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Socioeconomic Inequalities in Physical and Mental Functioning of British, Finnish, and Japanese Civil Servants: Role of Job Demand, Control, and Work Hours

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Abstract

This study aims to evaluate whether the pattern of socioeconomic inequalities in physical and mental functioning as measured by the Short Form 36 (SF-36) differs among employees in Britain, Finland, and Japan and whether work characteristics contribute to some of the health inequalities. The participants were 7340 (5122 men and 2218 women) British employees, 2297 (1638 men and 659 women) Japanese employees, and 8164 (1649 men and 6515 women) Finnish employees. All the participants were civil servants aged 40–60 years. Both male and female low grade employees had poor physical functioning in all cohorts. British and Japanese male low grade employees tended to have poor mental functioning but the associations were significant only for Japanese men. No consistent employment-grade differences in mental functioning were observed among British and Japanese women. Among Finnish men and women, high grade employees had poor mental functioning. In all cohorts, high grade employees had high control, high demands and long work hours. The grade differences in poor physical functioning and disadvantaged work characteristics among non-manual workers were somewhat smaller in the Finnish cohort than in the British and Japanese cohorts. Low control, high demands, and both short and long work hours were associated with poor functioning. When work characteristics were adjusted for, the socioeconomic differences in poor functioning were mildly attenuated in men, but the differences increased slightly in women. This study reconfirms the generally observed pattern of socioeconomic inequalities in health for physical functioning but not for mental functioning. The role of work characteristics in the relationship between socioeconomic status and health differed between men and women but was

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modest overall. We suggest that these differences in the pattern and magnitude of grade differences in work characteristics and health among the 3 cohorts may be attributable to the different welfare regimes among the 3 countries.

Keywords

UK; Finland; Japan; health inequalities; psychosocial stress; socioeconomic status (SES); civil servants; employment

Introduction

Despite an overall decline in mortality rates, the gap in mortality rates among socioeconomic status (SES) groups has increased in many countries in the last couple of decades (Acheson, 1998; Mackenbach et al., 2003). Although established coronary risk factors such as cigarette smoking, hypertension, and hypercholesterolemia are more common in low SES groups, these differences do not account for more than a third of the social gradients in cardiovascular disease in the British civil servants study (Marmot, Shipley, & Rose, 1984). In addition, international variations in the three established coronary risk factors account for less than half of the international variations in coronary heart disease mortality rates (The World Health Organization MONICA Project, 1994).

Karasek reported that high-demands and low-control conditions at work were considered stressful (Karasek, 1979). The original model was later modified to include social support at work as a third dimension (Johnson & Hall, 1998). In general, low control, high demands, and low social support are associated with health risk behaviors (Lallukka et al., 2008), metabolic syndrome (Chandola, Brunner & Marmot, 2006), coronary heart diseases (Bosma et al., 1997), musculoskeletal diseases (Hoogendoorn, van Poppel, Bongers, Koes, & Bouter, 2000), and depression (Paterniti, Niedhammer, Lang, & Consoli, 2002). In addition, working overtime was associated with poor perceived general health, cardiovascular diseases, injuries, health risk behaviors, and increased mortality (Caruso, Hitchcock, Dick, Russo & Schmit, 2004).

SES differences in psychosocial stress and work hours (Marmot, et al., 1991; Sekine, Chandola, Martikainen, Marmot, & Kagamimori, 2006) may contribute to social inequalities in health. In the British civil servants study, psychosocial work characteristics explained some of the grade gradient in physical functioning and, in particular, depressive symptoms (Stansfeld, Head, Fuhrer, Wardle, & Cattell, 2003). Sekine et al. (2006) reported that some of the SES inequalities in physical and mental functioning were explained by work and family characteristics in men. However, in women, the grade differences did not change but tended to increase after adjustment for work characteristics. Thus, SES difference in health and the underlying mechanisms may differ between men and women.

In addition, caution may be needed against generalizing the results on health inequalities from western population to non-western populations. Whereas SES differences existed in physical functioning among British and Finnish men and women and among Japanese men (Martikainen et al., 2004), a comparison of coronary risk factors between British and Japanese employees showed that obesity and low HDL cholesterol were not necessarily more common among low SES individuals in Japan (Martikainen, Ishizaki, Marmot, Nakagawa, & Kagamimori, 2001). Thus, SES inequalities in health and their underlying mechanisms may also differ between countries.

Before introducing more specific and effective health policies to reduce social determinants of health, it is important to clarify the similarities and differences in the pattern and degree of SES inequalities in health and their underlying mechanisms between countries and genders. The purpose of this study is, therefore, to examine the following research questions in three populations of civil servants (from Britain, Finland, and Japan): (1) whether there are SES differences in work characteristics and poor physical and mental functioning and (2) whether work characteristics contribute to some of the SES differences in poor physical and mental functioning.

The analysis of data from countries with different welfare regimes may provide further information on the context of factors relating to SES differences in health. Finland belongs to the social democratic group of welfare regimes with a strong emphasis on universal and egalitarian policies, while the UK and Japan belong to liberal and conservative welfare regimes, respectively (Esping-Andersen, 1990). Navarro et al. (2006) showed that welfare states and labour markets aimed at reducing social inequalities had better population health in wealthy European countries. We, therefore, hypothesized that grade differences in disadvantaged work characteristics and poor health are smaller in the Finnish cohort than in the British and the Japanese cohorts.

Methods

Participants

The British civil servants study (the Whitehall II study) was comprised of employees working in the London offices of 20 National Government Civil Service departments, aged 35–55 when they were recruited in 1985–1988 (Marmot et al., 1991). In Phase 3 (1991–1993) and later phases of the survey, SF36 information on physical and mental functioning was available, so data from Phase 3 were used in this study. At baseline, the response rate for the Whitehall II study was 73%. The response rate for Phase 3 was 83.8% of the original cohort.

The Japanese civil servants study (the JACS study) was comprised of employees working in local government on the west coast of Japan (Sekine et al., 2006). Phase 1 of the survey was conducted in 1998. In Phase 2 (2003) information on grades of employment was available, so data from Phase 2 were used in this study. A postal questionnaire was distributed to all employees and gathered through the personnel section of the local government agency. The participants were 20–65 years at the time of the Phase 2 survey (response rate: 79.2%).

The Finnish civil servants study (the Helsinki Health Survey) was comprised of employees working in the City of Helsinki in 2000 and 2001, aged 40, 45, 50, 55, and 60 at the time of the survey in each year, respectively (Martikainen et al., 2004). The response rate was 68%. Although the data were broadly representative of the target population, younger men and those with lower SES were slightly underrepresented.

In the present study, we included men and women who were 40–60 years at the time of the questionnaire survey of each cohort. Altogether, 7340 participants (5122 men and 2218 women) from Britain, 2297 (1638 men and 659 women) from Japan, and 8164 (1649 men and 6515 women) from Finland were included.

The British civil servants study was approved by the University College London Medical School Committee on the ethics of human research. The Finnish civil servants study was approved by the Ethics Committee of the Department of Public Health and the Ethics Committee of the health authorities at the City of Helsinki. The Japanese civil servants study was conducted as a part of annual health check-ups regulated by the Industrial Safety and Health Law. An ad hoc committee of the civil service, comprising the ordinary member of the

Safety and Health Committee, labour representatives, and personnel representatives approved the contents and the ethical aspects of the study. Informed consents were taken in all cohorts. All participants were voluntary.

Measures of work characteristics

Psychosocial stress at work and work hours were chosen to measure the work characteristics of the participants in this study.

Psychosocial stress at work was evaluated using the job demand-control model (Karasek, 1979). In the British cohort, the self-reported items consisted of 19 items (15 items for control and 4 items for demand at work) (Bosma et al., 1997). In the Japanese cohort, a translated version of the English questionnaire was used (Sekine et al., 2006). In the Finnish cohort, the self-reported items consisted of 19 items (9 items for the control measure and 10 items for the demand measure). Eight out of nine questions for the control measure and 4 out of the 10 questions for the demand measure used in the Finnish study were the same as those in the British and Japanese cohort studies. For this comparative study, we, therefore, used those twelve items to evaluate control and demand at work for all cohorts (see Appendix).

Response categories ranged from 0 (often) to 3 (never) for the British and Japanese cohorts and ranged from 0 (fully agree) to 4 (fully disagree) for the Finnish cohort. After all items were recoded in the same direction, scores for each scale were calculated by summing the item scores. For the Finnish cohort, the scale scores were multiplied by 3/4 to adjust the score differences attributable to the differences in the number of response categories between the Finnish study and the other two studies. If the participants did not answer one of the items of each scale, the mean item score of the participants was used to construct the measure (Bosma et al., 1998). The participants who did not answer two or more items were excluded. The number of those excluded in this process corresponded to less than 2% of each cohort. A higher score for each scale indicates high control and high demand at work. All the scales were grouped into tertiles for the analysis.

The correlation coefficients of the scale score between the original questionnaire and the short version for this study ranged from 0.88 to 0.99. Thus, the reduction in the number of questions for the control and demand measures may not significantly affect the interpretation of psychosocial stress at work in this study. Cronbach's α (Cronbach, 1951) ranged from 0.77 to 0.81 for the control measure and from 0.65 to 0.69 for the demand measure. Cronbach's α of 0.5 or more is considered acceptable for group comparisons (Helmstadter, 1964).

Work hours was rated as one of 12 response categories, ranging from less than 1 hour a day to 12 hours a day or more in the British cohort, 1 of 10 response categories, ranging from less than 6 hours a day to 14 hours a day or more in the Japanese cohort, and 1 of 5 response categories, ranging from 1–10 hours a week to more than 50 hours a week in the Finnish cohort. Participants in the British and Japanese cohorts were placed in 4 groups: less than 7 hours; 7–9 hours; 9–11 hours; 11 hours or more. Participants in the Finnish cohort were placed in 4 groups: less than 30 hours a week; 31–40 hours a week; 40–50 hours a week; more than 50 hours a week.

Measure of physical and mental functioning

The Short Form 36 (SF-36) (Ware, 1993) was used to measure physical and mental health functioning of the civil servants. For the Finnish and Japanese cohorts, validated translated versions of the SF-36 were used (Hagman, 1996; Fukuhara, Suzukamo, Bito, & Kurokawa, 2001). The SF-36 consists of 36 items and generates 8 subscales: physical functioning (PF), role limitations due to poor physical health (RP), bodily pain (BP), general health perception

(GH), vitality (VT), social functioning (SF), role limitations due to poor emotional health (RE), and mental health (MH). For all cohorts, the subscale scores were standardized by using the general US population to generate a corresponding z-score. Aggregate physical and mental component summary scores of the SF36 (PCS and MCS, respectively) were obtained by multiplying each z-score by its respective physical and mental factor score coefficient and summing the eight products. Finally, each aggregate component score was transformed to a norm-based score with a US population mean of 50 and standard deviation of 10. Higher scores represent better health. Poor physical and mental functioning were defined as having a PCS and MCS score below the 25th percentile. The percentile cut-off point was obtained from the score distribution of each cohort.

Socioeconomic status

SES was evaluated using grades of employment for all three cohorts. Questions on SES were somewhat different among the 3 cohorts, but the SES measure reflected the hierarchical rank systems that are commonly used in each population.

In the British cohort, grade of employment was based on questionnaire information and three grades were obtained by collapsing the 12 non-industrial salary based grade levels used in the Civil Service in the following way: Grade 1: unified grades 1–6 (Permanent Secretary to Senior Principal); Grade 2: unified grade 7 (Principal), senior executive officers, higher executive officers, and executive officers and professional equivalents; Grade 3: clerical officers, clerical assistants, and office support staffs.

In the Japanese cohort, grade of employment were based on questionnaire information and hierarchically ranked in the following way: Grade 1: senior administrative workers with an employment grade of section leader or higher (e.g., Head of Bureau, Head of Department, and Head of Section) and professional equivalents; Grade 2: administrative workers with an employment grade of lower than section leader (e.g., Assistant Head of Section and Subsection Chief) and professional equivalents; Grade 3: civil servants with no particular administrative title and professional equivalents.

In the Finnish cohort, grade was based on the combined information from the personnel registry data of the City of Helsinki and questionnaire data, which was hierarchically ranked in the following way: Grade 1: managers in supervisory positions; Grade 2: professionals and semi-professionals; Grade 3: clerical employees and other female dominated non-professional occupations within social and health care; Grade 4: manual workers.

Statistical analysis

Age-standardized percentages of psychosocial stress (low control and high demand) and long work hours of 9 hours per day or longer (for the Finnish cohort, long work hours of 40 hours per week or longer) by grade of employment were calculated using 10-year age groups of the lowest grade employees as the standard population. Chi-squared tests were used to evaluate whether there were grade differences in the psychosocial stress and long work hour variables. Logistic regression analysis was performed to examine (1) whether there were grade differences in poor physical and mental functioning, (2) whether work characteristics contributed to some SES inequalities in poor physical and mental functioning. The odds ratios (ORs) and 95% confidence intervals were calculated. Statistical analyses were performed using SPSS (10.0.J) (SPSS Inc.). A two-tailed P value of less than 0.05 was considered to be significant.

Results

Table 1 shows the characteristics of the participants. The mean age of the participants was approximately 50 years in all cohorts. More men than women occupied higher grades. Mean work control and demands scores did not differ significantly among countries, with relatively higher control scores among Japanese employees. In the British and Japanese cohorts, women were more likely to have low control scores. Whereas in the British cohort, men were more likely to have high demand, the opposite was true for the Japanese and Finnish cohorts. In the British and Finnish cohorts, the percentage of men working long hours was higher than that of women. The opposite was true for the Japanese cohort. Mean PCS and MCS scores were approximately 50 in all cohorts for the British and Finnish cohorts and slightly lower than 50 for the Japanese cohort.

Table 2 shows the age-standardized grade differences in work characteristics. In general, higher grade employees had significantly higher control, higher demand, and longer working hours. Several exceptions were observed: among Japanese men, there were no significant grade differences in the frequency of long work hours; among Finnish men and women, there were significant grade-differences in demand and work hours, but the grade differences were not quite linear. The magnitude of the grade differences in disadvantaged work characteristics among non-manual grades (grade 1–3) was somewhat smaller in the Finnish cohort than in the British and Japanese cohorts.

Table 3 shows the grade differences in poor physical functioning among men. In the age-adjusted model (Model 1), low grade employees were more likely to have poor physical functioning than high grade employees in all cohorts. The magnitude of the grade differences among non-manual grades was somewhat smaller in the Finnish cohort than in the British and Japanese cohorts. In the age- and work-adjusted model (Model 2), high work demands and low control were generally associated with poor physical functioning in all cohorts. While short work hours had links with poor physical functioning in all cohorts, long work hours were associated with poor physical functioning for the Japanese and Finnish men. After adjusting for work characteristics, the grade differences in poor physical functioning decreased only slightly among British and Japanese men and manual men (grade 4) of the Finnish cohort but increased slightly among non-manual men of the Finnish cohort.

Table 4 shows grade differences in poor physical functioning among women. In Model 1, low grade employees were likely to have poorer physical functioning than high grade employees in all cohorts. The magnitude of the grade differences among non-manual grades was somewhat smaller in the Finnish cohort than in the British and the Japanese cohorts. In Model 2, high demands and low control were generally associated with poor physical functioning in all cohorts. While short work hours were significantly associated with poor physical functioning for Japanese and Finnish women, long work hours were associated, but not significantly, with poor physical functioning for Japanese women. After adjusting for work characteristics, the grade differences in poor physical functioning increased slightly among British and Japanese women and non-manual women of the Finnish cohort but reduced slightly among manual women of the Finnish cohort.

Table 5 shows the grade differences in poor mental functioning among men. In Model 1, low grade employees tended to have poor mental functioning among British and Japanese men but the associations were significant only for Japanese men. Low grade employees had significantly better mental functioning among Finnish men. In Model 2, low control and high work demands had strong links with poor mental functioning. While short work hours were associated with poor mental functioning in all cohorts, long work hours were associated with poor mental functioning only for Japanese men. After adjusting for work characteristics, grade

difference in poor mental functioning decreased among British and Japanese men, whereas the difference increased slightly among Finnish men.

Table 6 shows the grade differences in poor mental functioning among women. In Model 1, while there were no significant grade differences in poor mental functioning among British and Japanese women, low grade employees had significantly better mental functioning among Finnish women. In Model 2, lower control and higher work demands were associated with poor mental functioning in all cohorts. For Finnish women, short work hours were associated with poor mental functioning. Among Japanese women, long work hours were associated with poor mental functioning. After adjusting for work characteristics, the grade differences in poor mental functioning increased in all cohorts.

The Hosmer-Lemeshow test (Hosmer & Lemeshow, 1989) validated the final models (Model 2s in Table 3–6). The likelihood ratio tests showed that the interaction terms of the demand and the control measures did not add significantly to the multivariate models (Model 2s in Table 3–6). The findings from the Finnish study hardly changed after the exclusion of manual workers (not tabulated).

Discussion

This study showed that there were significant grade-differences in physical functioning in all cohorts and in both men and women (i.e., the lower the SES, the poorer the health). The grade differences in physical functioning among non-manual workers were somewhat smaller in the Finnish cohort than in the British and the Japanese cohorts. Regarding poor mental functioning, the pattern of SES differences was somewhat different among the 3 cohorts. In the British and Japanese cohorts, low grade employees were likely to have poor mental functioning in men but the associations were significant only for Japanese men. In women, no consistent grade differences in mental functioning were observed. In the Finnish cohort, the reverse associations for mental functioning (i.e., the lower the SES, the better the health) were observed in both men and women. High SES individuals generally had high control, high demand and long work hours, and the grade differences among non-manual workers were somewhat smaller in the Finnish cohort than in the British and the Japanese cohorts.

These findings were not inconsistent with the existing data. Martikainen et al. (2004) reported that poor physical health was more common in low SES individuals than high SES individuals, particularly among men. In the British and Japanese civil servants study, whereas male low grade employees tended to have poor mental health, no clear grade differences were observed among females (Hemingway, Nicholson, & Marmot, 1997; Sekine et al., 2006). In the Finnish civil servants study, low grade employees had better mental functioning in both men and women (Lahelma, Laaksonen, Martikainen, Rahkonen, & Sarlio-Lahteenkorva, 2006).

According to Esping-Andersen (1990), The UK and Japan belong to liberal and conservative welfare regimes, respectively. However, in Japan, neoliberal policies with competitive market principles and a budget reduction in public expenditure on healthcare and welfare services have been intensively introduced after the burst of the Japanese bubble economy of the 1990's (Doi, 2008); income inequalities increased (Tachibanaki, 1998). During the 1990's and 2000's, the Gini index for Japan ranged from 0.32 to 0.34, which was close to that for the UK (0.34–0.37) and was larger than that for Finland (0.23–0.27) (OECD Stat Extracts). Concomitantly, organizational reforms including the reduction in the number of employees for improving efficiency and the changes in the corporate governance with a strong emphasis on higher decision latitude and responsibility of top grades have been introduced in Japan, which referred to the UK government reforms in 1980's (Okibe, 2003). In Britain and Japan, such material and psychological advantages of top grades with high salary and work control may lead to

better physical and mental functioning through healthy behaviors (Lalluka et al., 2008) and changes in the endocrine and autonomic nervous systems (Marmot & Wilkinson, 1999).

In contrast, somewhat smaller grade differences in work characteristics and physical functioning among non-manual grades and the reverse associations for mental functioning in the Finnish cohort may be attributable to the universal and egalitarian policies of social democratic countries because social democratic policies such as extensive welfare and social services, full employment policies, wealth redistribution through tax and transfer systems are considered to result in less inequalities in working conditions and health (Borrell, Espelt, Rodríguez-Sanz, & Navarro, 2007).

In the Finnish civil servants study, Lahelma et al. (2006) reported that the direction of SES differences in SF-36 mental functioning was dependent on the socioeconomic measure. When economic difficulties were used as measure of SES, individuals with economic difficulties showed poor mental functioning. However, when occupational class, household income, home ownership, and education were used as measures of SES, low SES individuals showed better mental functioning. Different SES measures may have different pathways to poor health. Whereas economic difficulties are associated with material and psychological deprivation that may result in poor mental functioning, the reverse associations of other SES measures (e.g., occupational class) with mental functioning deserve further research. The authors argue that the reverse associations may relate to current disappointment related to higher socioeconomic status. For high grade employees, despite their high grades with high responsibility, egalitarian treatment may cause disappointment, which could result in the reverse associations for mental functioning.

In this study, low control, high demand, and short and long work hours were generally associated with poor physical and mental functioning. These findings are consistent with the existing literature (Sekine et al., 2006). Although the reason for the high prevalence of poor physical and mental functioning among employees working less than seven hours is not clear, manifest and pre-clinical diseases and other problems not measured in this study may negatively influence health functioning.

When work characteristics were adjusted for in the present study, the grade differences in physical and mental functioning were attenuated only slightly among British and Japanese men, whereas the differences increased slightly among Finnish men. For women, the grade differences in physical and mental functioning increased in all cohorts. In the Japanese civil servants study, Sekine et al. (2006) reported that some of the grade differences in health decreased after adjustment for work characteristics in men but tended to increase slightly among women. The differences in the strengths of the underlying relations of grade with control, demands, and working hours may have resulted in the differential findings among countries and genders.

There are several methodological limitations. First, this study is a cross-sectional study, which makes it hard to determine the causal nature of the associations of SES and work characteristics with health. However, there is little evidence for an effect of poor physical and mental health on employment grade changes in the British civil servants study (Chandola, Bartley, Sacker, Jenkinson & Marmot, 2003).

Second, the participants were working civil servants. The civil servants were relatively young, well-educated, and white-collar in comparison to the general adult population. The extreme SES individuals may not be included; therefore, SES inequalities of health may be much larger in the general adult population. In addition, the participants were recruited from regions that may not be representative of the respective countries. The direct generalization of these results to the respective countries should be treated cautiously.

Third, there may be data comparability problems. The mean wages and the magnitude of the grade differences in wages may differ among the three cohorts (Suzuki, 2005). Another data comparability problem is attributable to the 10-year differences in data collection. Whereas all the data used in this study were collected in the midst of severe economic environments such as high unemployment rate (OECD Stat Extracts), the working style has changed (e.g., computerization) during the 10 years. In addition, there may also be data comparability problems for work characteristics and health measures.

Fourth, only the contributions of demand and control measures to SES differences in health were evaluated. Because low work support and effort-reward imbalance are associated with poor health (Johnson & Hall, 1998; Siegrist, 1996), these psychosocial factors may result in further explanation of SES differences in health.

Fifth, individuals with negative affectivity tend to report work stress, social support, and health negatively (McCrae, 1990). However, in the Whitehall II study, the relationship between low work control and the development of cardiovascular disease remained significant after adjustment for negative affectivity (Bosma et al., 1998). Also, higher SES individuals are generally likely to be optimistic about their health (Ettilé & Milcent, 2006). However, the association of SES and health remained significant after adjustment for longstanding illness in our previous study of Japanese civil servants (Sekine et al., 2006).

In conclusion, we have confirmed the generally observed pattern of SES inequalities in health for physical functioning. However, the pattern of SES inequalities in mental functioning differed across countries. The role of psychosocial stress and work hours on the relationship between SES and health functioning also differed between countries and between genders. These differences may be at least partly attributable to the different welfare regimes among countries. Different approaches may be needed to reduce SES inequalities in health among countries and genders.

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Appendix

The characteristics of psychosocial stress at work (i.e., job control and job demands) were assessed by means of 12 items. The job control measure consisted of the following eight items: Do you have a choice in deciding how you do your job? Do you have a choice in deciding what you do at work? I have a good deal of say in decisions about work. Do you have to do the same thing over and over again? Does your job provide you with a variety of interesting things? Do you have the possibility of learning new things through your work? Does your work demand a high level of skill or expertise? Does your job require you to take the initiative? The job demand measure consisted of the following four items: Do you have to work very fast? Do you have to work very intensively? Do you have enough time to do everything? Do different groups at work demand things from you that you think are hard to combine?

Table 1

Characteristics of the Participants

	Britain			Japan			Finland		
	Men (n=5122) %	Women (n=2218) %	P value	Men (n=1638) %	Women (n=659) %	P value	Men (n=1649) %	Women (n=6515) %	P value
Mean age	48.6(5.57)	49.7(5.78)	<0.001	50.4(5.49)	49.9(5.59)	0.022	50.0(6.61)	49.1(6.59)	<0.001
Age groups									
40–49	59.9	50.8		45.5	51.3		38.3	43.2	
50–60	40.1	49.2	<0.001	54.5	48.7	0.013	61.7	56.8	<0.001
Grades									
Grade 1	48.3	16.5		24.2	3.2		43.6	27.6	
Grade 2	45.1	45.0		31.2	24.4		19.4	19.1	
Grade 3	6.6	38.5	<0.001	44.5	72.4	<0.001	10.1	42.1	<0.001
Grade 4	–	–		–	–		26.9	11.2	<0.001
Control									
Mean	5.7 (3.51)	8.0 (4.34)	<0.001	13.0 (5.24)	11.8 (5.05)	<0.001	8.5 (4.08)	8.3 (3.72)	0.069
Low	25.7	49.4		30.8	39.5		28.3	27.5	
Intermediate	31.9	27.8		34.6	37.0		31.5	33.0	
High	42.5	22.8	<0.001	34.6	23.5	<0.001	40.2	39.5	0.497
Demand									
Mean	7.5 (2.24)	6.9 (2.41)	<0.001	6.3 (2.61)	7.3 (2.53)	<0.001	5.7 (2.21)	5.3 (2.22)	<0.001
Low	31.2	42.8		37.8	24.6		38.0	31.1	
Intermediate	33.8	30.5		40.6	39.8		25.8	25.6	
High	35.1	26.7	<0.001	21.6	35.7	<0.001	36.3	43.3	<0.001
Work hours *									
<7 hours/day	2.1	5.8		10.0	5.2		7.3	10.5	
7–9 hours/day	69.7	78.7		67.6	60.7		71.3	76.3	
9–11 hours/day	22.3	13.3		16.2	26.4		17.8	11.6	
11 hours/day <	5.9	2.2	<0.001	6.1	7.7	<0.001	3.6	1.6	<0.001
Mean PCS	53.2(5.91)	50.6(8.05)	<0.001	49.5(6.20)	47.3(7.05)	<0.001	50.5(7.47)	48.9(8.56)	<0.001
Mean MCS	51.2(8.31)	50.1(9.18)	<0.001	47.4(9.80)	44.1(10.9)	<0.001	51.5(10.0)	51.6(9.81)	0.792

Abbreviations: In the British cohort, Grade 1: unified grade 1–6; Grade 2: unified grade 7 and executive officers; Grade 3: clerical officers. In the Japanese cohort, Grade 1: senior administrative officers; Grade 2: administrative officers; Grade 3: civil servants with no administrative title. In the Finnish cohort, Grade 1: managers; Grade 2: professionals; Grade 3: clerical officers; Grade 4: manual workers. PCS: physical component summary scale; MCS: mental component summary scale. Data on age, mean control, and demand scores. PCS and MCS are expressed as mean (standard deviation).

* In the Finnish cohort, work hours was categorized as less than 30 hours /week, 30–40 hours /week, 41–50 hours /week, and more than 50 hours / week.

Table 2

Age-standardized Grade Differences in Psychosocial Stress and Long Work Hours by Sex

		Britain			P value	Japan			P value	Finland				P value
		Grade 1 %	Grade 2 %	Grade 3 %		Grade 1 %	Grade 2 %	Grade 3 %		Grade 1 %	Grade 2 %	Grade 3 %	Grade 4 %	
Men Control Demand * Work hours	Low	11.3	33.8	77.8	<0.001	10.5	21.7	47.3	<0.001	8.4	23.3	31.5	63.0	<0.001
	High	46.2	24.7	10.7	<0.001	28.3	22.9	19.9	0.006	44.3	34.2	21.2	30.9	<0.001
	Long (>9hours/day)	39.4	18.4	14.8	<0.001	19.6	24.3	23.6	0.212	26.4	13.0	9.2	25.1	<0.001
Women Control Demand * Work hours	Low	9.6	40.6	76.6	<0.001	0	23.2	46.5	<0.001	7.7	15.4	39.5	52.9	<0.001
	High	57.4	28.7	11.6	<0.001	62.2	46.1	31.4	<0.001	54.0	45.7	35.3	41.0	<0.001
	Long (>9hours/day)	39.4	14.3	7.7	<0.001	77.3	42.7	30.6	<0.001	23.5	7.1	10.6	6.6	<0.001

Abbreviations: In the British cohort, Grade 1: unified grade 1–6; Grade 2: unified grade 7 and executive officers; Grade 3: clerical officers. In the Japanese cohort, Grade 1: senior administrative officers; Grade 2: administrative officers; Grade 3: civil servants with no administrative title. In the Finnish cohort, Grade 1: managers; Grade 2: professionals; Grade 3: clerical officers; Grade 4: manual workers. PCS: physical component summary scale; MCS: mental component summary scale.

* In the Finnish cohort, “long work hours” means work hours of 41 hours /week or longer.

Grade Differences in Poor Physical Functioning before and after Adjustment for Work Characteristics among Men

Table 3

	Britain			Japan			Finland		
	poor PCS %	Model 1 (Age-adjusted) OR (95%CI)	Model 2 (Model 1+ work) OR (95%CI)	poor PCS %	Model 1 (Age-adjusted) OR (95%CI)	Model 2 (Model 1+ work) OR (95%CI)	poor PCS %	Model 1 (Age-adjusted) OR (95%CI)	Model 2 (Model 1+ work) OR (95%CI)
Grades									
Grade 1	18.2	1.00	1.00	16.9	1.00	1.00	14.9	1.00	1.00
Grade 2	21.6	1.28(1.11–1.48)	1.28(1.10–1.50)	21.5	1.41(1.00–1.98)	1.39(0.98–1.98)	22.8	1.73(1.23–2.41)	1.86(1.30–2.65)
Grade 3	28.4	1.74(1.34–2.25)	1.69(1.27–2.26)	24.8	1.73(1.24–2.42)	1.69(1.18–2.42)	21.0	1.71(1.11–2.63)	2.17(1.37–3.34)
Grade 4							25.1	2.01(1.49–2.71)	1.99(1.38–2.88)
Age									
40–49	18.1	1.00	1.00	22.0	1.00	1.00	13.8	1.00	1.00
50–60	24.0	1.44(1.26–1.66)	1.46(1.27–1.67)	21.7	1.15(0.89–1.48)	1.23(0.95–1.60)	23.5	2.01(1.53–2.64)	2.12(1.60–2.80)
Control									
Low	23.5		1.25(1.03–1.52)	24.6		1.30(0.94–1.81)	26.1		1.33(0.94–1.90)
Intermediate	20.6		1.13(0.96–1.34)	19.9		0.99(0.73–1.33)	18.1		1.06(0.77–1.46)
High	18.4		1.00	21.3		1.00	16.6		1.00
Demand									
Low	20.4		1.00	17.3		1.00	13.7		1.00
Intermediate	20.8		1.16(0.98–1.39)	21.1		1.41(1.05–1.91)	22.6		1.98(1.42–2.76)
High	20.2		1.21(1.01–1.46)	31.4		2.41(1.71–3.40)	24.1		2.34(1.70–3.22)
Work hours *									
<7 hours/day	29.0		1.54(1.00–2.37)	23.8		1.36(0.91–2.03)	28.3		2.23(1.42–3.50)
7–9 hours /day	20.1		1.00	19.6		1.00	17.8		1.00
9–11 hours /day	20.8		1.14(0.96–1.35)	28.6		1.39(1.01–1.91)	22.8		1.28(0.92–1.77)
11< hours /day	20.2		1.10(0.82–1.49)	26.0		1.08(0.66–1.77)	26.4		1.64(0.88–3.03)

Abbreviations: In the British cohort, Grade 1: unified grade 1–6; Grade 2: unified grade 7 and executive officers; Grade 3: clerical officers; Grade 4: manual workers; PCS: physical component summary scale; OR: odds ratio; 95%CI: 95% confidence interval.

* In the Finnish cohort, work hours was categorised as less than 30 hours /week, 30–40 hours /week, 41–50 hours /week, and more than 50 hours / week.

Model 1 was adjusted for age.

Model 2 was adjusted for age and work characteristics (control, demand, and work hours).

Grade Differences in Poor Physical Functioning before and after Adjustment for Work Characteristics among Women

Table 4

	Britain			Japan			Finland		
	poor PCS %	Model 1 (Age -adjusted) OR (95%CI)	Model 2 (Model 1+ work) OR (95%CI)	poor PCS %	Model 1 (Age -adjusted) OR (95%CI)	Model 2 (Model 1+ work) OR (95%CI)	poor PCS %	Model 1 (Age -adjusted) OR (95%CI)	Model 2 (Model 1+ work) OR (95%CI)
Grades									
Grade 1	24.7	1.00	1.00	9.5	1.00	1.00	19.3	1.00	1.00
Grade 2	35.0	1.57(1.19–2.06)	1.76(1.31–2.37)	34.2	5.49(1.23–24.5)	5.94(1.29–27.3)	23.5	1.41(1.18–1.68)	1.48(1.23–1.78)
Grade 3	40.8	1.89(1.43–2.50)	2.44(1.74–3.42)	33.3	5.44(1.25–23.8)	6.60(1.43–30.4)	29.8	1.79(1.55–2.07)	1.90(1.61–2.23)
Grade 4							35.2	2.23(1.84–2.71)	2.17(1.75–2.68)
Age									
40–49	30.5	1.00	1.00	30.5	1.00	1.00	18.1	1.00	1.00
50–60	40.8	1.44(1.21–1.73)	1.47(1.23–1.77)	35.2	1.33(0.96–1.85)	1.46(1.03–2.05)	32.6	2.17(1.93–2.45)	2.17(1.92–2.45)
Control									
Low	37.1		1.04(0.80–1.36)	29.2		1.09(0.67–1.77)	34.2		1.35(1.16–1.58)
Intermediate	36.3		1.14(0.88–1.49)	39.8		1.56(0.99–2.46)	25.3		1.06(0.91–1.22)
High	31.1		1.00	27.7		1.00	21.7		1.00
Demand									
Low	32.5		1.00	25.3		1.00	20.2		1.00
Intermediate	37.8		1.50(1.21–1.86)	32.4		1.48(0.93–2.36)	25.6		1.47(1.25–1.72)
High	37.8		1.83(1.43–2.34)	38.3		1.91(1.14–3.21)	31.2		2.09(1.82–2.41)
Work hours *									
<7 hours/day	39.5		1.22(0.84–1.78)	47.1		2.41(1.16–4.99)	36.2		1.37(1.14–1.65)
7–9 hours /day	35.6		1.00	29.5		1.00	29.7		1.00
9–11 hours /day	34.8		1.04(0.79–1.38)	34.5		1.11(0.72–1.69)	24.0		0.95(0.79–1.15)
11< hours /day	27.1		0.71(0.36–1.37)	43.1		1.79(0.94–3.41)	23.6		0.88(0.55–1.40)

Abbreviations: In the British cohort, Grade 1: unified grade 1–6; Grade 2: unified grade 7 and executive officers; Grade 3: clerical officers; Grade 4: manual workers. PCS: physical component summary scale; OR: odds ratio; 95%CI: 95% confidence interval.

* In the Finnish cohort, work hours was categorized as less than 30 hours /week, 30–40 hours /week, 41–50 hours /week, and more than 50 hours / week.

Model 1 was adjusted for age.

Model 2 was adjusted for age and work characteristics (control, demand, and work hours).

Grade Differences in Poor Mental Functioning before and after Adjustment for Work Characteristics among Men

Table 5

	Britain			Japan			Finland		
	poor MCS %	Model 1 (Age -adjusted) OR (95%CI)	Model 2 (Model 1+ work) OR (95%CI)	poor MCS %	Model 1 (Age -adjusted) OR (95%CI)	Model 2 (Model 1+ work) OR (95%CI)	poor MCS %	Model 1 (Age -adjusted) OR (95%CI)	Model 2 (Model 1+ work) OR (95%CI)
Grades									
Grade 1	22.4	1.00	1.00	12.6	1.00	1.00	25.5	1.00	1.00
Grade 2	23.7	1.04(0.91–1.20)	1.02(0.88–1.19)	21.9	1.70(1.17–2.47)	1.53(1.04–2.25)	24.1	0.92(0.68–1.25)	0.77(0.55–1.08)
Grade 3	24.3	1.15(0.88–1.51)	1.08(0.80–1.45)	25.9	1.95(1.36–2.80)	1.62(1.09–2.39)	25.1	0.92(0.62–1.36)	0.85(0.55–1.30)
Grade 4							21.0	0.76(0.57–1.01)	0.42(0.29–0.60)
Age									
40–49	26.2	1.00	1.00	27.2	1.00	1.00	28.2	1.00	1.00
50–60	18.5	0.64(0.56–0.73)	0.66(0.57–0.75)	16.6	0.63(0.49–0.82)	0.66(0.51–0.86)	21.3	0.68(0.54–0.86)	0.67(0.52–0.85)
Control									
Low	27.9		1.96(1.63–2.36)	25.4		2.52(1.77–3.58)	32.8		3.70(2.61–5.23)
Intermediate	23.3		1.36(1.15–1.60)	23.6		2.09(1.52–2.89)	22.9		1.65(1.22–2.23)
High	20.0		1.00	15.7		1.00	18.6		1.00
Demand									
Low	17.6		1.00	13.7		1.00	15.7		1.00
Intermediate	22.4		1.54(1.29–1.84)	21.8		2.03(1.48–2.79)	21.4		1.54(1.11–2.14)
High	28.7		2.45(2.04–2.94)	34.2		4.03(2.80–5.80)	34.4		2.82(2.10–3.78)
Work hours *									
<7 hours/day	27.1		1.51(0.96–2.35)	20.1		1.31(0.85–2.02)	29.1		1.58(1.02–2.46)
7–9 hours /day	23.3		1.00	18.5		1.00	22.7		1.00
9–11 hours /day	22.6		0.90(0.76–1.06)	28.2		1.27(0.91–1.76)	25.9		1.01(0.73–1.38)
11< hours /day	21.2		0.81(0.60–1.09)	38.0		2.07(1.30–3.28)	28.3		1.28(0.69–2.35)

Abbreviations: In the British cohort, Grade 1: unified grade 1–6; Grade 2: unified grade 7 and executive officers; Grade 3: clerical officers; Grade 4: manual workers. MCS: mental component summary scale; OR: odds ratio; 95%CI: 95% confidence interval.

* In the Finnish cohort, work hours was categorized as less than 30 hours /week, 30–40 hours /week, 41–50 hours /week, and more than 50 hours / week.

Model 1 was adjusted for age.

Model 2 was adjusted for age and work characteristics (control, demand, and work hours).

Grade Differences in Poor Mental Functioning before and after Adjustment for Work Characteristics among Women

Table 6

	Britain			Japan			Finland		
	poor MCS %	Model 1 (Age -adjusted) OR (95%CI)	Model 2 (Model 1+ work) OR (95%CI)	poor MCS %	Model 1 (Age -adjusted) OR (95%CI)	Model 2 (Model 1+ work) OR (95%CI)	poor MCS %	Model 1 (Age -adjusted) OR (95%CI)	Model 2 (Model 1+ work) OR (95%CI)
Grades									
Grade 1	31.8	1.00	1.00	28.6	1.00	1.00	28.8	1.00	1.00
Grade 2	31.6	1.06(0.82–1.38)	1.19(0.89–1.58)	34.8	1.24(0.45–3.41)	1.60(0.54–4.75)	25.8	0.87(0.74–1.02)	0.86(0.72–1.02)
Grade 3	25.8	0.88(0.67–1.15)	1.14(0.81–1.59)	33.8	1.17(0.44–3.11)	1.77(0.60–5.26)	23.5	0.76(0.66–0.87)	0.67(0.58–0.79)
Grade 4							22.4	0.71(0.58–0.87)	0.55(0.44–0.69)
Age									
40–49	35.0	1.00	1.00	35.8	1.00	1.00	25.0	1.00	1.00
50–60	23.6	0.59(0.49–0.72)	0.59(0.49–0.72)	31.8	0.84(0.60–1.17)	1.02(0.71–1.45)	25.5	1.04(0.93–1.16)	1.01(0.90–1.13)
Control									
Low	28.1		1.48(1.12–1.96)	30.8		1.59(0.96–2.64)	31.4		2.12(1.80–2.48)
Intermediate	32.9		1.52(1.16–1.99)	39.3		1.66(1.04–2.67)	24.5		1.37(1.12–1.59)
High	27.9		1.00	30.3		1.00	21.7		1.00
Demand									
Low	21.8		1.00	21.6		1.00	17.0		1.00
Intermediate	30.1		1.58(1.25–2.00)	27.5		1.18(0.72–1.92)	22.1		1.34(1.14–1.59)
High	40.7		2.72(2.10–3.52)	49.4		2.43(1.44–4.10)	33.2		2.33(2.02–2.69)
Work hours *									
<7 hours/day	25.6		1.03(0.67–1.57)	23.5		1.04(0.45–2.40)	29.2		1.30(1.08–1.57)
7–9 hours /day	28.9		1.00	24.8		1.00	24.6		1.00
9–11 hours /day	33.8		0.99(0.75–1.31)	50.0		2.44(1.61–3.69)	26.7		1.01(0.84–1.21)
11< hours /day	31.3		0.95(0.50–1.81)	56.9		3.43(1.80–6.54)	22.2		0.84(0.53–1.35)

Abbreviations: In the British cohort, Grade 1: unified grade 1–6; Grade 2: unified grade 7 and executive officers; Grade 3: clerical officers; Grade 4: manual workers. MCS: mental component summary scale; OR: odds ratio; 95%CI: 95% confidence interval.

* In the Finnish cohort, work hours was categorized as less than 30 hours /week, 30–40 hours /week, 41–50 hours /week, and more than 50 hours / week.

Model 1 was adjusted for age.

Model 2 was adjusted for age and work characteristics (control, demand, and work hours).