

## ORIGINAL ARTICLE

# Socioeconomic determinants of long sickness absence affected by work, family, and personal health-related characteristics: A longitudinal study of the Japanese civil servants

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**Funding information**

Daiwa Anglo-Japanese Foundation, Grant/Award Number: 03/2059; Great Britain Sasakawa Foundation, Grant/Award Number: 2551; Japanese Society for the Promotion of Science, Grant/Award Number: 20790437; Occupational Health Promotion Foundation; the Universe Foundation, Grant/Award Number: 98.04.017

**Abstract**

**Objectives:** Sickness absence is increasingly affecting society at different levels. This study explores how work, family, and personal health-related characteristics will contribute to socioeconomic status (SES) differences in future long sickness absence (7 days or more) with respect to sex differences.

**Methods:** A total of 1562 civil servants worked for the Local Japanese government and were considered from 2003 to 2014 for this study. Logistic regression analyses were performed to examine whether there were employment-grade differences in long sickness absence after 11 years and whether such SES differences were associated with work, family, and personal health-related characteristics or sexes.

**Results:** Male low-grade employees had a significantly higher odds ratio (OR) for long sickness absence (age-adjusted OR = 1.75, 95% confidence interval (CI) [1.04–2.95]). However, after adjustment for work characteristics, the association of significance disappeared (OR = 1.65, [0.96–2.84]). Female low-grade employees had a significantly lower OR for long sickness absence after 11 years (OR = 0.26, [0.08–0.86]). Male employees working long hours and male and female employees in high job demand take less sickness absence. Meanwhile, male employees working short hours take longer sickness absence.

**Conclusions:** This study showed that male employees at low grades take longer sickness absence than those at high grades; however, this was alleviated by work characteristics. Female employees at low grades take less sickness absence than those at high grades. Japanese female employees with low grades, male employees with long working hours, and both sexes with high job demands take less sickness absence, although they may be unhealthy because of work stress.

**KEYWORDS**

grade of employment, job stress, longitudinal study, sickness absence, socioeconomic status, the JACS study

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## 1 | INTRODUCTION

The impact of sickness absence on society, such as an increase in medical expenses and a decrease in work productivity, is substantial.<sup>1–3</sup> Among Japanese civil servants, sickness absence because of mental problems doubled from 2005 to 2020,<sup>1</sup> and employees with a high risk of health problems had a significant loss of work productivity.<sup>2</sup> Globally, the total cost (i.e., direct, and indirect costs) of sickness absence in 2015 accounts for 3.2%–5.7% of gross domestic product (GDP) in each country, and it is expected to increase to 3.4%–6.7% of GDP in 2030.<sup>3</sup>

The relationships between sickness absence and work, family, and personal health-related characteristics were reflected in previous studies. For example, older employees are more likely to take longer sickness absence than younger ones.<sup>4</sup> For work characteristics, employees with low job satisfaction take longer sickness absence.<sup>5</sup> Longitudinal studies showed that employees with long working hours, who worked shifts and experienced high job stress were more likely to take sickness absence than those without.<sup>6,7</sup> For family characteristics, employees who were single male and female, have poor mental health,<sup>8</sup> and mental fatigue from stress is associated with an increased risk of long sickness absence.<sup>9</sup> A double burden hypothesis, measured by either work-to-family or family-to-work conflict, was associated with subsequent sickness absence in both females and males.<sup>10</sup> Therefore, it is important to focus on the family context when assessing individuals with sickness absence.<sup>10</sup> For personal health-related characteristics, employees who had sleep problems were more likely to take sickness absence than those without sleep problems.<sup>9</sup> Individuals with high negative affect were at an increased risk of physical illnesses such as high blood pressure, diabetes, respiratory and gastrointestinal illnesses,<sup>11</sup> which leads to sickness absence.

Females were more likely to take sickness absence than males.<sup>12</sup> There are differences between males and females in sickness absence because of gender segregation in the labor market and the differences in employment or working conditions that stem from this.<sup>12</sup> Females reported more work–family conflict than males indicating that it contributed to the gender gap in sickness absence.<sup>10</sup> There is also a difference in sickness absence within different socioeconomic status (SES) groups.<sup>12</sup> SES is an important determinant of occupational and individual health.<sup>8</sup> In previous studies, low-SES male employees were associated with poor physical and mental health,<sup>8</sup> and it was suggested that low-SES employees took more sickness absence compared to high-SES employees.<sup>7</sup>

Therefore, research had been conducted on each factor individually: work, family, personal health-related characteristics, and sickness absence; however, few studies

comprehensively evaluated whether work, family, and personal health-related characteristics were associated with long sickness absence. Moreover, there are minimal longitudinal studies that focus on SES differences in sickness absence after accounting for the aforementioned factors.<sup>13</sup> Such studies are required to comprehensively investigate these factors and highlight possible causal relationships. Therefore, we aimed to clarify how work, family, and personal health-related characteristics contribute to SES differences in future sickness absence depending on sexes.

## 2 | METHODS

### 2.1 | Study and Questionnaire

The Japanese Civil Servants Study (the JACS study)<sup>8,14,15</sup> is an international study in collaboration with the Whitehall II study (British Civil Servants Study) and the Helsinki Health Study. Phase 1 of the JACS study was conducted from 1998 to 1999, and subsequent phases were conducted approximately every 5 years. Phase 2 was conducted between January and February 2003 and Phase 4 between January and February 2014. Most questionnaire items in our study were selected from the Whitehall II study.<sup>4,13,16</sup> These items were translated to Japanese, and thereafter translated back to English by an individual who was blind to the original questionnaire. The reverse translated questionnaire was reviewed and confirmed by the researchers of the Whitehall II study.

A questionnaire was sent by post to the participants. Once completed, they were returned to the researchers in sealed envelopes. This study was approved by the Ethics Committee of the University of Toyama. The participants provided informed consent and voluntarily participated in the study.

### 2.2 | Participants

Data from 2003 containing information on SES (grade of employment) were used as the baseline in this study. The participants were all civil servants who worked in a local government office located on Honshu Island in Japan and were 20–55 years when the survey was conducted.

A total of 4272 participants (response rate: 79.2%) out of 5394 target employees responded in 2003. Of the 4272 participants, 1575 participants were excluded from the analysis, because of no responses to questions on age, sex, family status, longstanding illness, sleep status, affect balance, Karasek's job strain model, grade of employment, shift work, job satisfaction, work hours, and sickness absence. Of the 2697 participants without missing data in

2003, 1135 dropped out (42.1%) during the follow-up period. Data from 1562 participants followed up from 2003 to 2014 (1110 males and 452 females) were analyzed. The mean age of the participants was  $48.8 \pm 6.91$  years for males and  $46.3 \pm 7.42$  years for females.

The variables of drop-out and follow-up employees were tested using the *t*-test and  $\chi^2$  test. There was no significant difference in the number of days of sickness absence in 2003 for both males and females, however, those who were followed up were younger and had lower job grades.

There were few females in this study. However, the percentage of females with high job grades<sup>17</sup> and females who are living with family (especially parents)<sup>18,19</sup> concurred with the statistical results of local civil servants. Therefore, the data was considered representative of working females.

### 2.3 | Measures for sickness absence

The participants were requested to provide information on the total number of days of sickness absence in the previous year. We defined short sickness absence as periods of less than 7 days and long sickness absences as 7 days or more in the previous year.<sup>15</sup> Previous Whitehall II studies used 7 days as the cut-off for long sickness absence because a sickness absence longer than 7 days required a medical certificate and short and long sickness absences had different determinants.<sup>5</sup> Furthermore, long sickness absence (7 days or more) was more likely to represent deterioration in physical health.<sup>15</sup> In Japan, civil servant employees had to provide a medical certificate for sickness absence for more than 7 days. Therefore, we used 7 days or more as a long sickness absence. Regarding validity, a previous study showed that the sensitivity and specificity of self-reported sickness absence were acceptable for lengths not exceeding 1 week.<sup>20</sup>

### 2.4 | Measures for SES

This study used the grade of employment as a measure of SES. We asked, "Which of the following is your position in the workplace?", and the response was classified into three grades. According to our previous studies,<sup>8,14</sup> the grade of employment was classified as follows: the highest-grade (grade 1) included senior administrative workers (e.g., Head of Bureau, Head of Department, Deputy Head of Department, and Head of Section); intermediate-grade (grade 2) included administrative workers (e.g., Assistant Head of Section and Subsection Chief); the lowest-grade (grade 3) included clerical workers. The highest

and intermediate-grade employees were combined in the analysis because the numbers of the highest-grade employees were low in both males and females.

### 2.5 | Measures for the working characteristics

The participants' working environment was evaluated based on work hours, job satisfaction, shift work, and Karasek's job strain model.<sup>16,21</sup> The variables for the classification of working characteristics were divided according to previous JACS studies.<sup>8,14,22</sup> Previous studies<sup>8,14,22</sup> showed that the following factors: divided into four quartiles of working hours, shift worker or not, job satisfaction or dissatisfaction, and tertiles of Karasek's job stress model, influenced employees' physical and mental health. Therefore, we adopted the classification of previous studies.

Work hours per day were classified into <7, 7–9, 9–11, and 11 h or more. The following questions were asked: regarding shiftwork: "Does your job have shift work?" Shift work was classified into two categories: "shift workers" or "no shift workers;" regarding job satisfaction: "Are you satisfied with your job as a whole?" Items on job satisfaction had four response categories: very satisfied, satisfied, unsatisfied, and very unsatisfied with their own job. The responses were collapsed into two categories: "satisfied" (very satisfied and satisfied) and "unsatisfied" (unsatisfied and very unsatisfied). A previous study showed that the reliability of the single-item measurement of job satisfaction was 0.68.<sup>23</sup>

Karasek's job strain (demand-control-support) model<sup>21</sup> was used to evaluate psychosocial work characteristics. It has 25 self-reported items, including 15 items for job control, four items for job demand, and six items for social support at work.<sup>16</sup> Response categories ranged from 0 (often) to 3 (never). Once all items were re-coded in the same direction, scores for each scale were calculated by summing the item scores. The participants were divided into tertiles according to their scores. A high score on each scale indicated high control, demand, and support at work, respectively. The reliability coefficient (Cronbach's alpha<sup>24</sup>) was 0.78 for the control, 0.68 for the demand, and 0.83 for the social support groups, respectively, in this study population.

### 2.6 | Measures for family characteristics

Participants were asked, "Who are you living with?" There were nine response categories to this question which were further classified into three: "spouse status"

(living with spouse), “children status” (living with children under 5 years old, with children 5–15 years old, with children 15 years old or more) and “parents’ status” (living with father, mother, father-in-law, or mother-in-law).

## 2.7 | Measures for personal health-related characteristics

This study used data on sleep time and quality. We asked, “What is your actual average sleep time last month?” and “How do you evaluate your sleep quality last month?” The sleep quality item consisted of four response categories which were further classified into two: “good” (very good and good) and “poor” (poor and very poor). Participants were requested to provide sleep hours as the average sleeping time in the previous month. A previous study showed that the association between sleep hours and physical and mental health formed a U-shaped curve and that individuals who slept between 6 and 8 h were mostly healthy.<sup>25</sup> Therefore, we divided sleep time into the following categories: 6 or less, 6–8, and >8 h. In this study, female employees who slept >8 h were few. Therefore, 6–8 and >8 h were combined in the analysis.

For a longstanding illness, the subjects were asked: “Do you have a longstanding illness?” The participants responded “yes” or “no.”

The Affect Balance Scale contains 10 items (5 items for positive affect and 5 items for negative affect). Each item has four response categories ranging from 0 to 3.<sup>26</sup> The affect balance score was calculated by reducing the negative affect score from the positive affect score, resulting in a total range score from –15 to 15. The participants were grouped into those with a positive affect (zero or higher score), and those with a negative affect (<0).<sup>27</sup> In this study, Cronbach’s alpha was 0.64 for the positive scale and 0.67 for the negative scale.

## 2.8 | Statistical analyses

$\chi^2$  tests were conducted to evaluate whether there were sex differences in work, family, and personal health-related characteristics. Logistic regression analyses were conducted to examine whether there were employment-grade differences in sickness absence and such SES differences were because of work, family, and personal health-related characteristics in each sex. Odds ratios (ORs) and 95% confidence intervals (95% CIs) were calculated. SPSS (22.0.J) was used to conduct statistical analyses. A two-tailed *P*-value of <.05 was considered significant.

The model building strategy is devised. First, we adjusted for work characteristics that were directly related to both job grades and sickness absence. Second, we adjusted for family characteristics because job grade is also associated with family-work conflicts and family structure in our previous study.<sup>28</sup> Third, we adjusted for personal health-related characteristics which affect sickness absence. Variables related to sickness absence in previous studies were used as candidate variables, and after evaluating their relationship with work, family, and personal health-related characteristics, they were included as forced inputs in the final models.

## 3 | RESULTS

Table 1 shows the characteristics of the participants according to sex. The females were relatively young. More females had lower employment grades and control and higher demands than males. Furthermore, females were more likely to work shifts and live with their parents. Males were more likely to live with their spouses and children than females. Males were also more likely to sleep longer and have more longstanding illnesses compared to females.

Table 2 shows the influence of SES differences and work, family, and personal health-related characteristics at baseline on taking long sickness absence after 11 years among males. In the age-adjusted model (model 1), low-grade employees had a significantly higher OR for long sickness absence (OR = 1.75, 95%CI [1.04–2.95]). The association between grade of employment and long sickness absence after 11 years reduced (OR = 1.65, 95%CI [0.96–2.84]) and was no longer significant after work characteristics were adjusted (Model 2).

Males working 11 h or more had a lower OR for long sickness absence after 11 years (OR = 0.28, 95%CI [0.08–0.92]). After adjusting for family characteristics and for all covariates at baseline (Model 3 and 4), the association remained significant (OR = 0.24, 95%CI [0.07–0.79] and OR = 0.25, 95%CI [0.07–0.84], respectively). Moreover, males working <7 h had a higher OR for long sickness absence after 11 years (OR = 1.97, 95%CI [1.12–3.47]), and in Models 3 and 4, the association remained significant (OR = 1.96, 95%CI [1.10–3.49] and OR = 2.08, 95%CI [1.13–3.82], respectively). Employees with high demand at baseline had a lower OR for long sickness absence after 11 years, and the association remained significant in the fully adjusted model (OR = 0.50, 95%CI [0.29–0.88]). Although employees with low control, low support, and dissatisfaction with their job at baseline were likely to take long sickness absence after 11 years, the associations were not statistically significant.

**TABLE 1** Participant characteristics.(baseline)

		Male ( <i>n</i> = 1110)		Female ( <i>n</i> = 452)	
		<i>n</i>	%	<i>n</i>	%
Age					
	20–29	143	12.9	120	26.5
	30–39	502	45.2	180	39.8
	40–55	465	41.9	152	33.6
Grade of employment					
	Grade1 + 2	194	17.5	31	6.9
	Grade3	916	82.5	421	93.1
Job satisfaction					
	Satisfied	728	65.6	291	64.4
	Not satisfied	382	34.4	161	35.6
Shift work					
	Yes	83	7.5	163	36.1
	No	1027	92.5	289	63.9
Work hours					
	<7 h	82	7.4	20	4.4
	7–9 h	655	59.0	262	58.0
	9–11 h	276	24.9	141	31.2
	≥11 h	97	8.7	29	6.4
Job stress					
Control	Low	334	30.1	157	34.7
	Middle	347	31.3	152	33.6
	High	429	38.6	143	31.6
Demand	High	256	23.1	131	29.0
	Middle	329	29.6	127	28.1
	Low	525	47.3	194	42.9
Support	Low	365	32.9	135	29.9
	Middle	319	28.7	122	27.0
	High	426	38.4	195	43.1
Living with family					
Parent	Without	572	51.5	183	40.5
	With	538	48.5	269	59.5
Spouse	Without	267	24.1	159	35.2
	With	843	75.9	293	64.8
Children	Without	491	44.2	231	51.1
	With	619	55.8	221	48.9
Affect balance scale					
	Negative affect	459	41.4	185	40.9
	Positive affect	651	58.6	267	59.1
Sleep					
Time	≤6 h	365	32.9	202	44.7
	6–8 h	714	64.3	244	54.0
	>8 h	31	2.8	6	1.3
Subjective	Good	826	74.4	328	72.6

(Continues)



TABLE 1 (Continued)

		Male ( <i>n</i> = 1110)		Female ( <i>n</i> = 452)	
		<i>n</i>	%	<i>n</i>	%
Sleep quality	Poor	284	25.6	124	27.4
Longstanding illness					
	Yes	307	27.7	102	22.6
	No	803	72.3	350	77.4
Taking sickness absence at baseline					
	≥7 days	97	8.7	41	9.1
	<7 days	1013	91.3	411	90.9

Abbreviations: Grade1, the highest grade employees; Grade2, intermediate grade employees; Grade3, the lowest grade employees.

Males without a spouse had a higher OR for long sickness absence after 11 years in Model 4, however, the associations were not statistically significant (OR = 1.65, 95%CI [0.95–2.87]). Furthermore, employees without children had significantly higher ORs in Models 3 and 4 (OR = 1.63, 95%CI [1.05–2.53] and OR = 1.82, 95%CI [1.16–2.87], respectively). Additionally, longstanding illness was associated with long sickness absence after 11 years (OR = 2.50, 95%CI [1.66–3.77]). Employees who took long sickness absence at baseline were more likely to take long sickness absence after 11 years (OR = 3.69, 95%CI [2.24–6.07]).

Table 3 shows the influence of SES differences and work, family, and personal health-related characteristics at baseline on taking long sickness absence after 11 years among females. Lower grade employees at baseline had a significantly lower OR for long sickness absence after 11 years (OR = 0.26, 95%CI [0.08–0.86]) in the fully adjusted model (Model 4).

Females working 11 h or more at baseline had a higher OR for long sickness absence after 11 years (OR = 2.26, 95%CI [0.63–8.07]), however, it was not significant. Furthermore, employees with high demand at baseline had lower OR for long sickness absence after 11 years, and the significant association remained in the fully-adjusted model (OR = 0.31, 95%CI [0.11–0.87], OR = 0.32, 95%CI [0.11–0.91], and OR = 0.33, 95%CI [0.11–0.96], respectively). Other factors such as job stress and job dissatisfaction at baseline were not associated with long sickness absence after 11 years in females.

Females without children had significantly higher ORs (OR = 2.42, 95%CI [1.11–5.26] and OR = 2.59, 95%CI [1.15–5.84], respectively). Poor sleep quality and longstanding illness were not significantly associated with long sickness absence. Employees who took a long sickness absence at baseline were more likely to take a long sickness absence after 11 years (OR = 3.48, 95%CI [1.39–8.76]).

Regarding multicollinearity, we evaluated and confirmed the correlation coefficients between independent

variables, ranging from 0 to 0.45, which indicates that the results from this study may not be explained by the multicollinearity of the variables in the model.

## 4 | DISCUSSION

This study showed that SES differences affected sickness absence after 11 years and work, family, and personal health-related characteristics at baseline affected the relationship between these two elements. Males who were low-grade employees were more likely to take sickness absence. However, there were no significant associations between low-grade employees and long sickness absence after adjusting for work characteristics. Low SES was associated with poor physical and mental health and poor sleep quality.<sup>14,29</sup> However, it was found that, among males, the influence of SES differences on sickness absence after 11 years was reduced by work characteristics.

Furthermore, after adjusting for work characteristics we found that low-grade female employees take less sickness absence compared to their high-grade counterparts. A previous study showed that low-grade employees take more sickness absence in the future compared to high-grade employees.<sup>7</sup> For females, our results contradicted that of previous studies. Moreover, for work characteristics, male and female employees in high demand showed that they take less sickness absence after 11 years. Additionally, male employees who work long hours take less sickness absence. Previous studies showed that employees with long working hours and high job stress were more likely to take sickness absence in the future than those who did not.<sup>6,7</sup> However, the results of this study contradicted those of previous studies. Females with a low job grade, males with long working hours, and both sexes with high job demands take less long sickness absences. Previous JACS studies showed that individuals with lower job grades had poor physical and mental health.<sup>14</sup> In this study, employees with long working hours and highly

TABLE 2 Influence of SES differences and work, family, and personal health-related characteristics at baseline on taking long sickness absence after 11 years in male.

	The rate of sickness absence 7 days or more (%)			
	model1 OR (95%CI)	model2 OR (95%CI)	model3 OR (95%CI)	model4 OR (95%CI)
Grade of employment				
Grade1+2	11.9	1.00	1.00	1.00
Grade3	14.1	1.75 [1.04–2.95]*	1.65 [0.96–2.84]	1.46 [0.84–2.53]
Age				
20–29	7.0	1.00	1.00	1.00
30–39	13.1	2.03 [1.01–4.05]*	1.89 [0.94–3.81]	2.71 [1.31–5.62]*
40–55	16.3	3.17 [1.56–6.44]*	2.69 [1.31–5.54]*	4.28 [1.99–9.20]*
Work hours per day				
<7 h	24.4	1.97 [1.12–3.47]*	1.96 [1.10–3.49]*	2.08 [1.13–3.82]*
7–9 h	13.3	1.00	1.00	1.00
9–11 h	15.2	1.40 [0.91–2.16]	1.42 [0.92–2.19]	1.39 [0.88–2.19]
≥11 h	3.1	0.28 [0.08–0.92]*	0.24 [0.07–0.79]*	0.25 [0.07–0.84]*
Job satisfaction				
Satisfied	13.3	1.00	1.00	1.00
Not satisfied	14.4	1.06 [0.72–1.56]	1.00 [0.68–1.49]	0.99 [0.65–1.52]
Shift work				
Yes	13.3	0.83 [0.42–1.64]	0.90 [0.45–1.78]	0.82 [0.41–1.67]
No	13.7	1.00	1.00	1.00
Job stress				
Control				
Low	17.4	1.11 [0.71–1.72]	1.13 [0.72–1.76]	1.06 [0.66–1.69]
Middle	10.7	0.73 [0.46–1.16]	0.71 [0.44–1.12]	0.63 [0.39–1.03]
High	13.3	1.00	1.00	1.00
Demand				
High	9.0	0.55 [0.33–0.93]*	0.53 [0.31–0.91]*	0.50 [0.29–0.88]*
Middle	13.1	0.81 [0.53–1.23]	0.82 [0.54–1.26]	0.85 [0.55–1.33]
Low	16.4	1.00	1.00	1.00
Support				
Low	17.3	1.34 [0.87–2.08]	1.37 [0.88–2.13]	1.36 [0.86–2.15]
Middle	12.2	0.96 [0.60–1.52]	0.96 [0.61–1.54]	0.95 [0.59–1.54]
High	11.7	1.00	1.00	1.00
Living with family				

(Continues)

TABLE 2 (Continued)

The rate of sickness absence 7 days or more (%)		model1 OR (95%CI)	model2 OR (95%CI)	model3 OR (95%CI)	model4 OR (95%CI)
Parent	Without	12.1		0.94 [0.64–1.36]	1.06 [0.71–1.56]
	With	15.4		1.00	1.00
Spouse	Without	17.6		1.62 [0.96–2.73]	1.65 [0.95–2.85]
	With	12.5		1.00	1.00
Children	Without	16.7		1.63 [1.05–2.53]*	1.82 [1.16–2.87]*
	With	11.3		1.00	1.00
Affect balance scale					
Negative affect		14.8			0.84 [0.56–1.28]
Positive affect		12.9			1.00
Sleep					
Time	≤6 h	14.0			1.12 [0.74–1.70]
	6–8 h	13.3			1.00
	>8 h	19.4			1.48 [0.56–3.97]
Subjective	Good	13.2			1.00
	Poor	15.1			1.03 [0.67–1.61]
Longstanding illness					
Yes		22.5			2.50 [1.66–3.77]*
No		10.3			1.00
Taking sickness absence at baseline					
≥7 days		37.1			3.69 [2.24–6.07]*
<7 days		11.5			1.00

Notes: Model1 is adjusted for age and work characteristics (job satisfaction, shift work, work hours, and job stress [control, demand and support]). Model2 is adjusted for age, work characteristics, and family characteristics (living with spouse, child, and parents). Model3 is adjusted for age, work, family, and personal characteristics (affect balance, sleep time and quality, longstanding illness, and taking sickness absence at baseline).

Abbreviations: OR, odds ratios; 95%CI, 95% confidence intervals; Grade1, the highest grade employees; Grade2, intermediate grade employees; Grade3, the lowest grade employees.

\* $P < .05$ .



TABLE 3 Influence of SES differences and work, family, and personal health-related characteristics at baseline on taking long sickness absence after 11 years in female

	The rate of sickness absence 7 days or more (%)			
	model1 OR (95%CI)	model2 OR (95%CI)	model3 OR (95%CI)	model4 OR (95%CI)
Grade of employment				
Grade1+2	16.1	1.00	1.00	1.00
Grade3	10.2	0.41 [0.14–1.23]	0.27 [0.09–0.88] <sup>*</sup>	0.28 [0.09–0.92] <sup>*</sup>
Age				
20–29	13.3	1.00	1.00	1.00
30–39	11.1	0.78 [0.39–1.58]	0.76 [0.36–1.59]	0.94 [0.42–2.08]
40–55	7.9	0.46 [0.20–1.07]	0.44 [0.18–1.09]	0.66 [0.24–1.77]
Work hours per day				
<7 h	15.0	1.38 [0.37–5.18]	1.61 [0.42–6.19]	1.39 [0.32–5.97]
7–9 h	11.5	1.00	1.00	1.00
9–11 h	7.8	0.93 [0.42–2.04]	0.91 [0.41–2.03]	1.05 [0.46–2.39]
≥11 h	13.8	2.17 [0.63–7.51]	1.96 [0.56–6.90]	2.26 [0.63–8.07]
Job satisfaction				
Satisfied	11.0	1.00	1.00	1.00
Not satisfied	9.9	0.91 [0.45–1.82]	0.84 [0.41–1.70]	0.75 [0.35–1.62]
Shift work				
Yes	7.9	0.73 [0.35–1.55]	0.69 [0.32–1.48]	0.72 [0.33–1.57]
No	12.1	1.00	1.00	1.00
Job stress				
Control				
Low	13.4	1.66 [0.74–3.72]	1.80 [0.78–4.18]	2.06 [0.87–4.91]
Middle	9.2	1.06 [0.46–2.45]	1.13 [0.48–2.63]	1.17 [0.49–2.80]
High	9.1	1.00	1.00	1.00
Demand				
High	4.6	0.31 [0.11–0.87] <sup>*</sup>	0.32 [0.11–0.91] <sup>*</sup>	0.33 [0.11–0.96] <sup>*</sup>
Middle	12.6	2.07 [0.51–2.25]	1.09 [0.51–2.31]	1.10 [0.51–2.39]
Low	13.4	1.00	1.00	1.00
Support				
Low	11.9	1.03 [0.48–2.19]	1.01 [0.46–2.20]	1.10 [0.50–2.45]
Middle	8.2	0.67 [0.30–1.53]	0.70 [0.31–1.60]	0.73 [0.32–1.70]
High	11.3	1.00	1.00	1.00
Living with family				
Parent				
Without	12.0		1.42 [0.70–2.81]	1.31 [0.65–2.62]
With	9.7		1.00	1.00

(Continues)

TABLE 3 (Continued)

		The rate of sickness absence 7 days or more (%)			
		model1 OR (95%CI)	model2 OR (95%CI)	model3 OR (95%CI)	model4 OR (95%CI)
Spouse	Without			0.94 [0.42–2.10]	0.96 [0.42–2.17]
	With			1.00	1.00
Children	Without			2.42 [1.11–5.26] <sup>*</sup>	2.59 [1.15–5.84] <sup>*</sup>
	With			1.00	1.00
Affect balance scale					
	Negative affect	10.8			0.95 [0.47–1.93]
	Positive affect	10.5			1.00
Sleep					
	Time				
	≤6 h	8.9			0.80 [0.40–1.60]
	>6 h	12.3			1.00
	Subjective				
	Good	10.1			1.00
	Poor	12.1			1.33 [0.62–2.89]
Longstanding illness					
	Yes	10.8			1.00 [0.45–2.20]
	No	10.6			1.00
Taking sickness absence at baseline					
	≥7 days	24.4			3.48 [1.39–8.76] <sup>*</sup>
	<7 days	9.2			1.00

Notes: Model1 is adjusted for age and work characteristics (job satisfaction, shift work, work hours, and job stress [control, demand, and support]). Model2 is adjusted for age, work characteristics, and family characteristics (living with spouse, child, and parents). Model3 is adjusted for age, work, family, and personal characteristics (affect balance, sleep time and quality, longstanding illness, and taking sickness absence at baseline).

Abbreviations: OR, odds ratios; 95%CI, 95% confidence intervals; Grade1, the highest grade employees; Grade2, intermediate grade employees; Grade3, the lowest grade employees.

<sup>\*</sup> $P < .05$ .

demanding work were significantly associated with lower mental health compared to their counterparts. Long working hours and high job stress were also associated with long sickness absence<sup>6,7</sup> and poor physical and mental health.<sup>8,14</sup> Therefore, although employees may be unhealthy, they take less sickness absence because of work. Future studies should examine this.

The results showed that male employees who worked lesser hours were more likely to take long sickness absence. Employees work less hours in Japan because they are raising children, providing nursing care,<sup>30,31</sup> and returning to work after long sickness absence.<sup>32</sup> Previous studies showed that family and child caregivers experienced stress<sup>33</sup> which caused sickness absence<sup>34</sup>; therefore, caregivers tended to take sickness absence more than other employees. In addition, 19%–37% of employees who took sickness absence because of mental health illnesses at baseline had recurrent episodes after returning to work during the follow-up year.<sup>35</sup>

Among both males and females, employees living without children took more sickness absence than those living with children in the fully adjusted models. A previous study showed that sickness absence was more common in employees with children than in those without.<sup>36</sup> Our results however showed that males and females with children take less sickness absence. In Japan, employees with children have more motivation to work than those without children. Female employees decide how to work according to their children's needs.<sup>37</sup> Approximately 55% of male employees want to do household chores and childcare the same way they work.<sup>38</sup> Another reason is healthy employees can have children and take less sickness absence.

Regarding personal health-related characteristics, male employees with longstanding illnesses as well as male and female employees taking long sickness absence at baseline were more likely to take long sickness absence. Employees who returned to work and had common mental health problems at baseline had recurrent episodes during the follow-up year.<sup>35</sup> Therefore, when employees return to work after a long sickness absence, there is a high rate of further long sickness absence.

There are strengths in this study. A comprehensive and longitudinal investigation of SES differences in long sickness absence was conducted. It examined the influence of work, family, and personal health-related characteristics by sex. Although the role of individual factors in various work environments and sickness absence were shown in previous studies,<sup>6,7</sup> comprehensive investigations of these relationships are scarce. Therefore, this study showed that low-grade male employees took long sickness absences adjusted by work characteristics. Furthermore, the results showed that low-grade female employees take less sickness absence, and employees with long working hours and high demand work among Japanese civil servants

take less sickness absence. This study also showed that although employees may be unhealthy because of work-related stress, they took less sickness absence.

This study has several limitations. First, there is potential selection bias in this study. There were no significant differences in the proportion of long sickness absence between those who dropped out and those who were followed up during the 11-year period. However, male and female employees who could be followed up were significantly younger, had lower job grades, and fewer longstanding illnesses. Furthermore, males who were followed up had long working hours, low job satisfaction, high job demand, low job control, and less sleep time than those who dropped out. Females who were followed up had less shift workers and job demands. For males who could be followed up, factors such as lower job grades, long working hours, and high job stress, were associated with sickness absence. The influence of selection bias because of health differences was not substantial. However, females who were followed up had less job stress and shift work. Although there was no difference in sickness absence days, it may have affected the results.

Second, because the participants included regular, young, and white-collar employees working as civil servants, caution should be exercised in generalizing these results to the Japanese adult population. In Japan, the absence rate was high in non-regular, old, and blue-collar workers (e.g., agriculture, forestry, fisheries, construction, and cleaning).<sup>39</sup> Therefore, the association between sickness absence and working environment may have been underestimated. Furthermore, half of the females are professionals, and the difference between the results of male and female subjects may have been influenced by occupational differences. Therefore, caution should be exercised in generalization. Third, the findings of this study were based on data from 2003 to 2014, and it is unclear whether they are currently relevant. However, the sickness absence rate per 100 000 population increased since 2006, remained continuously high, and increased further after 2013.<sup>1</sup> Therefore, the association between work, family, and personal health-related characteristics and sickness absence may be much stronger. Fourth, we used a small sample size. Future studies should use a larger sample size. Fifth, we researched how factors from 11 years ago would affect sickness absence 11 years later. However, the number of changes was not considered. Future studies should analyze these changes. Sixth, this study does not examine the mediation between grade of employment and sickness absence as well as over adjustment between each variable. This requires further research.

In conclusion, this study showed SES differences in long sickness absence after 11 years in Japanese civil servants based on sex. Our findings include the following: SES differences at baseline affected long sickness absence after 11 years among males; low-grade employees took

longer sickness absence than high-grade employees, and the differences were attenuated when adjusted for work characteristics. Contrastingly, regarding SES differences in long sickness absence after 11 years among females, low-grade employees took less sickness absence than their high-grade counterparts. It was suggested that employees with long working hours, in high-demand jobs take less long sickness absences. However, these factors increase sickness absences. Japanese employees take less sickness absence although they may be unhealthy because of work stress which negatively impacts their health. Male employees working short hours tend to take longer sickness absence. Moreover, employees with a long sickness absence history had a higher tendency to take long sickness absence in the future. To reduce long sickness absence, it is necessary to rethink how to work and build sickness absence systems.

### AUTHOR CONTRIBUTIONS

All authors participated in the survey conference (e.g., designing the study, creating, and revising the questionnaire) and conducting the survey. Saori Nose analyzed and interpreted data and wrote the manuscript. Michikazu Sekine did overall survey planning, conducted the study, reviewed the manuscript, and advised on interpretation. Takashi Tatsuse contacted local government civil servants, aided with data acquisition, reviewed the manuscript, and advised on interpretation. Masaaki Yamada reviewed the manuscript and gave advice on interpretation.

### ACKNOWLEDGMENTS

We are indebted to all the civil servants in the local government department for their participation in this study. This study was in part funded by the Ministry of Health, Labour and Welfare of Japan, Japanese Society for the Promotion of Science (20790437), Occupational Health Promotion Foundation, the Universe Foundation (98.04.017), Daiwa Anglo-Japanese Foundation (03/2059), and Great Britain Sasakawa Foundation (2551). The funding sources were not involved in the study design, the collection and analysis and interpretation of data, the writing of the report, and the decision to submit the paper for publication.

### CONFLICT OF INTEREST

Authors declare no conflict of interests for this article.

### DISCLOSURE

*Approval of the research protocol:* The study was approved by the Institutional Review Board of the Graduate School of Medicine, the University of Toyama. *Informed consent:* The participants provided informed consent in writing in

advance and voluntarily participated in this study. *Registry and the registration no. of the study:* N/A. *Animal studies:* N/A.

### DATA AVAILABILITY STATEMENT

The dataset generated during the current study is not publicly available due to privacy or ethical restrictions but is available from the corresponding author on reasonable request after approval from the Ethical Committee of the University of Toyama.

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**How to cite this article:** Nose S, Sekine M, Tatsuse T, Yamada M. Socioeconomic determinants of long sickness absence affected by work, family, and personal health-related characteristics: A longitudinal study of the Japanese civil servants. *J Occup Health*. 2022;64:e12363. doi: [10.1002/1348-9585.12363](https://doi.org/10.1002/1348-9585.12363)