (table 3). By contrast, PAF for lack of control and support at work were lower (7%), and marginally below those for rarely feeling unappreciated at work (9%), lacking a sense of achievement in work (8%), and overall job dissatisfaction (10%). In comparison, the PAF for insomnia associated with financial hardship (depending on the metric chosen from table 1) ranged from 12–16%, for smoking it was 5% (95% CI 3–7%) and 5% (95% CI 2–8%) for frequent rotating or variable shift working (or 2% for night shift working, which was less common in the sample).

In a sensitivity analysis, we considered interactions between the factors in table 3 and educational

Table 3. Associations between sleep disturbance and feelings about work and its demands, with estimated population attributable fractions [OR=odds ratio; 95% CI=95% confidence intervals; PAF=population attributable fraction]

Risk factor	Severe difficulty falling asleep		Severe difficulty staying asleep		Severe problem waking early		Feeling unrefreshed		Insomnia			
	OR ^a	95% CI	OR ^a	95% CI	OR ^a	95% CI	OR ^a	95% CI	OR ^a	95% CI	PAF%	95% CI
Choice at work												
Often/sometimes	1		1		1		1		1			
Rarely/never	2.1	1.6–2.9	1.6	1.3–2.0	1.5	1.2–1.8	1.6	1.3–1.9	1.5	1.3–1.8	7.0	3.4–10.5
Support from colleagues												
Often/sometimes	1		1		1		1		1			
Rarely/never	2.3	1.6–3.3	2.1	1.7–2.8	1.8	1.4–2.4	1.9	1.5–2.5	1.9	1.5–2.3	6.9	3.9–9.8
Paid by output												
No	1		1		1		1		1			
Yes	1.1	0.7–1.5	1	0.8–1.3	0.9	0.7–1.2	0.9	0.7–1.1	1	0.8–1.2	-0.5	-3.3–2.1
Overall job satisfaction												
Satisfied	1		1		1		1		1			
Dissatisfied	4.5	3.2–6.4	3.9	3.0–5.1	3.6	2.8–4.6	4.4	3.5–5.6	3.9	3.1–4.9	9.9	7.3–12.3
Feeling of achievement												
Often/sometimes	1		1		1		1		1			
Rarely/never	3.2	2.2–4.6	2.7	2.1–3.6	2.6	2.0–3.4	2.9	2.2–3.7	2.9	2.3–3.6	7.7	5.2–10.0
Feeling of appreciation												
Often/sometimes	1		1		1		1		1			
Rarely/never	3.4	2.5–4.7	2.4	1.8–3.0	2.7	2.1–3.3	2.6	2.1–3.3	2.5	2.1–3.1	9.2	6.4–11.9
Job security												
Secure	1		1		1		1		1			
Insecure	1.5	1.1–2.0	1.6	1.3–1.9	1.5	1.2–1.8	1.7	1.5–2.1	1.6	1.4–1.9	18.4	12.2–24.2
Difficult colleagues												
No	1		1		1		1		1			
Yes	2.2	1.7–2.8	1.7	1.4–2.1	1.8	1.5–2.2	2.2	1.8–2.6	1.9	1.6–2.1	17.3	12.4–21.9
Friendship at work												
Yes	1		1		1		1		1			
No	1.5	1.1–2.0	1.5	1.3–1.8	1.3	1.1–1.6	1.5	1.2–1.7	1.4	1.2–1.7	15.1	8.1–21.5
Being criticized unfairly at work												
Sometimes/rarely/never	1		1		1		1		1			
Often	4.1	2.4–7.0	3.9	2.6–5.9	4.1	2.8–6.1	5.2	3.6–7.7	4.2	3.0–6.1	3.8	2.3–5.4
Coping with physical demands												
Easily	1		1		1		1		1			
At least some difficulty	4.3	3.3–5.7	3.2	2.7–3.9	3.1	2.6–3.7	3.8	3.2–4.6	3.6	3.1–4.1	33.4	28.8–37.8
Coping with mental demands												
Easily	1		1		1		1		1			
At least some difficulty	3.1	2.4–4.1	2.9	2.4–3.5	3.0	2.5–3.6	3.5	3.0–4.2	3.2	2.8–3.8	33.3	28.4–37.8

^a Adjusted for age and sex.

attainment, employment status and difficulty in managing financially. Important interactions ($P < 0.05$) were largely confined to educational attainment, whereby lack of choice, feeling unappreciated and not coping with work's demands had a bigger impact on insomnia in those with a university or higher professional qualification than in those without (OR 59–93% higher, PAF 33–91% higher).

Table 4 considers poor sleep in relation to poor self-assessed health. All of the assessed measures of poor health were strongly associated with insomnia and specific symptoms of sleep disturbance, including fair/poor self-rated health (OR 3.9–6.5), low mood (CES-D score ≥ 16) (OR 5.5–9.4), poor well-being (WEMWBS < 32) (OR 5.2–8.5), pre-frailty (1–2 Fried criteria met, OR 2.2–3.1), frailty (3–5 Fried criteria met;

Table 4. Associations between sleep disturbance and impaired health [OR=odds ratio; 95% CI=95% confidence intervals; WEMWBS=Warwick-Edinburgh Mental Well-being Scale; CES-D=Centre for Epidemiologic Studies Depression scale. For definitions, see text.]

Risk factor	Severe difficulty falling asleep		Severe difficulty staying asleep		Severe problem waking early		Feeling unrefreshed		Insomnia	
	OR ^a	95% CI	OR ^a	95% CI	OR ^a	95% CI	OR ^a	95% CI	OR ^a	95% CI
Self-rated health										
At least good	1		1		1		1		1	
Fair/poor	6.5	5.2–8.0	4.7	4.1–5.5	3.9	3.4–4.6	6.4	5.5–7.4	5.1	4.5–5.8
Low mood										
No (CES-D <16)	1		1		1		1		1	
Yes (CES-D ≥16)	7.4	5.9–9.2	5.5	4.7–6.3	5.6	4.8–6.5	9.4	8.0–10.9	6.9	6.1–7.8
Well-being										
Good (WEMWBS ≥32)	1		1		1		1		1	
Poor (WEMWBS <32)	7.6	5.9–9.8	5.6	4.5–6.9	5.2	4.1–6.4	8.5	6.9–10.5	6.7	5.4–8.2
Frailty										
Not frail	1		1		1		1		1	
Pre-frail	2.8	2.3–3.5	2.2	1.9–2.5	2.5	2.2–3.0	3.1	2.6–3.6	2.5	2.2–2.8
Frail	13.3	9.6–18.4	9.2	7.0–12.2	7.1	5.3–9.4	17.1	12.9–22.6	13.2	10.0–17.5
Memory problems										
Other	1		1		1		1		1	
Serious problems/got a lot worse	6.5	4.8–8.7	5.5	4.3–7.0	4.3	3.3–5.6	7.4	5.8–9.4	6.8	5.3–8.7
Somatizing tendency										
No	1		1		1		1		1	
Yes	4.4	3.6–5.4	4.4	3.8–5.2	3.7	3.2–4.3	4.7	4.1–5.5	4.2	3.7–4.8
Persistent musculoskeletal pain in past 12 months										
No	1		1		1		1		1	
Yes	4.1	3.4–5.1	3.5	3.0–4.1	3.2	2.7–3.7	3.7	3.2–4.3	3.4	3.0–3.8

^a Adjusted for age, sex and social class (in 3 bands).

OR 7.1–17.1), serious or worsening memory problems (OR 4.3–7.4), somatizing tendency (OR 3.7–4.7), and persistent troublesome musculoskeletal pain in the past 12 months (OR 3.2–4.1). All associations were significant at the 5% level.

In case the associations of sleep disturbance with difficulty meeting work's physical demands were confounded by physical ill-health, or those with difficulty meeting work's mental demands were confounded by mental ill-health, we conducted further sensitivity analyses. Risk estimates for the former were adjusted also for persistent musculoskeletal pain and frailty and risk estimates for the latter for low mood. OR for insomnia were reduced, but still remained significantly elevated (2.6, 95% CI 2.3–3.1, and 2.0, 95% CI 1.7–2.4, respectively).

Finally, insomnia was found to be strongly and significantly associated with prolonged sickness absence (>20 versus ≤20 days) in the previous 12 months (OR 6.1, 95% CI 3.8–8.3).

Discussion

Within our sample, symptoms of sleep disturbance were more common among women and those who lived alone, were of low social class, suffered financial hardship, or were obese; and were less prevalent at older ages, among the educated, those living in the

South-East of England, and those engaged in voluntary work, leisure-time activities, socializing and friendships. Potential occupational determinants of sleep disturbance included unemployment, shift working, lack of control and support at work, job insecurity, job dissatisfaction and several of its determinants, such as lacking a sense of achievement, feeling unappreciated at work, having difficult colleagues, and feeling criticized unfairly at work. Difficulties in coping with work demands, job insecurity, working with difficult colleagues and lack of friendships at work had particularly high PAF for insomnia and sleep disturbance. Severe sleep problems were more common among those struggling to cope with work's demands and far more common among those with poor self-reported health; they were also associated with prolonged sickness absence.

Our study had the benefit of a large, geographically dispersed, population-based sampling frame (since almost everyone in Britain registers with a general practice for healthcare which is free at the point of delivery). A second strength was a focus on several relatively understudied occupational risk factors for sleep disturbance. These advantages in combination enabled us to derive PAF and thus assess the potentially avoidable proportion of cases in the population, assuming causal relationships.

Study limitations included a relatively low response rate at baseline and the availability, at this baseline phase of the HEAF study, only of cross-sectional data.

Members of the recruited sample were somewhat older, better educated, and wealthier than 50–64-year-olds in the population as a whole, although they were drawn from most English regions and most deciles of affluence and were reasonably representative as judged by employment status, ethnicity, and marital status (24). Nevertheless, the prevalence of insomnia could have been over- or under-estimated if those with insomnia were more or less likely to participate. In comparison, a population survey of five English general practices with a higher response rate reported a higher prevalence of sleep problems (3), although its case definitions were based on frequent rather than severe disturbances of sleep, and it studied a wider age range than in the HEAF cohort. More importantly, associations of insomnia with the demographic and occupational predictors of interest would only be biased in our study if they differed importantly between responders and non-responders. This seems unlikely, the more so as questions on sleep disturbance represented only a small part of a far larger question set and were a disguised focus of interest.

The cross-sectional nature of our analysis limits interpretation. Thus, for example, while job dissatisfaction, lacking a sense of achievement, poor interpersonal relationships and poor relational justice at work are likely causes of sleep disturbance, we cannot exclude the possibility that poor sleep sometimes contributes to these outcomes by undermining work performance and people's standing with others. Similarly, associations with many of our measures of impaired health may well be bidirectional. However, some longitudinal studies have indicated that high demands, low choice and poor co-worker support are weakly predictive of impaired sleep (19, 21, 35), while other cohort evidence indicates that sleep is predictive, for example, of incident depression (8), and this encourages us, in calculating PAF, to assume causal relations for our other less-established findings.

Several well-recognized associations with insomnia emerged from our analysis, including higher rates among women (1–4), the lonely (1), those with socioeconomic disadvantage, low education, or a low income (1, 16, 36), and those in poor health (1, 3, 4, 16). Insomnia has also been linked with consumption of nicotine and with an abnormal BMI (1). Our findings support these observations. We found a lower risk of insomnia among 60–64-year-olds than 50–54-year-olds. However, the age bands studied were narrower than in other reports, some (but not all) of which have indicated higher rates of insomnia in later life. Differences in age band and measuring instrument may also explain why the overall prevalence of insomnia was lower in this study than in some other population-based alternatives.

Previous studies in the workplace setting have

focused principally on anti-social work schedules (7, 12, 17, 18) and stressful jobs, defined commonly using the demand–support–control paradigm of occupational stress (7, 12, 17, 19–22, 35). In keeping with others, we found higher risks of sleep disturbance among those working shifts or in jobs with low perceived autonomy or coworker support, as well as in the unemployed (37). We also found strong associations with less commonly studied but relevant occupational circumstances, such as those relating to unfair criticism at work (38, 39), and with seldom-studied risk factors for this outcome such as job dissatisfaction, interpersonal conflicts and friendships at work.

Our study is unusual in providing estimates of PAF – the proportions of insomnia that might arise from various avoidable risk factors. The PAF cannot be inferred simply from the relative risk that a factor carries, since it depends also on the frequency of the risk factor in the population at large. For example, while being unfairly criticized at work was a stronger risk factor for insomnia than job insecurity in our sample (OR 4.2 versus 1.6), because job insecurity was more commonly experienced, it was a bigger potential contributor to the population burden (PAF 18% versus 4%). When judged in this way, certain of the less-studied risk factors in our study appeared potentially to be more important occupational determinants of sleep disturbance than job choice, job support, and frequent working of shifts (although it should be noted that cross-sectional analysis may underestimate the lifetime burden of shift working on insomnia, since it assesses a self-selected population tolerant of atypical working hours). There were also some differences between subgroups, such that lack of choice, feeling unappreciated and not coping with work's demands had a bigger impact on the highly educated than those without qualifications.

Relatively few investigations have focused on sleep disturbance among older workers (19, 21), so our data add new knowledge in a group among whom the aim should be to promote well-being and satisfaction with an extended working life. Although cross-sectional, the data suggest that insomnia in this age group may be caused or aggravated by a number of workplace elements (eg, feeling unappreciated or unfairly criticized, job insecurity, poor co-worker relationships) that are potentially avoidable through better employment practices and policies. Participants of the HEAF study are being followed-up with linkage to their healthcare records, and this prospective phase should provide information on whether insomnia is predictive of early exit from the labor market and what impact it has on doctor-recorded health outcomes. At this stage, however, the occupational findings, including those on sickness absence, should serve as an encouragement to employers to take action.

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Competing interests

Professor Cooper has received consultancy and honoraria from Alliance for Better Bone Health, Amgen, Eli Lilly, GSK, Medtronic, Merck, Novartis, Pfizer, Roche, Servier, Takeda and UCB. The remaining authors have no interests to declare.

Data sharing statement

Requests for data sharing should be addressed to the corresponding author.

References

- Ohayon MM. Epidemiology of insomnia: what we know and what we still need to learn. *Sleep Med Rev.* 2002;6:97–111. <https://doi.org/10.1053/smr.2002.0186>.
- Singleton N, Bumpstead R, O'Brien M, et al. Psychiatric morbidity among adults living in private households, 2000. London, United Kingdom: The Stationery Office, 2001.
- Morphy H, Dunn KM, Lewis M, Boardman HF, Croft PR. Epidemiology of insomnia: a longitudinal study in a UK population. *Sleep.* 2007;30:274–80.
- Morin CM, LeBlanc M, Daley M, Grégoire JP, Merette C. Epidemiology of insomnia: prevalence, self-help treatments, consultations, and determinants of helpseeking behaviors. *Sleep Med.* 2006;7:123–30. <https://doi.org/10.1016/j.sleep.2005.08.008>.
- Jacquinet-Salord MC, Lang T, Fouriaud C, Nicoulet I, Bingham A. Sleeping tablet consumption, self-reported quality of sleep, and working conditions. *J Epidemiol Community Health.* 1993;47:64–8. <https://doi.org/10.1136/jech.47.1.64>.
- Kuppermann M, Lubeck DP, Mazonson PD, et al. Sleep problems and their correlates in a working population. *J Gen Intern Med.* 1995;10:250–32. <https://doi.org/10.1007/BF02599573>.
- Akerstedt T. Psychosocial stress and impaired sleep. *Scand J Work Environ Health.* 2006;32(6):493–501. <https://doi.org/10.5271/sjweh.1054>.

- Chang PP, Ford DE, Mead LA, Cooper-Patrick L, Klag MJ. Insomnia in young men and subsequent depression. The Johns Hopkins Precursors Study. *Am J Epidemiol.* 1997;146:105–14. <https://doi.org/10.1093/oxfordjournals.aje.a009241>.
- Leineweber C, Kecklund G, Janszky I, Akerstedt T, Orth-Gomér K. Poor sleep increases the prospective risk for recurrent events in middle-aged women with coronary disease. The Stockholm Female Coronary Risk Study. *J Psychosom Res.* 2003;54:121–7. [https://doi.org/10.1016/S0022-3999\(02\)00475-0](https://doi.org/10.1016/S0022-3999(02)00475-0).
- Kripke DF, Garfinkel L, Wingard DL, Klauber MR, Marler MR. Mortality associated with sleep duration and insomnia. *Arch Gen Psychiatry.* 2002;59:131–6. <https://doi.org/10.1001/archpsyc.59.2.131>.
- Bolge SC, Doan JF, Kannan H, Baran RW. Association of insomnia with quality of life, work productivity, and activity impairment. *Qual Life Res.* 2009;18:415–22. <https://doi.org/10.1007/s11136-009-9462-6>.
- Linton SJ, Bryngelsson I-L. Insomnia and its relationship to work and health in a working-age population. *J Occup Rehabil.* 2000;10:169–83. <https://doi.org/10.1023/A:1009408204694>.
- Daley M, Morin CM, LeBlanc M, Grégoire JP, Savard J, Baillargeon L. Insomnia and its relationship to health-care utilization, work absenteeism, productivity and accidents. *Sleep Med.* 2009;10:427–38. <https://doi.org/10.1016/j.sleep.2008.04.005>.
- Sivertsen B, Overland S, Neckelmann D, et al. The long-term effect of insomnia on work disability: the HUNT-2 historical cohort study. *Am J Epidemiol.* 2006;163:1018–24. <https://doi.org/10.1093/aje/kwj145>.
- Daley M, Morin CM, LeBlanc M, Grégoire JP, Savard J. The economic burden of insomnia: direct and indirect costs for individuals with insomnia syndrome, insomnia symptoms, and good sleepers. *Sleep.* 2009;32:55–64.
- Sivertsen B, Krokstad S, Overland S, Mykletun A. The epidemiology of insomnia: associations with physical and mental health. The HUNT-2 study. *J Psychosom Res.* 2009;67:109–16. <https://doi.org/10.1016/j.jpsychores.2009.05.001>.
- Akerstedt T, Knutsson A, Westerholm P, Theorell T, Alfredsson L, Kecklund G. Sleep disturbances, work stress and work hours: a cross-sectional study. *J Psychosom Res.* 2002;53:741–8. [https://doi.org/10.1016/S0022-3999\(02\)00333-1](https://doi.org/10.1016/S0022-3999(02)00333-1).
- Ribet C, Francis D. Age, working conditions, and sleep disorders: A longitudinal analysis in the French cohort E.S.T.E.V. *Sleep.* 1999;22:491–504.
- Jansson-Fröjmark M, Lundqvist D, Lundqvist N, Linton SJ. Psychosocial work stressors for insomnia: a prospective study on 50–60-year-old adults in the working population. *Int J Behav Med.* 2007;14:222–8. <https://doi.org/10.1007/BF03002996>.
- Ota A, Masue T, Yasuda N, Tsutsumi A, Mino Y, Ohara H. Association between psychosocial job characteristics and insomnia: an investigation using two relevant job stress models--the demand-control-support (DCS) model

- and the effort-reward imbalance (ERI) model. *Sleep Med.* 2005;6:353–8. <https://doi.org/10.1016/j.sleep.2004.12.008>.
21. Jansson M, Linton SJ. Psychosocial work stressors in the development and maintenance of insomnia: a prospective study. *J Occup Health Psychol.* 2006;11:241–48. <https://doi.org/10.1037/1076-8998.11.3.241>.
 22. Linton SJ. Does work stress predict insomnia? A prospective study. *Br J Health Psychol.* 2004;9:127–36. <https://doi.org/10.1348/135910704773891005>.
 23. Vahtera J, Westerlund H, Hall M, et al. Effect of retirement on sleep disturbances: the GAZEL prospective cohort study. *Sleep.* 2009; 32:1459–66.
 24. Palmer KT, Walker-Bone K, Harris EC, et al. Health and Employment after Fifty (HEAF): a new prospective cohort study. *BMC Public Health.* 2015;15:1071. <https://doi.org/10.1186/s12889-015-2396-8>.
 25. Jenkins CD, Stanton B-A, Niemcryk SJ, Rose RM. A scale for the estimation of sleep problems in clinical research. *J Clin Epidemiol.* 1988;41:313–21. [https://doi.org/10.1016/0895-4356\(88\)90138-2](https://doi.org/10.1016/0895-4356(88)90138-2).
 26. Reis C, Mestre C, Tecedor M, Paiva T. Translation, cross-cultural adaptation and psychometric properties of the Jenkins Sleep Scale in a sample of Portuguese shift workers. *Laboratorio de Psicologia.* 2014;12:89–98. <https://doi.org/10.14417/lp.894>.
 27. Davies KA, Macfarlane GJ, Nicholl BI, et al. Restorative sleep predicts the resolution of chronic widespread pain: Results from the EPIFUND study. *Rheumatol.* 2008;47:1809–13. <https://doi.org/10.1093/rheumatology/ken389>.
 28. Vahtera J, Pentti J, Helenius H, Kivimäki M. Sleep disturbances as a predictor of long-term increase in sickness absence among employees after family death or illness. *Sleep.* 2006;29:673–82.
 29. Department for Communities and Local Government. English Indices of Deprivation 2010. Neighbourhoods Statistical Release, 24/11/2011, ISBN 9781409829249. Available from: <https://www.gov.uk/government/statistics/english-indices-of-deprivation-2010> [Accessed 16/12/15]
 30. Eriksson I, Undén A-L, Elofsson S. Self-rated health. Comparisons between three different measures. Results from a population study. *Int J Epidemiol.* 2001;30:326–33. <https://doi.org/10.1093/ije/30.2.326>.
 31. Radloff LS. The CES-D scale a self-report depression scale for research in the general population. *Appl Psychol Meas.* 1977;1:385–401. <https://doi.org/10.1177/014662167700100306>.
 32. Tennant R, Hiller L, Fishwick R, et al. The Warwick-Edinburgh mental well-being scale (WEMWBS): development and UK validation. *Health Qual Life Outcomes.* 2007;5:63. <https://doi.org/10.1186/1477-7525-5-63>.
 33. Fried LP, Tangen CM, Walston J, et al. Frailty in older adults: evidence for a phenotype. *J Gerontol A Biol Sci Med Sci.* 2001;56:M146–M156. <https://doi.org/10.1093/gerona/56.3.M146>.
 34. Derogatis LR, Melisaratos N. The brief symptom inventory: an introductory report. *Psychol Med.* 1983;13:595–605. <https://doi.org/10.1017/S0033291700048017>.
 35. Linton SJ. Does work stress predict insomnia? A prospective study. *Br J Health Psychol.* 2004;9:127–36. <https://doi.org/10.1348/135910704773891005>.
 36. Patel NP, Grandner MA, Xie D, Branas CC, Gooneratne N. “Sleep disparity” in the population: poor sleep quality is strongly associated with poverty and ethnicity. *BMC Public Health.* 2010;10:475. <https://doi.org/10.1186/1471-2458-10-475>.
 37. Hyypä MT, Kronholm E, Alanen E. Quality of sleep during economic recession in Finland: A longitudinal cohort study. *Soc Sci Med.* 1997;45:731–8. [https://doi.org/10.1016/S0277-9536\(96\)00407-8](https://doi.org/10.1016/S0277-9536(96)00407-8).
 38. Elovainio E, Kivimäki M, Vahtera J, Keltikangas-Järvinen L, Virtanen M. Sleeping problems and health behaviors as mediators between organizational justice and health. *Health Psychol.* 2003;22:287–93. <https://doi.org/10.1037/0278-6133.22.3.287>.
 39. Hietapakka L, Elovainio M, Heponiemi T, et al. Do nurses who work in a fair organization sleep and perform better and why? Testing potential psychosocial mediators of organizational justice. *J Occup Health Psychol.* 2013;18:481–91. <https://doi.org/10.1037/a0033990>.

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