

Repeated Job Strain and the Risk of Depression: Longitudinal Analyses From the Whitehall II Study

Stephen A. Stansfeld, PhD, Martin J. Shipley, MSc, Jenny Head, MSc, and Rebecca Fuhrer, PhD

Major depressive disorder (MDD) has a high prevalence among adults in the general population¹ and is associated with considerable disability² and sickness absence.^{3,4} This is a burden in both human and economic terms,^{5,6} and any measures that could be identified to ameliorate this would be of great benefit. One area in which there is scope for preventive measures is the workplace. Adverse psychosocial work characteristics have been associated with increased risk of depressive symptoms^{7,8} and common mental disorder,^{9–13} and a meta-analysis of common mental disorder has identified job strain, effort–reward imbalance, and low social support as consistent risk factors.¹⁴ In the job strain model,¹⁵ high demands at work coupled with low control over work (low decision latitude) and low work social support have also been associated with increased risk of cardiovascular disease^{16,17} and decreased well-being.⁹

The evidence from these studies has been criticized because of (1) reliance on self-report measurement of work characteristics, and (2) outcomes derived from mental health symptom scales that are subject to exposure misclassification and response bias from negative affectivity and common method variance.^{18,19} Nevertheless, associations between job strain, low social support, and depression have been found in studies using structured interviews such as the Composite International Diagnostic Interview (CIDI) and the Clinical Interview Schedule,^{20–25} in which negative affectivity is reduced. Additionally, job strain has been linked to physician-diagnosed depression²⁶ and the prescription of antidepressants.²⁷

However, a systematic review has described the evidence linking the job strain model and depression as inconsistent, and there is a need for studies assessing duration and intensity of exposure to workplace hazards to test potential causal associations.²⁸ Two analytic strategies could assist this type of study: first, test whether there is any evidence of dose–response

Objectives. We addressed whether repeated job strain and low work social support increase the risk of major depressive disorder (MDD).

Methods. We used work characteristics from Karasek's Job Strain model, measured on 3 occasions over 10 years in a cohort of 7732 British civil servants, to predict subsequent onset of MDD with the Composite International Diagnostic Interview.

Results. Repeated job strain was associated with increased risk of MDD (odds ratio [OR] = 2.19; 95% confidence interval [CI] = 1.48, 3.26; high job strain on 2 of 3 occasions vs none) in a fully adjusted model. Repeated low work social support was associated with MDD (OR = 1.61; 95% CI = 1.10, 2.37; low work social support on 2 of 3 occasions vs none). Repeated job strain remained associated with MDD after adjustment for earlier psychological distress.

Conclusions. Demonstration of an increased association for repeated job strain adds to the evidence that job strain is a risk factor for depression. Recognition and alleviation of job strain through work reorganization and staff training could reduce depression in employees. (*Am J Public Health.* 2012;102:2360–2366. doi:10.2105/AJPH.2011.300589)

associations between number of occasions of exposure to adverse work characteristics and increased risk of depression, and second, examine whether adverse change in work characteristics is longitudinally associated with increased risk of MDD. We employed these 2 strategies using data from the Whitehall II study, a longitudinal occupational study of British civil servants.

METHODS

The Whitehall II study was established between 1985 and 1988 and recruited civil servants, aged 35 to 55 years, in 20 London-based civil service departments.²⁹ A total of 10 308 civil servants was examined in phase 1 of the study: 6895 men and 3413 women. The true response rate was higher because around 4% of the invited employees had moved before the study and were not eligible for inclusion. We analyzed data from phase 1 (1988; questionnaire and screening; response rate = 73%), phase 2 (1989; postal questionnaire; response rate = 79%), and phase 3 (1991–1993; questionnaire and screening; response rate = 83%),

and CIDI depression measured at phase 5 (1997–1999; questionnaire and screening; response rate = 79%). There were 7571 (73%) individuals who participated at phases 1, 2, and 3; 9376 (91%) participants took part at either phase 2 or 3, and of these, 7771 also took part at phase 5. The CIDI was introduced partway through the phase 5 screening, and 4369 participants completed the CIDI, 4309 of whom had participated at earlier phases (Figure A, available as a supplement to the online version of this article at <http://www.ajph.org>). We analyzed the data of 3942 (76%) participants for whom complete data on covariates and the CIDI were available. At phase 5, 2786 (71%) participants were still working in either the civil service or other paid employment.

Work Characteristics

We measured work characteristics (decision latitude, work demands, work social support) in a self-report questionnaire at phases 1, 2, and 3 using an adapted version of the Job Content Instrument.³⁰ At phase 1, we calculated the Cronbach α (a measure of the internal

consistency) for each scale, and we obtained the following results—decision latitude (15 items): 0.84; job demands (4 items): 0.67; and social support at work (6 items): 0.79.

We calculated job strain as the score of decision latitude subtracted from the work demand score and then divided it into tertiles ranging from -87 to 83 .³¹ We defined job strain at each phase as being in the most adverse tertile. In other studies job strain has been developed from median splits of job demands and control, where job strain is composed of high demands and low control⁹ or by dividing job demands by job control and dichotomizing this continuous variable at the highest quartile to indicate job strain.²⁶ Other studies divide demands and control into thirds and define job strain by the top or middle thirds in the demands scale combined with the bottom third of the control scale.²⁶ It is unclear from the literature whether altering the threshold for job strain has an effect on results.⁹

The advantage of our method over the quadrant method is that it initially uses the full range of continuous scores rather than a binary score. Work social support included items on support from supervisors and clarity and consistency of information from supervisors. We expressed the work social support score, ranging 0 to 18, as percentages and divided them into tertiles.

Major Depressive Disorder

We measured episodes of MDD in the past 12 months using the University of Michigan version of the CIDI adapted for self-administered computerized interview.³² We assessed the prevalence of 12-month or past-year MDD using criteria from the *Diagnostic and Statistical Manual of Mental Disorders, Third Edition*.³³

The definition of an MDD required that the episode also fulfilled criteria for impairment and change in function and that the symptom cluster did not derive from organic conditions, bereavement, or mania. We made these assessments at phase 5 of the Whitehall II study.

General Health Questionnaire

We measured common mental disorder at phases 1, 2, and 3 using the 30-item General Health Questionnaire (GHQ), a well-established

screening questionnaire for psychiatric disorder.³⁴ We used the GHQ as a continuous measure in analyses to adjust for negative affectivity that might influence the reporting of work characteristics and as a proxy measure for prior depression.

We also used GHQ caseness (dichotomized at 4/5+) and depressive symptom caseness (dichotomized at 2/3+) as alternative ways of classifying the GHQ for adjustment. The latter is a better proxy for previous depression than is overall GHQ caseness.

Covariates

We derived covariates from phase 3 data collection. Two percent of covariate values at phase 3 were missing, and we substituted these with values from phase 2 (99% of values) or phase 1 (1% of values). We measured socioeconomic position by civil service employment grade. We classified marital status as married or cohabiting; single; or widowed, divorced or separated. Education level was the highest level of formal education attained (education to 16 years, education to 18 years, higher education after 18 years).

The health behaviors we assessed at phase 3 included smoking (never, ex-smoker, current smoker), alcohol intake in the past week (none; 1–14 units [women] or 1–21 units [men]; ≥ 15 [women] or ≥ 22 units [men]), physical activity (amount of moderate or vigorous physical activity per week: none, < 2.5 hours, 2.5 hours moderate or 1 hour vigorous).

We measured perceived confiding or emotional social support received over the past 12 months from the person nominated as closest on the Close Persons Questionnaire³⁵ using the mean of assessments at phases 1 and 2. We devised a measure of social networks outside the household from questions about the frequency and number of contacts with relatives, friends, and social groups.³⁶ We assessed prior physical and mental illness at phase 3 using the self-reported presence of longstanding illness.

Data Analysis

We used logistic regression analysis to estimate the odds ratios (ORs) for job strain, work social support, and covariates on the onset of major depressive episode. We adjusted all ORs, apart from those for age and gender, for age and gender by fitting a term

for gender and 2 terms for age that allowed the linear effect of age to be different in men and women. We first analyzed the separate association of job strain and work social support tertiles measured at phases 1, 2, and 3 on MDD at phase 5.

We created repeated measures of job strain and work social support that indicated the number of times that each participant was in the adverse tertile. We included participants in the analyses of repeated job strain and social support only if they had at least 2 of the 3 assessments. We examined the effects of change in job strain between phases 1 and 3 by comparing the odds of MDD in those with and without job strain (the most adverse tertile) at phases 1 and 3.

RESULTS

There were 1023 women and 2919 men in the analyses of job strain and MDD. Because of missing information on covariates and because they did not have at least 2 measures of job strain, we excluded 367 participants from the sample who completed the CIDI at phase 5 ($n = 4309$). From the original baseline sample of 10 308, the participants included in the analyses were younger (aged 43.6 vs 45.0 years; $P < .001$), more likely to be men (74% vs 64%), and less likely to be from the lower clerical or other grades (13% vs 28%; $P < .001$). The mean GHQ in the participants that we excluded and those we included was 3.65 and 3.64, respectively ($P = .89$).

The 12-month, or 1-year, prevalence of MDD was 5.3% for women and 3.6% for men. The prevalence of MDD in this study is similar to that found in a review of 42 studies of MDD (12-month prevalence of MDD = 5.3; interquartile range = 3.6–6.8).⁶ Women reported job strain 31.9% at 1 phase, 16.5% at 2 phases, and 14.8% at 3 phases, whereas in men this pattern was 29.2%, 14.9%, and 9.8%, respectively.

In analyses adjusted for age and gender, there was a higher prevalence of MDD in women, younger participants, middle employment grades, those getting insufficient physical activity, and those reporting longstanding physical illness (Table 1). GHQ caseness at each of the 3 phases was strongly associated with increased risk of MDD.

TABLE 1—Covariates at Phase 3 and Prevalence and OR (95% CI) for Associations With Major Depressive Disorder at Phase 5: Whitehall II Study, London, UK, 1988–1999

Covariate	Proportion (No.)	Major Depressive Disorder at Phase 5	
		Prevalence (No.)	OR ^a (95% CI)
Age, y			
45–54	79.2 (3123)	4.45 (139)	1.00 (Ref)
55–64	20.8 (819)	2.32 (19)	0.51 (0.32, 0.83)
Gender			
Male	74.0 (2919)	3.56 (104)	1.00 (Ref)
Female	26.0 (1023)	5.28 (54)	1.50 (1.07, 2.10)
Employment grade			
Administrative	42.4 (1671)	2.87 (48)	1.00 (Ref)
Executive or professional	46.9 (1847)	4.87 (90)	1.62 (1.13, 2.33)
Clerical or other	10.8 (424)	4.72 (20)	1.50 (0.85, 2.67)
Age of completion of education, y			
≤ 16	29.9 (1178)	3.48 (41)	1.00 (Ref)
17–18	24.9 (980)	4.49 (44)	1.26 (0.81, 1.94)
> 18	45.3 (1784)	4.09 (73)	1.11 (0.74, 1.65)
Marital status			
Married or cohabiting	78.8 (3107)	3.73 (116)	1.00 (Ref)
Single	13.9 (547)	4.39 (24)	1.07 (0.68, 1.70)
Widowed, divorced, or separated	7.31 (288)	6.25 (18)	1.61 (0.96, 2.73)
Smoking			
Never	49.3 (1942)	3.55 (69)	1.00 (Ref)
Ex-smoker	36.6 (1444)	4.57 (66)	1.41 (0.99, 1.99)
Current	14.1 (556)	4.14 (23)	1.17 (0.72, 1.90)
Alcohol intake, units/wk			
None	15.8 (624)	3.04 (19)	1.00 (Ref)
1–14 (women)/1–21 (men)	67.7 (2669)	4.20 (112)	1.47 (0.89, 2.42)
≥ 15 (women)/≥ 22 (men)	16.5 (649)	4.16 (27)	1.46 (0.80, 2.67)
Physical activity			
Vigorous	54.6 (2153)	3.11 (67)	1.00 (Ref)
Moderate	31.8 (1252)	5.35 (67)	1.69 (1.19, 2.40)
None	13.6 (537)	4.47 (24)	1.40 (0.86, 2.30)
Confiding and emotional support			
High	32.9 (1298)	4.08 (53)	1.00 (Ref)
Intermediate	31.5 (1243)	4.26 (53)	1.12 (0.76, 1.66)
Low	35.5 (1401)	3.71 (52)	1.09 (0.74, 1.61)
Social network			
High	36.6 (1441)	4.23 (61)	1.00 (Ref)
Medium	37.3 (1470)	4.01 (59)	0.93 (0.65, 1.35)
Low	26.2 (1031)	3.69 (38)	0.88 (0.58, 1.33)
Longstanding physical illness			
No	67.2 (2648)	3.29 (87)	1.00 (Ref)
Yes	32.8 (1294)	5.49 (71)	1.77 (1.28, 2.45)
GHQ caseness at phase 1			
Noncase	72.9 (2859)	3.11 (75)	1.00 (Ref)
Case	27.1 (1065)	6.48 (72)	2.05 (1.48, 2.84)

*Continued***Job Strain and Social Support at Phases 1, 2, and 3**

The association between job strain and MDD at each of the 3 phases is shown in Table 2. Prevalence rates of MDD were highest for those with job strain across each of the 3 phases. ORs for MDD were significantly increased for job strain relative to no job strain for each of the 3 phases with slightly increased magnitude for phase 3 versus phase 1 (Table 2).

The prevalence of MDD was highest in the lowest work support tertile at each of the 3 phases, but the ORs for the lowest relative to the highest tertile of work social support was only significant at phase 2.

Repeated Exposure to Job Strain and Social Support

The prevalence of MDD increased with 1 and 2 or 3 occasions of exposure to job strain (Table 3). Exposure to job strain on 2 or 3 occasions was associated with a twofold risk of MDD, which was not substantially diminished after adjustment for age, gender, employment grade, marital status, age of highest educational attainment, smoking, weekly alcohol intake, physical activity, confiding and emotional support, and social networks (Table 3). There was a small reduction in risk after further adjustment for longstanding physical and mental illness, but the OR remained significant with a dose–response association of increasing risk for 1 occasion and for 2 or 3 occasions of exposure to job strain.

In a further analysis, we adjusted for GHQ score measured concurrently with the assessment of job strain to control for response bias related to negative affectivity and previous depressive illness. This substantially reduced the size of the ORs, but the trend for high job strain on 2 or 3 occasions versus on 1 occasion remained statistically significantly associated with increased risk of MDD. The reduction in ORs was smaller when the association was adjusted for GHQ caseness or depressive symptom caseness using the depressive symptoms subscale from the GHQ. These results changed little when we added a term, to indicate that only 2 out of 3 job strain measures were available, to the models.

Repeated exposure to low social support at work was modestly associated with increased

TABLE 1—Continued

GHQ caseness at phase 2			
Noncase	70.4 (2562)	2.93 (75)	1.00 (Ref)
Case	29.6 (1076)	6.69 (72)	2.30 (1.65, 3.21)
GHQ caseness at phase 3			
Noncase	77.9 (3007)	2.86 (86)	1.00 (Ref)
Case	22.1 (855)	7.60 (65)	2.63 (1.88, 3.67)

Note. CI = confidence interval; GHQ = General Health Questionnaire; OR = odds ratio. The sample size was n = 3942.
^aORs for covariates are adjusted for age and gender. Age and gender are mutually adjusted.

risk of MDD in analyses adjusting for age, gender, employment grade, marital status, age of highest educational attainment, smoking,

weekly alcohol intake, physical activity, confiding and emotional support, and social networks (Table 3). However, these associations

were no longer significant after adjusting for the GHQ score at phases 1, 2, and 3.

Change in Job Strain and Major Depressive Disorder

We examined the prevalence of MDD in participants who had job strain at phase 1 and not at phase 3 and in participants who had no job strain at phase 1 but job strain at phase 3 (Table 4).

Adverse change in job strain was associated with increased prevalence and increased odds of MDD compared with no job strain on either occasion. The odds for the adverse change in job strain were slightly higher than were those for the beneficial change in job strain between phases 1 and 3. The highest odds were associated with repeated high job strain at phases 1 and 3.

DISCUSSION

Repeated exposure to job strain is associated with increased risk of MDD that was maintained after adjustment for covariates. The association was reduced by adjustment for total GHQ score at phases 1, 2, and 3 to account for the effects of negative affectivity, which may have influenced response bias on the reporting of work characteristics and prior depressive illness.

Work social support on 2 occasions was associated with increased risk of MDD, but this was no longer significant after adjustment for GHQ score.

Self-report of work characteristics implies that objective working conditions are filtered through the perceptions, appraisal, and coping strategies of individual workers. Associations of self-report work characteristics and self-report health outcomes have been shown to be confounded by negative affectivity,³⁷ although not in all studies,⁷ and prior psychological distress has been shown to influence report of work characteristics.^{38,39} Because a structured interview was used as the outcome in this study, there is less susceptibility to response bias than might be found when using a symptom-rating scale.

The lack of association of work social support with MDD after adjustment may mean that report of low social support at work is subject to response bias related to concomitant or

TABLE 2—Prevalence and OR (95% CI) of Major Depressive Disorder at Phase 5 by Job Strain at Phases 1, 2, and 3: Whitehall II Study, London, UK, 1988–1999

Job Characteristic	No.	Major Depressive Disorder at Phase 5		P
		Prevalence (No.)	OR (95% CI) ^a	
Job strain				
Phase 1 (n = 3915)				
Low	1348	3.04 (41)	1.00 (Ref)	
Medium	1308	3.67 (48)	1.19 (0.78, 1.82)	.42
High	1259	5.24 (66)	1.72 (1.16, 2.57)	.008
Phase 2 (n = 3641)				
Low	1158	3.11 (36)	1.00 (Ref)	
Medium	1240	3.47 (43)	1.10 (0.70, 1.73)	.67
High	1243	5.47 (68)	1.76 (1.16, 2.67)	.007
Phase 3 (n = 3660)				
Low	1243	2.82 (35)	1.00 (Ref)	
Medium	1313	3.81 (50)	1.32 (0.85, 2.06)	.21
High	1104	5.53 (61)	1.96 (1.28, 3.00)	.002
Work social support				
Phase 1 (n = 3928)				
High	1304	3.53 (46)	1.00 (Ref)	
Medium	1302	3.46 (45)	0.99 (0.65, 1.51)	.96
Low	1322	4.99 (66)	1.44 (0.98, 2.11)	.07
Phase 2 (n = 3635)				
High	1154	3.29 (38)	1.00 (Ref)	
Medium	1176	3.91 (46)	1.23 (0.79, 1.91)	.35
Low	1305	4.83 (63)	1.52 (1.01, 2.29)	.05
Phase 3 (n = 3629)				
High	1159	3.45 (40)	1.00 (Ref)	
Medium	1250	4.08 (51)	1.18 (0.78, 1.81)	.43
Low	1220	4.43 (54)	1.27 (0.83, 1.93)	.26

Note. CI = confidence interval; OR = odds ratio.
^aAdjusted for age and gender.

TABLE 3—Prevalence and OR (95% CI) for Repeated Job Strain and Low Work Support and Major Depressive Disorder at Phase 5: Whitehall II Study, London, UK, 1988–1999

Job Characteristic	Major Depressive Disorder at Phase 5				
	Prevalence (No.)	OR (95% CI) ^a	OR (95% CI) ^b	OR (95% CI) ^c	OR (95% CI) ^d
Job strain					
None	2.67 (46)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
1 occasion	4.16 (49)	1.56 (1.03, 2.36)	1.56 (1.03, 2.36)	1.53 (1.01, 2.32)	1.28 (0.84, 1.95)
2–3 occasions	6.05 (63)	2.27 (1.53, 3.37)	2.19 (1.48, 3.26)	2.10 (1.41, 3.13)	1.49 (0.98, 2.27)
<i>P</i> for trend		< .001	< .001	< .001	.05
Low work social support					
None	3.26 (54)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
1 occasion	3.74 (41)	1.12 (0.74, 1.70)	1.12 (0.74, 1.71)	1.12 (0.74, 1.70)	0.97 (0.64, 1.49)
2–3 occasions	5.29 (62)	1.62 (1.11, 2.36)	1.62 (1.10, 2.37)	1.61 (1.10, 2.37)	1.16 (0.77, 1.74)
<i>P</i> for trend		.01	.01	.01	.43

Note. CI = confidence interval; OR = odds ratio. The sample size was n = 3942. Analyses for low work support were derived from 3923 participants.

^aAdjusted for age and gender.

^bAdjusted for all covariates: age, gender, employment grade, education, marital status, smoking habit, alcohol intake, physical activity, confiding and emotional support, and social network.

^cAdditionally adjusted for longstanding illness.

^dAdditionally adjusted for General Health Questionnaire at phases 1–3.

concurrent psychological distress. However, as low work social support has been related to mental health outcomes in other studies,¹⁴ an alternative interpretation is that we have overadjusted in these analyses.

In general, the evidence for the effects of adverse work characteristics on diagnostic measures of depression has been strongest for job strain than for other work characteristics.¹⁴ There have been few studies of repeated exposure to job strain and depression, but 3 studies have found results similar to our study:

de Lange et al.⁸ found that repeated job strain was associated with increased risk of depressive symptoms, Bourbonnais et al.⁴⁰ found effects of repeated job strain on depression in nurses, and Wang et al.⁴¹ found exposure to repeated job strain was associated with depression in a national Canadian sample.

We found that both repeated job strain and increased job strain between phases 1 and 3 were associated with increased risk of MDD at phase 5. This is similar to other studies: de Lange et al.⁸ found the transition from no strain

to strain was associated with increased risk of depressive symptoms but the reverse transition of strain to no strain was not associated with a statistically significant decrease in risk of depressive symptoms. This concurs with our findings that decrease in job strain between phases 1 and 3 was not associated with a decreased risk of depression; the latter may indicate that the risk associated with job strain does not decline immediately despite a beneficial change in working conditions. Alternatively, it could be that job strain increased again in some of these participants after phase 3, or it could indeed be a chance finding because Wang et al. did find that the risk of depression decreased with reduction in job strain.⁴¹ Further analysis could explore the job demands resources model in which the effects of demands may be relatively independent of control and the availability of resources may increase motivation at work.⁴²

These findings fit with an exposure time effect model where the longer the exposure to job strain, the higher the incidence of depression. Underlying this hypothesis is the assumption that accumulation of job strain in terms of both time exposed and intensity of job strain increases the risk of depression.

In our study this assumes that repeated exposure to job strain is a proxy measure of increased duration of exposure to job strain, although we cannot rule out that participants may not have been subject to job strain in the intervals between measurements. However, unless jobs change radically it seems reasonable to expect that job strain will remain the same over a period of 2 to 3 years. This is in contrast to an initial impact model in which initial exposure leads to a stress response to which there is gradual adaptation. Our results do not suggest adaptation to job strain. Removal, or at least subsequent lower reporting of job strain, was not related to decreased risk of depression, suggesting that once a depressive illness has become established, simple removal of the stressor may not reverse this process.

It is important to consider the effects of aging on our results. It may be that the same level of job strain becomes more stressful with increasing age. However, the association of job strain with MDD was greater in those younger than 50 years than in those older than 50 years (results not reported). Age-related health

TABLE 4—Change in Job Strain Between Phases 1 and 3 and Risk of Major Depressive Disorder: Whitehall II Study, London, UK, 1988–1999

Job Strain Change	Major Depressive Disorder at Phase 5		
	Prevalence (No.)	OR (95% CI) ^a	OR (95% CI) ^b
No change phases 1–3 (low strain)	2.87 (54)	1.00 (Ref)	1.00 (Ref)
High job strain phase 1 to low job strain phase 3	4.42 (29)	1.56 (0.99, 2.48)	1.55 (0.97, 2.48)
Low job strain phase 1 to high job strain phase 3	5.05 (29)	1.77 (1.11, 2.81)	1.67 (1.04, 2.67)
High job strain phases 1 and 3	5.95 (31)	2.12 (1.34, 3.34)	1.94 (1.22, 3.08)

Note. CI = confidence interval; OR = odds ratio.

^aAdjusted for age and gender.

^bAdjusted for all covariates: age, gender, employment grade, education, marital status, smoking habit, alcohol intake, physical activity, confiding and emotional support, and social network.

selection out of the cohort may ensure a more resilient population of survivors.

Strengths and Limitations

The strengths of our study are the high response rates, the longitudinal design, the large numbers of people in similar occupations, the use of the CIDI to measure MDD, and the extensive data on covariate factors. One limitation of the study is the fact that not all the respondents at phase 5 had the opportunity to participate in the CIDI because it was started after screening had begun. The participants who completed the CIDI and those who did not differed slightly by gender and employment grade, which may have influenced the results, but there was no differential selection in those who completed the CIDI and those who did not.

Generalization from this study is largely limited to white-collar working populations, whereas differences between government servants and the private sector diminished during the period of the study. A limitation is that we had no observational measures of work and relied on self-report questions for the job strain model. However, a qualitative observational study of work characteristics in this cohort study did find that skill utilization, similar to Karasek's skill discretion measured by work observation methods, was associated with reduced risk of depressive symptoms.⁴³ Skill utilization has been suggested to be an intervening variable between control over work and depression.⁴⁴

We had no information on job characteristics between the 3 waves of data collection and there may have been changes in job strain and social support of which we were unaware, although it is likely that we captured most of the major changes in job characteristics. We were unable to completely control for previous depression, as we did not have data on prior evidence of MDD measured by the CIDI and used the GHQ as a measure of psychological distress.

The advantage of the GHQ data was that we had them on 3 occasions contemporaneously with the measurement of work characteristics. Adjustment for prior GHQ score could be considered overadjustment, especially as the GHQ is a strong predictor of MDD.

A further limitation was the 5-year interval between the final assessment of work

characteristics and the measurement of MDD. This may have weakened the magnitude of the association between job strain and MDD because of the intercurrent changes in work characteristics and mental health. However, we found the same association between job strain and MDD in those who were still in employment at phase 5 (results not reported).

Conclusions

MDD is a common condition (median prevalence = 5.3%; interquartile range = 3.6–6.5) that is estimated to cost \$97.3 billion per year in the United States; so preventive interventions could be cost effective.⁵ Job strain is made up of 2 dimensions that could be modified in the workplace: job demands and decision latitude. Job demands, in terms of high work pace and conflicting demand, can be modified to some extent. Flattening of work hierarchies and giving more job discretion to employees have increased decision latitude in some workplaces, but there have been few systematic evaluations of these interventions in relation to MDD. Further research should investigate objective measurement of work characteristics and evaluate the health consequences of interventions in the workplace that are designed to decrease job strain. ■

About the Authors

Stephen A. Stansfeld is with the Centre for Psychiatry, Wolfson Institute of Preventive Medicine, Barts and the London School of Medicine and Dentistry, Queen Mary, University of London, UK. Martin J. Shipley and Jenny Head are with the Department of Epidemiology and Public Health, University College London Medical School, London. Rebecca Fuhrer is with the Department of Epidemiology, Biostatistics, and Occupational Health, McGill University, Montreal, Quebec, Canada.

Correspondence should be sent to Stephen A. Stansfeld, Centre for Psychiatry, Barts and the London School of Medicine and Dentistry, Queen Mary, University of London, Old Anatomy Building, Charterhouse Square, London EC1M 6BQ, UK (e-mail: s.a.stansfeld@qmul.ac.uk). Reprints can be ordered at <http://www.ajph.org> by clicking the "Reprints" link.

This article was accepted November 6, 2011.

Contributors

S.A. Stansfeld conceptualized and designed the study, interpreted the data, and wrote the first draft of the article. M.J. Shipley carried out the analyses and contributed to their interpretation. Jenny Head contributed to the analyses and to their interpretation. Rebecca Fuhrer codesigned the study and contributed to the analyses and the interpretation of the data. All authors contributed to writing the article.

Acknowledgments

The Whitehall II study has been supported by grants from the Medical Research Council, British Heart Foundation, Health and Safety Executive, Department of Health, the US National Institutes of Health (NIH) National Heart Lung and Blood Institute (grant HL36310), the NIH National Institute on Aging (grant AG13196), Agency for Health Care Policy Research (grant HS06516), and the John D. and Catherine T. MacArthur Foundation Research Networks on Successful Midlife Development and Socio-economic Status and Health. M.J. Shipley is supported by a grant from the British Heart Foundation.

We thank Michael Marmot, who directs the Whitehall II study, for his encouragement. We thank all participating civil service departments and their welfare, personnel, and establishment officers; the Occupational Health and Safety Agency; the Council of Civil Service Unions; all participating civil servants in the Whitehall II study; and all members of the Whitehall II study team.

Human Participant Protection

Ethical approval for the Whitehall II study was obtained from the University College London Medical School committee on the ethics of human research. Written informed consent was obtained from all participants

References

1. Kessler RC, Berglund P, Demler O, et al. National Comorbidity Survey replication: the epidemiology of major depressive disorder: results from the National Comorbidity Survey Replication (NCS-R). *JAMA*. 2003;289(23):3095–3105.
2. Wells KB, Stewart A, Hays RD, et al. The functioning and well-being of depressed patients. Results from the Medical Outcomes Study. *JAMA*. 1989;262(7):914–919.
3. Kessler RC, Frank RG. The impact of psychiatric disorders on work loss days. *Psychol Med*. 1997;27(4):861–873.
4. Goetzel RZ, Long SR, Ozminkowski RJ, Hawkins K, Wang S, Lynch W. Health, absence, disability, and presenteeism cost estimates of certain physical and mental health conditions affecting U.S. employees. *J Occup Environ Med*. 2004;46(4):398–412.
5. Wang PS, Simon G, Kessler RC. The economic burden of depression and the cost-effectiveness of treatment. *Int J Methods Psychiatr Res*. 2003;12(1):22–33.
6. Eaton WW, Martins SS, Nestadt G, Bienvenu OJ, Clarke D, Alexandre P. The burden of mental disorders. *Epidemiol Rev*. 2008;30:1–14.
7. Paterniti S, Niedhammer I, Lang T, Consoli SM. Psychosocial factors at work, personality traits and depressive symptoms. Longitudinal results from the GAZEL study. *Br J Psychiatry*. 2002;181:111–117.
8. de Lange AH, Taris TW, Kompier MA, Houtman IL, Bongers PM. Effects of stable and changing demand-control histories on worker health. *Scand J Work Environ Health*. 2002;28(2):94–108.
9. de Lange AH, Taris TW, Kompier MA, Houtman IL, Bongers PM. "The very best of the millennium": longitudinal research and the demand-control-(support) model. *J Occup Health Psychol*. 2003;8(4):282–305.
10. Inoue M, Tsurugano S, Yano E. Job stress and mental health of permanent and fixed-term workers

- measured by effort-reward imbalance model, depressive complaints, and clinic utilization. *J Occup Health*. 2011;53(2):93-101.
11. Strazdins L, D'Souza RM, Clements M, Broom DH, Rodgers B, Berry HL. Could better jobs improve mental health? A prospective study of change in work conditions and mental health in mid-aged adults. *J Epidemiol Community Health*. 2011;65(6):529-534.
 12. Marchand A, Demers A, Durand P. Do occupation and work conditions really matter? A longitudinal analysis of psychological distress experiences among Canadian workers. *Sociol Health Illn*. 2005;27(5):602-627.
 13. Rugulies R, Bültmann U, Aust B, Burr H. Psychosocial work environment and incidence of severe depressive symptoms: prospective findings from a 5-year follow-up of the Danish work environment cohort study. *Am J Epidemiol*. 2006;163(10):877-887.
 14. Stansfeld S, Candy B. Psychosocial work environment and mental health: a meta-analytic review. *Scand J Work Environ Health*. 2006;32(6):443-462.
 15. Karasek RA. Job demands, job decision latitude, and mental strain: implications for job redesign. *Adm Sci Q*. 1979;24(2):285-309.
 16. Schnall PL, Landsbergis PA, Baker D. Job strain and cardiovascular disease. *Annu Rev Public Health*. 1994;15:381-411.
 17. Johnson JV, Hall EM. Job strain, workplace social support, and cardiovascular disease: a cross-sectional study of a random sample of the Swedish working population. *Am J Public Health*. 1988;78(10):1336-1342.
 18. Frese M, Zapf D. Methodological issues in the study of work stress: objective vs subjective measurement of work stress and the question of longitudinal studies. In: Cooper CL, Payne R, eds. *Causes, Coping and Consequences of Stress at Work*. Chichester, UK: Wiley & Sons; 1988:375-411.
 19. De Jonge J, Kompier MAJ. A critical examination of the demand-control-support model from a work psychological perspective. *Int J Stress Manag*. 1997;4(4):235-258.
 20. Cropley M, Steptoe A, Joeekes K. Job strain and psychiatric morbidity. *Psychol Med*. 1999;29(6):1411-1416.
 21. Mausner-Dorsch H, Eaton WW. Psychosocial work environment and depression: epidemiologic assessment of the demand-control model. *Am J Public Health*. 2000;90(11):1765-1770.
 22. Wang J. Perceived work stress and major depressive episodes in a population of employed Canadians over 18 years old. *J Nerv Ment Dis*. 2004;192(2):160-163.
 23. Shields M. Stress and depression in the employed population. *Health Rep*. 2006;17(4):11-29.
 24. Blackmore ER, Stansfeld SA, Weller I, Munce S, Zagorski BM, Stewart DE. Major depressive episodes and work stress: results from a national population survey. *Am J Public Health*. 2007;97(11):2088-2093.
 25. Plaisier I, de Bruijn JGM, de Graff R, ten Have M, Beekman AT, Penninx BW. The contribution of working conditions and social support to the onset of depressive and anxiety disorders among male and female employees. *Soc Sci Med*. 2007;64(2):401-410.
 26. Ylipaavalniemi J, Kivimäki M, Elovaino M. Psychosocial work characteristics and incidence of newly diagnosed depression: a prospective cohort study of three different models. *Soc Sci Med*. 2005;61(1):111-122.
 27. Virtanen M, Honkonen T, Kivimäki M. Work stress, mental health and antidepressant medication findings from the Health 2000 Study. *J Affect Disord*. 2007;98(3):189-197.
 28. Netterstrøm B, Conrad N, Bech P, et al. The relation between work-related psychosocial factors and the development of depression. *Epidemiol Rev*. 2008;30:118-132.
 29. Marmot MG, Smith GD, Stansfeld S, et al. Health inequalities among British civil servants: the Whitehall II study. *Lancet*. 1991;337(8754):1387-1393.
 30. Karasek R, Theorell T. *Healthy Work: Stress, Productivity and the Reconstruction of the Working Life*. New York: Basic Books; 1990.
 31. Kivimäki M, Head J, Ferrie JE, et al. Why is evidence on job strain and coronary heart disease mixed? An illustration of measurement challenges in the Whitehall II study. *Psychosom Med*. 2006;68(3):398-401.
 32. Kessler RC, Wittchen H, Abelson JM, et al. Methodological studies of the Composite International Diagnostic Interview (CIDI) in the US National Comorbidity Survey (NCS). *Int J Methods Psychiatr Res*. 1998;7(1):33-55.
 33. *Diagnostic and Statistical Manual of Mental Disorders, Third Edition*. Washington, DC: American Psychiatric Association; 1980.
 34. Goldberg D. *The Detection of Psychiatric Illness by Questionnaire*. Oxford, UK: Oxford University Press; 1972.
 35. Stansfeld S, Marmot M. Deriving a survey measure of social support: the reliability and validity of the Close Persons Questionnaire. *Soc Sci Med*. 1992;35(8):1027-1035.
 36. Berkman LF, Syme SL. Social networks, host resistance, and mortality: a nine-year follow-up study of Alameda County residents. *Am J Epidemiol*. 1979;109(2):186-204.
 37. Hurrell JJ, Nelson DL, Simmons BL. Measuring job stressors and strains: where we have been, where we are, and where we need to go. *J Occup Health Psychol*. 1999;3(4):288-292.
 38. Taris TW, Bok IA, Calje DG. On the relation between job characteristics and depression: a longitudinal study. *Int J Stress Manag*. 1998;5(3):157-167.
 39. Stansfeld SA, Clark C, Caldwell T, Rodgers B, Power C. Psychosocial work characteristics and anxiety and depressive disorders in midlife: the effects of prior psychological distress. *Occup Environ Med*. 2008;65(9):634-642.
 40. Bourbonnais R, Comeau M, Vézina M. Job strain and evolution of mental health among nurses. *J Occup Health Psychol*. 1999;4(2):95-107.
 41. Wang J, Schmitz N, Dewa C, Stansfeld S. Changes in perceived job strain and the risk of major depression: results from a population based longitudinal study. *Am J Epidemiol*. 2009;169(9):1085-1091.
 42. Demerouti E, Bakker AB, de Jonge J, Janssen PPM, Schaufeli WB. Burnout and engagement at work as a function of demands and control. *Scand J Work Environ Health*. 2001;27(4):279-286.
 43. Griffin JM, Greiner BA, Stansfeld SA, Marmot M. The effect of self-reported and observed job conditions on depression and anxiety symptoms: a comparison of theoretical models. *J Occup Health Psychol*. 2007;12(4):334-349.
 44. Holman DJ, Wall TD. Work characteristics, learning-related outcomes, and strain: a test of competing direct effects, mediated, and moderated models. *J Occup Health Psychol*. 2002;7(4):283-301.