

Heavy overtime work and depressive disorder among male workers

Abstract

Background: The association between overtime and depression is unclear and very few studies have examined the association between heavy overtime work, i.e., working more than 60 hours per week, and depression.

Aims: To examine the association between heavy overtime work and the onset of depressive disorder among male workers.

Methods: A one year follow-up cohort study of male workers in a manufacturing company in Japan, between 2008 and 2009. Working hours, depressive disorder, assessed by the CES-D Scale (Score ≥ 16 points), and covariates were measured at baseline and at follow-up. Participants who had depressive disorder at baseline were excluded.

Results: At follow-up, 1,194 participants aged between 18 and 71 were analysed. Multiple logistic regression analysis revealed that the odds ratio for the new onset of

depressive disorder was 4.5 (95% CI 1.8-11.1) times higher for employees working more than 60 hours per week than for those working 50 hours per week or less, when adjusted for age, lifestyle factors, work-related characteristics and socio-demographic characteristics at baseline and working hours at follow-up. However, the correlation between working 50.1 to 60 hours per week and depressive disorder was not significant. The trend test of depressive disorder among groups by working hours was significant ($p < 0.01$).

Conclusions: Heavy overtime work is a risk factor for the new onset of depressive disorder in this population of male workers. Working more than 60 hours per week may be the cut-off to screen for high risk groups who need preventive action against depressive disorder.

Key words: Overtime work, working hours, depressive disorder, CES-D.

Introduction

Depression is a common condition that can lower work performance, increase absence, impair productivity, and decrease job retention, as well as lead to suicide (1, 2). According to the World Health Organization more than 350 million people of all ages worldwide are estimated to have depression and depression will become the leading cause of disease burden in high income countries by 2030 (3).

Sudden deaths from cardiovascular and cerebrovascular diseases caused by overwork have been an important topic of debate in Japan since the 1970s. These deaths have been referred to as *karoshi*, which means “death from overwork” in Japanese (4). A marked increase has been observed in the number of applications filed for workers’ compensation insurance and civil suits since the 1990s due to the rapidly increasing number of work-related suicides in Japan (*karojisatsu*, meaning “suicide from overwork” in Japanese) (2). The Japanese Ministry of Health, Labour and Welfare (JMHLW) released guidelines called “Comprehensive Program for the Prevention of Health Impairment Due to Overwork” in 2002 in an attempt to prevent health impairments due to overwork (5). According to these guidelines, Japanese employers should try to limit the number of overtime work hours to 45 or less per month. Moreover, if overtime work exceeds 100 hours in a month, or a

monthly average of 80 hours for 2 to 6 months, employers shall persuade these employees to consult a doctor.

The biopsychosocial model assumes that biological, social (environmental), circumstantial (life events), and psychological factors are all important in the aetiology of mental health problems (6, 7). Social factors include working conditions such as working hours. Long working hours are considered to be an important factor for the onset of depressive disorder in the occupational health field, and this has been previously investigated. To date, a significant correlation has been reported between long working hours and depression by some researchers, but not by others (8-12). Fujino et al. reported inconsistent results in the association between working hours and mental health burden in a review paper (13). In addition most previous studies used 55 hours or less per week as the cut-off point of long working hours (8-11). Therefore the association between longer working hours, in excess of 60 working hours per week, and depression needs to be examined.

Only one study of heavy overtime work, i.e. working more than 60 hours per week or more than 80 hours overtime per month, has shown that working more than 12 hours per day (more than 60 hours per week) significantly affected the development of mental symptoms in male employees of a telecommunications

enterprise (12). However, this study only used questions on a number of psychological symptoms to assess mental health, and incorporated neither representative scales having reliability and validity, such as the Center for Epidemiologic Studies Depression (CES-D) Scale or the General Health Questionnaire (GHQ), nor psychiatric diagnoses in the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV). Therefore, the association between heavy overtime work and the onset of depressive disorder, particularly in male workers remains unclear.

The aim of this study was to examine the association between heavy overtime work and the onset of depressive disorder, assessed by the CES-D Scale, in male employees of a Japanese manufacturing company over a 1 year period.

Methods

This cohort study was conducted in two factories of a manufacturing company in Tochigi and Fukushima, Japan, between April 2008 and June 2009. White-collar and blue-collar workers were engaged in various duties including clerical, business, engineering, managerial and manufacturing work. We excluded female employees and those who had data missing on gender, the CES-D Scale, or working hours per

week. We also excluded employees with depressive disorder defined by the CES-D Scale (Score ≥ 16 points) at baseline. At the 1 year follow-up those who were not employed and those employed who did not respond to the questionnaires, or did not complete the CES-D Scale, were excluded (Figure 1). Approval was obtained from the company's safety and health committee, which included representatives of the workers, and participation was voluntary. This study protocol was also approved by the Medical Ethics Committee of the University of Occupational and Environmental Health, Japan.

In the annual health examination a self-administered questionnaire survey was conducted to obtain information on sex, age, lifestyle factors, work-related characteristics and socio-demographic characteristics. The questionnaires were distributed in advance to each employee, were filled in by the employees and then collected at the reception of the health examination centre. Work-related items in the questionnaire included working hours per week, job grade, shift work, years of experience and the site of work. Items on socio-demographic characteristics consisted of family income and education. Items on lifestyle factors included smoking habits and alcohol consumption. Job grade was categorized into two categories: staff and manager. Shift work and smoking habits were divided into yes

or no. Family income was categorized into five categories: ≤ 2.99 million yen per year, 3.00-4.99, 5.00-7.99, 8.00-9.99, 10.00-14.99 and ≥ 15.00 million yen per year. Alcohol consumption was categorized into three categories: almost every day, sometimes, and abstinent. Questions on working hours per week, years of experience and education included the following: "How many hours per week do you work (including overtime work hours)?", "How many years have you worked at the present job?", and "How many years were you engaged in formal education (including compulsory education, high school, university and college)?"

Depressive disorder was measured using the Center for Epidemiologic Studies Depression (CES-D) Scale, a short self-report scale designed to measure depressive symptoms during the previous week in the general population (14-17). The scale was shown to have strong reliability and construct validity (16). Iwata. et al. reported Cronbach's alpha coefficients for the Japanese version of the CES-D Scale of 0.79 for males and 0.78 for females (18). According to previous studies (14-17), we used 16 points as a cut-off score to assess depressive disorder. A CES-D scale score of 16 or higher has a sensitivity of 64% and a specificity of 94% (17).

According to previous studies (9-12) and the Japanese guidelines "Comprehensive Program for the Prevention of Health Impairment Due to

Overwork” (5), we divided participants into three groups based on working hours per week at baseline: ≤ 50 hours per week, 50.1 to 60 hours per week and >60 hours per week. The number of legal working hours in Japan has been regulated to 40 hours per week according to the Labor Standards Law, with overtime referring to work time in excess of 40 hours per week. Therefore, we defined workers who worked 50.1 to 60 hours per week (or 40.1 to 80 hours overtime per month) as overtime workers, and more than 60 hours per week (or more than 80 hours overtime per month) as heavy overtime workers.

Descriptive statistics were carried out using an analysis of variance (ANOVA) and the Chi-squared test. The association between overtime and heavy overtime work and depressive disorder was examined with multiple logistic regression models adjusted for age, lifestyle factors, work-related characteristics and socio-demographic characteristics at baseline and working hours at follow-up. In addition, we carried out a trend test. All analyses were performed using IBM SPSS Statistics 19 for Windows. A significance level for all statistical analyses was set at $p < 0.05$.

Results

At baseline, 3,213 of 3,796 employees responded to the questionnaires giving a response rate of 85%. Of these 3,213 we excluded 429 employees because they were female or data on their gender was missing, 345 employees because of missing data on the CES-D Scale or working hours per week, and 576 employees (24%) with depressive disorder defined by the CES-D Scale (Score ≥ 16 points) at baseline. A total of 1,863 employees therefore remained at baseline. At the 1 year follow-up, 1,259 were still employed and responded to the questionnaires. Since 65 employees were excluded because of data missing on the CES-D Scale, data from 1,194 participants aged between 18 and 71 were analysed at follow-up. The validated response rate was 64%. At baseline numbers in the three groups based on working hours per week (≤ 50 , 50.1 to 60 and >60) were 918, 247, and 29 respectively (Figure 1).

Table 1 shows participant characteristics at baseline. The mean age, working hours per week, and CES-D Scale were 39 (standard deviation (SD) =13) years, 46.4 (SD =12.1) hours, and 9.6 (SD = 3.5), respectively.

Table 2 shows the association between working hours and each variable among the participants at baseline. Employees working more than 60 hours per week were more often managers with longer education periods, less often shift

workers and more often people with a family income of 8 million yen per year or more.

At the one year follow-up, 130 cases (11%) with new onset depressive disorder (CES-D Scale ≥ 16 points) were identified. The association between working hours at baseline and depressive disorder at follow-up is presented in Table 2. The rates of new onset of depressive disorder among employees working ≤ 50 , 50.1 to 60 and >60 hours per week were 11%, 10%, and 28%, respectively. The results of multiple logistic regression analysis are shown in Table 3. In model I adjusted for age, the odds ratio for depressive disorder was 3.7-fold higher (95% CI 1.5-8.7) for employees working more than 60 hours per week than for those working 50 hours or less per week in men without depressive disorder at baseline. A further adjustment for working hours at follow-up had little influence on this association (OR 3.6, 95% CI 1.5-8.7) in model II. This relationship remained significant after additional adjustments for lifestyle factors (smoking habits and alcohol consumption), work-related characteristics (job grade, shift work, years of experience and the site of work), and socio-demographic characteristics (family income and education) at baseline, with the odds ratio for depressive disorder being 4.5-fold higher for employees working more than 60 hours per week in the final model. However, the

correlation between working 50.1 to 60 hours per week and depressive disorder was not significant. The trend test of groups by working hours and depressive disorder at follow-up was significant ($p < 0.01$) in the final model.

Discussion

We found that heavy overtime work (working more than 60 hours per week or more than 80 hours overtime per month) was significantly correlated with the new onset of depressive disorder assessed by the CES-D Scale in male employees working in a Japanese manufacturing company. To the best of our knowledge, this is the first study to show that employees working more than 60 hours per week had a 3.6- to 4.5-fold higher risk of depressive disorder than those working 50 hours or less per week in a 1 year cohort study.

Although Suwazono et al. did not use the CES-D Scale, they reported that working more than 12 hours per day (more than 60 hours per week) significantly affected the development of mental symptoms (12) and this finding could support our results. Our results are consistent with previous studies on the association between overtime work and depression, which used more than 55 hours per week as the standard of overtime work (9, 10). According to previous studies, the prevalence

of depressive disorder assessed by the CES-D Scale (Score ≥ 16) among Japanese male workers ranged from 23% to 30% (19-21) and was almost entirely consistent with the 24% (576/2439 subjects) at baseline observed in this study. In addition the rate of new onset of depressive disorder assessed by the CES-D Scale in our study was 11%, consistent with the 10 to 18% reported among men in previous 1 year follow-up studies (22, 23). Thus, the mental health of our study population could be regarded as common among Japanese working populations in general. The association between overtime work and depressive disorder was robust even with adjustments for some potential confounding factors such as lifestyle factors, work-related characteristics and socio-demographic characteristics at baseline; thus we consider the results of our study indicate a genuine association.

Although like previous studies (8, 11) we found no significant correlation between working 50.1 to 60 hours per week and depressive disorder in men, we observed slightly higher rates for new onset of depressive disorder in groups with longer working hours. Excluding overtime work, mental disorders can be caused by psychosocial factors, including job strain and effort-reward imbalances (24), so these factors may influence the onset of depressive disorder among men working 50.1 to 60 hours per week. Once working hours exceed 60 hours per week, overtime work

may become a major factor in the onset of depressive disorder. However, the effects of heavy overtime work on depressive disorder may be modified by sleep deprivation, which has been reported previously (25). Therefore, special attention should be paid to the mental health of employees working more than 60 hours per week, and this should be used as the threshold to screen high risk groups who need preventive action against depressive disorder.

In the final model, we found an association between depressive disorder and age (OR 0.96, 95% CI 0.93-0.98) or education (OR 0.89, 95%CI 0.82-0.97) (data not shown in Table 3). On the other hand, the odds ratios of alcohol, smoking, and shift-work were not significant. Previous studies reported that the relationship between mental health and shift work and also between depression and lifestyle factors (smoking or alcohol consumption) were significant; however, they still remain controversial (26, 27, 28).

The main strengths of our study are its relative large sample size, the 1 year prospective design and use of the validated questionnaire. In the short-term the new onset of depressive disorder assessed by the CES-D Scale was related to heavy overtime work; therefore we believe our results provide strong evidence for screening by working hours to prevent depressive disorder.

The limitations of this study are as follows. Firstly, because information about depressive disorder and working hours was obtained from a self-administered questionnaire, we cannot exclude information bias even though participation was voluntary. Secondly several studies have identified a relationship between overtime work, fatigue and sleep problems, and depressive disorder associated with overtime work may be affected by these (25, 29, 30). Previous studies have demonstrated that the perception of psychosocial factors, such as high job demands, low decision latitude, effort-reward imbalance and organizational injustice in the workplace were associated with an elevated risk of subsequent onset of depressive symptoms or a major depressive episode (24). However, these were not included in this study. Thirdly we were unable to assess how long a person had been exposed to long working hours before baseline and over the follow-up period. Participants may have dropped out of the study at follow-up due to health problems, although we excluded those with depressive disorder, as assessed by the CES-D Scale, at baseline. We only assessed depressive disorder in this study and did not assess other psychological disorders or confirm the presence of a depressive disorder by assessment by a psychiatrist. Fourthly our finding was based on a very small number of employees working more than 60 hours per week compared to overall participants of this study. Finally although the target population

of the study belonged to a large Japanese manufacturing company and performed various job types we cannot clearly confirm whether these findings apply to all men working in manufacturing, whether Japanese or otherwise, since our study was conducted in only one company.

Intervention studies are needed to examine whether interventions designed to reduce working hours can alter the risk of depressive disorder among employees.

In conclusion, this study demonstrated that heavy overtime work, i.e. working more than 60 hours per week, was significantly correlated with the onset of depressive disorder during the study period in men working for a Japanese manufacturing company. We therefore suggest that employees who work more than 60 hours per week (or more than 80 hours overtime per month) should preferentially undergo screening for depressive disorder.

Key points

- Heavy overtime work (working more than 60 hours per week) was a risk factor for the onset of depressive disorder in Japanese male manufacturing workers.
- This relationship remained significant after adjustment for lifestyle factors,

work-related characteristics and socio-demographic characteristics.

- Working more than 60 hours per week may justify screening high risk groups to prevent or identify the onset of depressive disorder.

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Conflicts of interest

None declared.

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Table 1. Participant characteristics at baseline	
	n=1863
	M (SD)
Age, yr	38.9 (13.4)
Education, yr ^a	13.0 (2.7)
Years of experience ^a	9.3 (11.5)
Working hours, hours per week	46.4 (12.1)
CES-D scale	9.6 (3.5)
	n (%)
Job grade ^a	
Staff	1594 (86)
Manager	250 (14)
Family income, yen per year ^a	
≤2.99 million	280 (15)
3.00-4.99 million	610 (34)
5.00-7.99 million	484 (27)
8.00-9.99 million	221 (12)
10.00-14.99 million	185 (10)
≥15.00 million	30 (2)
Shift work ^a	
yes	809 (43)
no	1051 (57)
Smoking ^a	
non-smoker	857 (46)
smoker	1003 (54)
Alcohol intake ^a	
yes, almost every day	654 (35)
yes, sometimes	691 (37)
no	516 (28)
^a Excluded missing data.	

Table 2. Participant characteristics at baseline and the rate of depressive disorder at follow-up according to working hours

	Working hours per week			P value ^a
	≤50 hr. n=918	50.1-60 hr. n=247	>60 hr. n=29	
	M (SD)	M (SD)	M (SD)	
Age, yr	39.6 (13.3)	39.4 (11.0)	40.6 (11.9)	NS
Education, yr ^b	12.9 (2.5)	14.3 (2.9)	14.5 (2.6)	<0.001
Years of experience ^b	11.1 (12.1)	12.3 (10.7)	11.3 (11.1)	NS
	n (%)	n (%)	n (%)	P value ^a
Job grade ^b				
Staff	795 (87)	172 (70)	19 (66)	<0.001
Manager	116 (13)	74 (30)	10 (34)	
Family income, yen per year ^b				
≤2.99 million	70 (8)	7 (3)	3 (10)	<0.001
3.00-4.99 million	267 (30)	45 (18)	6 (21)	
5.00-7.99 million	310 (35)	88 (36)	6 (21)	
8.00-9.99 million	129 (14)	49 (20)	7 (24)	
10.00-14.99 million	102 (11)	50 (20)	7 (24)	
≥15.00 million	13 (1)	5 (2)	0	
Shift work ^b				
yes	426 (46)	55 (22)	8 (28)	<0.001
no	491 (54)	191 (78)	21 (72)	
Smoking ^b				
non-smoker	424 (46)	133 (54)	16 (55)	NS
smoker	493 (54)	112 (46)	13 (45)	
Alcohol intake ^b				
yes, almost every day	354 (39)	88 (36)	7 (24)	NS
yes, sometimes	315 (34)	105 (43)	11 (38)	
no	249 (27)	53 (22)	11 (38)	
Rate of depressive disorder at follow-up ^c				
CES-D scale, ≥16 points	97 (11)	25 (10)	8 (28)	<0.05
^a ANOVA or Chi-square test.				
^b Excluded missing data.				
^c Depressive disorder was assessed by the CES-D Scale (Score ≥16 points).				

Table 3. Association between working hours at baseline and depressive disorder at follow-up				
	Working hours per week			P for trend
	≤50 hr.	50.1-60 hr.	>60 hr.	
	Ref	OR (95% CI)	OR (95% CI)	
Model I	1.00	0.99 (0.62-1.58)	3.65 (1.54-8.67)	NS
Model II	1.00	1.00 (0.62-1.62)	3.62 (1.51-8.68)	NS
Model III	1.00	1.14 (0.70-1.86)	4.04 (1.68-9.75)	<0.05
Model IV	1.00	1.14 (0.70-1.84)	4.35 (1.79-10.56)	<0.05
Model V	1.00	1.03 (0.64-1.65)	3.90 (1.63-9.34)	NS
Model VI	1.00	1.26 (0.76-2.09)	4.51 (1.83-11.10)	<0.01
Depressive disorder was assessed by the CES-D Scale (Score ≥16 points).				
Model I was adjusted for age.				
Model II was adjusted for age and working hours at follow-up.				
Model III was adjusted for age, years of experience, job grade, shift work and the site of work.				
Model IV was adjusted for age, education and family income.				
Model V was adjusted for age, smoking and alcohol.				
Model VI was adjusted for age, working hours at follow-up, education, years of experience, job grade, family income, shift work, the site of work, smoking and alcohol.				

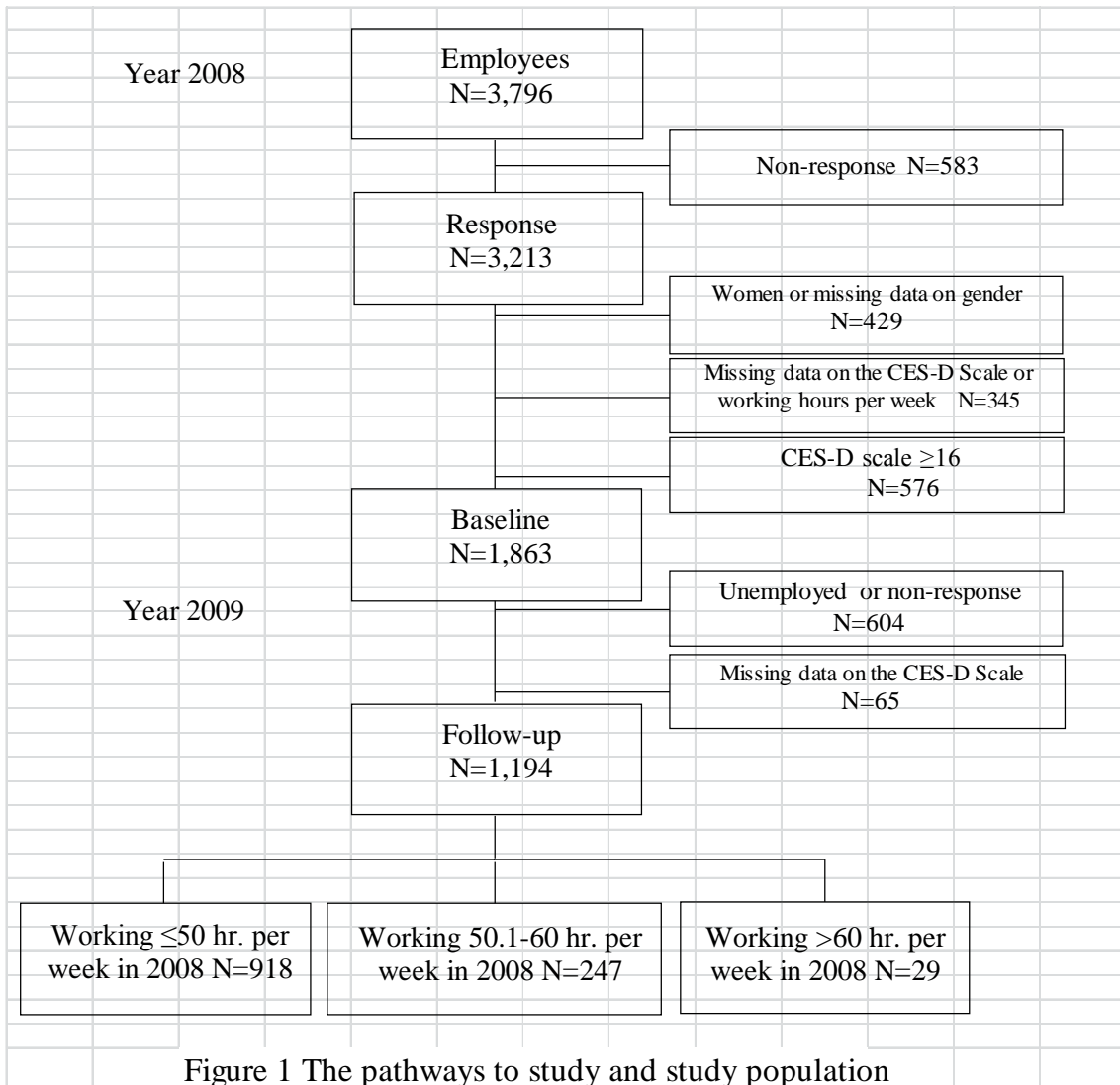


Figure 1 The pathways to study and study population