

- medical science: GMS e-journal. 2014;12:Doc10–Doc. <https://doi.org/10.3205/000195> PMID: [24872810](https://pubmed.ncbi.nlm.nih.gov/24872810/)
28. Chen E, Miller GE. Stress and inflammation in exacerbations of asthma. *Brain Behav Immun*. 2007; 21(8):993–9. <https://doi.org/10.1016/j.bbi.2007.03.009> PMID: [17493786](https://pubmed.ncbi.nlm.nih.gov/17493786/)
 29. Lehrer P, Feldman J, Giardino N, Song HS, Schmaling K. Psychological aspects of asthma. *J Consult Clin Psychol*. 2002; 70(3):691–711. <https://doi.org/10.1037//0022-006x.70.3.691> PMID: [12090377](https://pubmed.ncbi.nlm.nih.gov/12090377/)
 30. Cohen S, Tyrrell DAJ, Smith AP. Psychological Stress and Susceptibility to the Common Cold. *N Engl J Med*. 1991; 325(9):606–12. <https://doi.org/10.1056/NEJM199108293250903> PMID: [1713648](https://pubmed.ncbi.nlm.nih.gov/1713648/)
 31. Arenas A, Giorgi G, Montani F, Mancuso S, Perez JF, Mucci N, et al. Workplace Bullying in a Sample of Italian and Spanish Employees and Its Relationship with Job Satisfaction, and Psychological Well-Being. *Front Psychol*. 2015; 6:1912. <https://doi.org/10.3389/fpsyg.2015.01912> PMID: [26696948](https://pubmed.ncbi.nlm.nih.gov/26696948/)
 32. Rodríguez-Muñoz A, Baillien E, De Witte H, Moreno-Jiménez B, Pastor JC. Cross-lagged relationships between workplace bullying, job satisfaction and engagement: Two longitudinal studies. *Work & Stress*. 2009; 23(3):225–43.
 33. Olsen E, Bjaalid G, Mikkelsen A. Work climate and the mediating role of workplace bullying related to job performance, job satisfaction, and work ability: A study among hospital nurses. *J Adv Nurs*. 2017; 73(11):2709–19. <https://doi.org/10.1111/jan.13337> PMID: [28512986](https://pubmed.ncbi.nlm.nih.gov/28512986/)
 34. Cooper-Thomas H, Bentley T, Catley B, Gardner D, O'Driscoll M, Trenberth L. The impact of bullying on observers and targets. *New Zealand Journal of Human Resource Management*. 2014; 14(2):82–95.
 35. Sims RL, Sun P. Witnessing workplace bullying and the Chinese manufacturing employee. *Journal of Managerial Psychology*. 2012; 27(1):9–26.
 36. Salin D, Notelaers G. The effects of workplace bullying on witnesses: violation of the psychological contract as an explanatory mechanism? *The International Journal of Human Resource Management*. 2020; 31(18):2319–39.
 37. Tsuno K, Kawakami N, Inoue A, Abe K. Measuring workplace bullying: reliability and validity of the Japanese version of the negative acts questionnaire. *J Occup Health*. 2010; 52(4):216–26. <https://doi.org/10.1539/joh.110036> PMID: [20571253](https://pubmed.ncbi.nlm.nih.gov/20571253/)

Workplace Social Support and Reduced Psychological Distress

A 1-Year Occupational Cohort Study

Reiko Inoue, MD, Hiroyuki Hikichi, PhD, Akiomi Inoue, PhD, Yuko Kachi, PhD, Hisashi Eguchi, PhD, Kazuhiro Watanabe, PhD, Yumi Arai, MSN, Noboru Iwata, PhD, and Akizumi Tsutsumi, MD

Objective: There is little evidence that workplace social support can relieve workers' mental health problems. Therefore, we examined whether social support from coworkers and supervisors was associated with reduced serious psychological distress among employees. **Methods:** We used two-wave panel data from 13 Japanese companies. The baseline survey was conducted in 2011, and the follow-up survey 1 year later. From 9889 respondents, we selected 759 who had psychological distress at baseline, defined as ≥ 13 on the Kessler Psychological Distress Scale (K6). **Results:** Increased coworker support was significantly associated with employees' reduced psychological distress (odds ratio, 3.51; 95% confidence interval, 2.17 to 5.68). The association between increased supervisor support and reduced psychological distress was nonsignificant (odds ratio, 1.32, 95% confidence interval, 0.85 to 2.04). **Conclusion:** Encouraging coworker support may contribute to the secondary prevention of mental health problems among employees.

Keywords: epidemiology, occupational health, psychological distress, longitudinal study, social support

Workers' psychological distress is associated with persistent presenteeism.¹ The World Health Organization reported in 2019 that symptoms of depression and anxiety negatively impact workers' productivity, a situation that costs the global economy US \$1 trillion annually.² Arguably, early detection of and reductions in mental health problems are required to prevent the onset of chronic mental illnesses and to avoid lowered productivity among workers.

Indeed, occupational health studies have demonstrated that social support in workplaces may contribute to primary prevention of mental health problems.^{3,4} Emotional and instrumental support from coworkers and supervisors can reduce workers' negative emotions and help them resolve workplace issues that cause psychological distress.⁵ Workplace support can buffer the effects of stress at work on health problems.⁶

From the Department of Public Health, Kitasato University School of Medicine, Sagami-hara (Drs Inoue, Hikichi, Kachi, Watanabe, and Tsutsumi and Ms Arai); Institutional Research Center, University of Occupational and Environmental Health (Dr Inoue); and Department of Mental Health, Institute of Industrial Ecological Sciences, University of Occupational and Environmental Health (Dr Eguchi), Kitakyushu; and Department of Nursing, Faculty of Healthcare, Kiryu University, Midori (Dr Iwata), Japan.

The present study was supported by grant 20K19671 from the Grant-in-Aid for Scientific Research of the Japan Society for the Promotion of Science. The funder had no role in the study design, in the collection, analysis, or interpretation of data; in the writing of the report; or in the decision to submit the article for publication.

Conflicts of interest: none declared.

This research was conducted in full accordance with the Helsinki Declaration. Written consent was obtained from participants. This study was approved by the Research Ethics Committee of the Graduate School of Medicine and Faculty of Medicine, The University of Tokyo (no. 2772), Kitasato University Medical Ethics Organization (B12-103), and Ethics Committee of Medical Research, University of Occupational and Environmental Health, Japan (10-004).

Supplemental digital contents are available for this article. Direct URL citation appears in the printed text and is provided in the HTML and PDF versions of this article on the journal's Web site (www.joem.org).

Address correspondence to: Reiko Inoue, MD, 1-15-1 Kitasato, Minami-ku, Sagami-hara, Kanagawa 252-0374, Japan (dm18003@st.kitasato-u.ac.jp).

Copyright © 2022 American College of Occupational and Environmental Medicine
DOI: 10.1097/JOM.0000000000000265

It is likely then that secondary prevention of mental health problems may also be achieved by promoting workplace social support. Several population-based surveys have suggested that informational and emotional support can improve depressive symptoms in dementia patients and their caregivers.⁷⁻⁹ However, few studies have focused on the secondary prevention of mental health problems via support in the workplace and targeted only workers who report deteriorated mental health.

In the present study, therefore, using two-wave panel data consisting of 13 Japanese companies, we prospectively examined whether workplace social support was associated with reduced psychological distress among employees.

METHODS

Participants

We analyzed data obtained from a Japanese occupational cohort study—J-HOPE (the Japanese study of Health, Occupation and Psychosocial factors related Equity)—which was conducted for 4 consecutive years beginning in 2009 to ask employers about health and social connectedness in their workplaces.¹⁰ A detailed flowchart illustrating the sampling process is presented in Figure 1. To maximize the number of participants in the sample who were at high risk of mental health problems, we selected two-wave panel data derived from the 2011 and 2012 surveys (participation rates were 80.2% and 77.4%, respectively), which comprised 9889 employees from 13 companies (eg, manufacturing, transportation, service industries, information technology, and hospitals/medical facilities) in Japan. In this study, we defined serious psychological distress as a score of 13 or more on the K6 scale (the Kessler Psychological Distress Scale¹¹); after excluding 9056 employees who did not qualify as having serious psychological distress at baseline and 74 employees who had missing responses for relevant variables, the data from 759 employees were analyzed.

This research was conducted in full accordance with the Helsinki Declaration. Written consent was obtained from participants. This study was approved by the Research Ethics Committee of the Graduate School of Medicine and Faculty of Medicine, The University of Tokyo (no. 2772); Kitasato University Medical Ethics Organization (B12-103); and Ethics Committee of Medical Research, University of Occupational and Environmental Health, Japan (10-004).

Outcome Variables

Our outcome variable was reduced serious psychological distress. We measured serious psychological distress using the Japanese version of the K6.¹¹⁻¹³ The scale consists of six items that measure the frequency of the following indicators of psychological distress during the previous 30 days: (1) nervous, (2) hopeless, (3) restless or fidgety, (4) depression, (5) that everything was an effort, and (6) worthlessness. Responses ranged from 0 (none of the time) to 4 (all of the time). Reduced psychological distress was defined as a score of 12 points or less on the K6 in the follow-up survey (ie, 1: reduced psychological distress vs 0: persistent psychological distress).

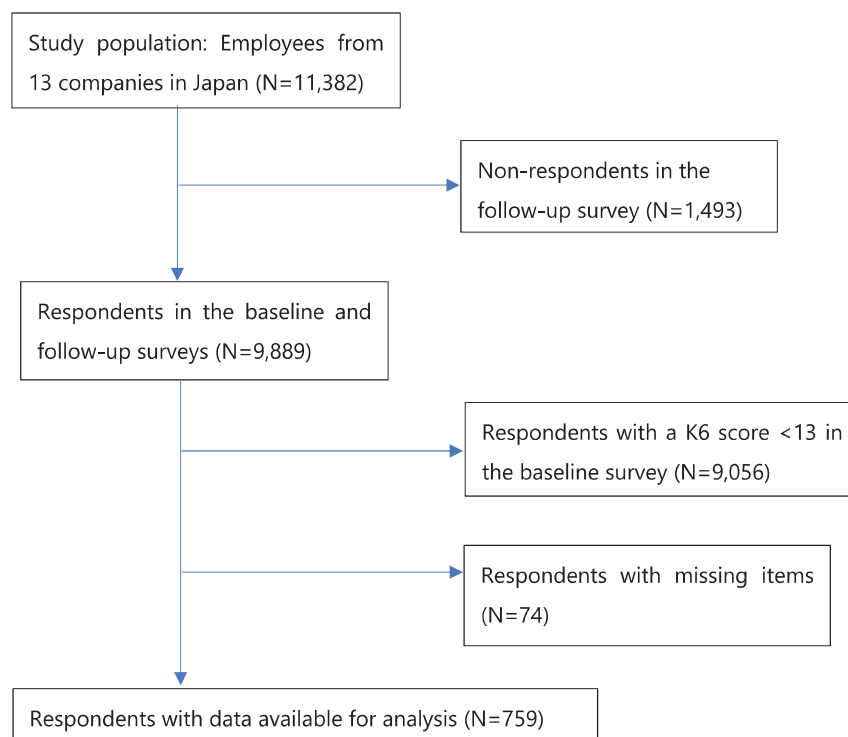


FIGURE 1. Recruitment process for the study sample.

Explanatory Variables

We measured coworker support and supervisor support using the Japanese version of the Job Content Questionnaire.¹³ Coworker support was measured using four items: “My coworkers are competent in doing their jobs,” “My coworkers take a personal interest in me,” “My coworkers are friendly,” and “My coworkers are helpful in getting the job done.” The supervisor support scale also contained four items: “My supervisor is concerned about the welfare of those under him/her,” “My supervisor pays attention to what I say,” “My supervisor is helpful in getting the job done,” and “My supervisor is good at getting people to work together.” Respondents answered all eight questions on a 4-point scale: 1 = “strongly disagree” to 4 = “strongly agree.” In accordance with the Job Content Questionnaire Users’ Guide, we calculated the total score of the four questions about coworkers and the total score of the four questions about supervisors for each participant (Cronbach α s were 0.84 and 0.92, respectively, in 2011).¹⁴

We hypothesized that increased social support from coworkers and supervisors during the period between baseline (T1) and follow-up (T2) would reduce employees’ psychological distress, whereas decreased workplace social support during that period would have the opposite effect. To examine our hypothesis, we split the social support scores from each survey at the median value (11 points) to create four categories that represented four different patterns of transition in workplace social support for each participant: (1) 2011 low scores and 2012 low scores (reference group); (2) 2011 low and 2012 high; (3) 2011 high and 2012 low; and (4) 2011 high and 2012 high.

Covariates

We selected the following potential confounding variables: age, sex, working hours per week (≤ 30 , 31 to 40, 41 to 50, 51 to 60, and ≥ 61),¹⁵ educational attainment (junior high school, high school, junior college, college, and graduate school),¹⁶ number of family members with whom the participant shares a living,¹⁷ job category (manager, nonmanual, manual, and other), and household income.¹⁶

Statistical Analysis

We implemented a multivariable logistic regression model to examine the association between four patterns of workplace social support transition over time and reduced psychological distress. The effects of coworker and supervisor support were separately analyzed because of their strong correlation ($r = 0.485$). We calculated the population attributable fraction to estimate the effect size of the low-high group among all populations reducing psychological distress. We calculated the values as $(IP_1 - IP_0) / IP_1$, in which IP_1 is the cumulative proportion of the total population getting reduced psychological distress and IP_0 is the cumulative proportion of participants in the low-low, high-low, and high-high groups who reduced psychological distress.¹⁸ In a sensitivity analysis, we used a continuous change variable in social support ($T2 - T1$) as an explanatory variable in the same model. Furthermore, taking into consideration time-dependent confounding, we repeated the analysis using a continuous variable for change in working hours ($T2 - T1$) as a covariate instead of baseline working hours. All statistical tests were two-sided with a significance level of 5%. Data were analyzed with IBM SPSS Statistics version 26 for Windows (IBM Corp, Armonk, NY).

RESULTS

Table 1 shows the characteristics of participants categorized by temporal transition in coworker support and supervisor support. Across the categories, more than 60% of respondents were men, more than half of whom were nonmanual workers; the average age ranged from 34.4 to 40.0 years. The highest proportion of educational attainment in the low-low group was high school (39.0% for coworker support and 37.3% for supervisor support), whereas most respondents in the high-high group had graduated from college (37.6% and 39.1%, respectively). In the follow-up survey, the prevalence of reduced psychological distress (a K6 score of ≤ 12) was highest in the low-high group (76.1% and 63.2%, respectively).

Table 2 shows the results of logistic regression analysis. Increased coworker support (low-high) and higher coworker support at

TABLE 1. Participants' Baseline Characteristics, Categorized Into Four Patterns of Transitioning Workplace Social Support

	Coworker Support						Supervisor Support									
	Low-Low (n = 331)		Low-High (n = 126)		High-Low (n = 96)		High-High (n = 206)		Low-Low (n = 346)		Low-High (n = 123)		High-Low (n = 99)		High-High (n = 191)	
	n (%)	Mean (SD)	n (%)	Mean (SD)	n (%)	Mean (SD)	n (%)	Mean (SD)	n (%)	Mean (SD)	n (%)	Mean (SD)	n (%)	Mean (SD)	n (%)	Mean (SD)
Sex																
Men	243 (73.4)		94 (74.6)		66 (68.8)		141 (68.4)		246 (71.1)		91 (74.0)		63 (63.6)		144 (75.4)	
Women	88 (26.6)		32 (25.4)		30 (31.3)		65 (31.6)		100 (28.9)		32 (26.0)		36 (36.4)		47 (24.6)	
Age, y																
Work hours per week																
≤30 h	42 (12.7)		13 (10.3)		9 (9.4)		22 (10.7)		45 (13.0)		16 (13.0)		10 (10.1)		15 (7.9)	
31–40 h	98 (29.6)		37 (29.4)		25 (26.0)		52 (25.2)		103 (29.8)		31 (25.2)		28 (28.3)		50 (26.2)	
41–50 h	142 (42.9)		58 (46.0)		44 (45.8)		90 (43.7)		141 (40.8)		59 (48.0)		41 (41.4)		93 (48.7)	
51–60 h	37 (11.2)		13 (10.3)		11 (11.5)		32 (15.5)		40 (11.6)		11 (8.9)		16 (16.2)		26 (13.6)	
≥61 h	12 (3.6)		5 (4.0)		7 (7.3)		10 (4.9)		17 (4.9)		6 (4.9)		4 (4.0)		7 (3.7)	
Education																
Junior high school	8 (2.4)		1 (0.8)		4 (4.2)		1 (0.5)		6 (1.7)		2 (1.6)		2 (2.0)		4 (2.1)	
High school	132 (39.9)		37 (29.4)		23 (24.0)		46 (22.3)		130 (37.6)		30 (24.4)		30 (30.3)		48 (25.1)	
Junior college	59 (17.8)		17 (13.5)		30 (31.3)		52 (25.2)		81 (23.4)		26 (21.1)		19 (19.2)		32 (16.8)	
College	99 (29.9)		55 (43.7)		30 (31.3)		78 (37.9)		100 (28.9)		50 (40.7)		38 (38.4)		74 (38.7)	
Graduate school	33 (10.0)		16 (12.7)		9 (9.4)		29 (14.1)		29 (8.4)		15 (12.2)		10 (10.1)		33 (17.3)	
No. of family members with whom share a living	2.9 (1.5)		2.7 (1.4)		2.5 (1.4)		2.4 (1.4)		2.8 (1.5)		2.7 (1.4)		2.6 (1.5)		2.5 (1.4)	
Job category																
Manager	33 (10.0)		20 (15.9)		6 (6.3)		19 (9.2)		25 (7.2)		20 (16.3)		12 (12.1)		21 (11.0)	
Nonmanual worker	165 (49.8)		70 (55.6)		61 (63.5)		130 (63.1)		181 (52.3)		68 (55.3)		56 (56.6)		121 (63.4)	
Manual worker	90 (27.2)		18 (14.3)		19 (19.8)		34 (16.5)		95 (27.5)		19 (15.4)		17 (17.2)		30 (15.7)	
Other	43 (13.0)		18 (14.3)		10 (10.4)		23 (11.2)		45 (13.0)		16 (13.0)		14 (14.1)		19 (9.9)	
Household income, million JPY	6.17 (2.82)		5.90 (2.89)		5.63 (2.80)		5.23 (2.79)		5.84 (2.76)		6.11 (3.02)		5.58 (2.79)		5.65 (2.92)	
K6 score*																
≤12 points	169 (51.1)		96 (76.2)		53 (55.2)		125 (60.7)		196 (56.6)		78 (63.4)		51 (51.5)		118 (61.8)	
*Score in the follow-up survey for the Kessler Psychological Distress Scale (K6).																

*Score in the follow-up survey for the Kessler Psychological Distress Scale (K6).

TABLE 2. Adjusted Odds Ratios for the Reduced Psychological Distress by the Category of Changes in Social Support (n = 759)

	Coworker Support		Supervisor Support	
	OR	95% CI	OR	95% CI
Change in social support (reference: low-low)				
Low-high	3.51	2.17–5.68	1.32	0.85–2.04
High-low	1.31	0.81–2.11	0.83	0.52–1.31
High-high	1.85	1.26–2.70	1.33	0.91–1.94
Sex (reference: men)	1.03	0.72–1.47	1.04	0.73–1.48
Age	1.01	0.99–1.03	1.00	0.99–1.02
Income	1.00	1.00–1.00	1.00	1.00–1.00
Education				
(reference: junior high school)				
High school	0.64	0.19–2.17	0.70	0.21–2.35
Junior college	0.53	0.15–1.86	0.60	0.17–2.06
College	0.47	0.14–1.63	0.57	0.17–1.94
Graduate school	0.42	0.11–1.56	0.49	0.13–1.78
Family	0.96	0.86–1.07	0.97	0.87–1.08
Job category (reference: manual)				
Nonmanual	0.81	0.53–1.26	0.86	0.56–1.32
Manager	1.26	0.63–2.54	1.45	0.73–2.90
Other	1.42	0.82–2.48	1.55	0.89–2.67
Work hours (reference: ≤30 h)				
31–40 h	0.98	0.57–1.67	1.01	0.60–1.71
41–50 h	1.09	0.65–1.83	1.08	0.65–1.81
51–60 h	0.99	0.51–1.91	0.98	0.51–1.88
≥61 h	1.73	0.71–4.23	1.67	0.70–4.02

CI, confidence interval; OR, odds ratio.

both surveys (high-high) were significantly associated with reduced psychological distress (odds ratio [OR], 3.51; 95% confidence interval [CI], 2.17 to 5.68; and OR, 1.85; 95% CI, 1.26 to 2.70, respectively). By contrast, neither increased supervisor support (low-high) nor higher supervisor support at both surveys (high-high) was significantly linked to reduced psychological distress, although the point es-

timates suggested the expected direction (OR, 1.32; 95% CI, 0.85 to 2.04; and OR, 1.33; 95% CI, 0.91 to 1.94, respectively).

The population attributable fraction of coworker's low-high group was 6.16%, and that of supervisor's low-high group was 1.71%.

Table 3 presents the results of our sensitivity analysis. The continuous variables for differences in coworker support were significantly related to reduced psychological distress, but the continuous variables for differences in supervisor support were not associated significantly with reduced psychological distress (OR, 1.18; 95% CI, 1.05 to 1.34; and OR, 1.07; 95% CI, 0.95 to 1.20, respectively).

Analysis using differences in working hours between baseline and follow-up showed the almost same results as the main analyses. Increased coworker support and higher coworker support at both surveys were significantly related to reduced psychological distress (OR, 3.56; 95% CI, 2.20 to 5.77; and OR, 1.91; 95% CI, 1.31 to 2.81, respectively). Increased supervisor support and higher supervisor support at both surveys were not significantly associated with reduced psychological distress (OR, 1.33; 95% CI, 0.86 to 2.06; and OR, 1.32; 95% CI, 0.90 to 1.92, respectively) (see Appendix, <http://links.lww.com/JOM/B185>).

DISCUSSION

In the present study, we prospectively investigated associations between workplace social support and reduced psychological distress among workers who reported serious psychological distress at baseline. Logistic regression analyses showed that enhanced coworker support over time (low-high) and higher coworker support at both T1 and T2 surveys (high-high) were associated with reduced psychological distress. Furthermore, each supervisor support category (low-high, high-high) was associated with reduced psychological distress, but it was not statistically significant. Those results were similar to those from our analyses in which changes in support were a continuous variable or that took into account changes in working hours between baseline and follow-up. Previous studies have suggested that social support can help prevent the incidence of mental illness among workers.^{3,4} Our

TABLE 3. Adjusted Odds Ratios for the Reduced Psychological Distress by the Continuous Change in Social Support (n = 759)

	Coworker Support		Supervisor Support	
	OR	95% CI	OR	95% CI
Change in social support*	1.18	1.05–1.34	1.07	0.95–1.20
Sex (reference: men)	1.01	0.71–1.44	1.01	0.71–1.43
Age	1.01	0.99–1.03	1.00	0.99–1.02
Income	1.00	1.00–1.00	1.00	1.00–1.00
Education				
(reference: junior high school)				
High school	0.70	0.21–2.35	0.70	0.21–2.34
Junior college	0.56	0.16–1.94	0.61	0.18–2.08
College	0.55	0.16–1.89	0.58	0.17–1.96
Graduate school	0.49	0.13–1.78	0.50	0.14–1.82
Family	0.97	0.87–1.08	0.96	0.86–1.08
Job category (reference: manual)				
Nonmanual	0.86	0.56–1.31	0.87	0.57–1.33
Manager	1.46	0.74–2.89	1.47	0.74–2.91
Other	1.53	0.88–2.64	1.54	0.89–2.66
Work hours (reference: ≤30 h)				
31–40 h	1.01	0.60–1.70	1.00	0.59–1.68
41–50 h	1.09	0.65–1.81	1.08	0.65–1.79
51–60 h	0.94	0.49–1.79	0.94	0.50–1.80
≥61 h	1.63	0.67–3.93	1.66	0.69–3.99

*The score used was the result of subtracting T1 from T2.
CI, confidence interval; OR, odds ratio.

results provide additional evidence that coworker support contributes to secondary prevention, as well as primary prevention, of mental health problems among workers.

Our results also suggest that coworker support may be more effective in relieving severe psychological distress than supervisor support. Indeed, in a community-based study, people with mental health problems were more likely to seek informal social support in intimate relationships.¹⁹ Coworkers, then, who typically interact more often and closely with one another than they do with their supervisors, can be a suitable resource for efficient social support to ameliorate mental health issues in the workplace. In addition, subordinates may not feel free to consult their supervisors, who are in a position to evaluate them and to see them as a person with whom they can discuss negative information about themselves such as psychological distress and hospital visits. However, the impact of coworker support on mitigating psychological distress may not be very large. Although the OR of the coworkers' low-high group was larger than 3, the population attributable risk was only 6.16% of the population because of the small prevalence of the low-high group.

In this study, we did not find clear evidence that supervisor support contributed to reducing serious psychological distress. Although no previous study on supervisor support has focused on its secondary prevention effect exclusively for workers with worsening mental health, some research has indicated that supervisor support may improve workers' mental health.²⁰ Further research is needed on the effects of supervisor support on the secondary prevention of mental health problems among employees.

One strength of the present study is its longitudinal design, which reduced the possibility of reverse causation in the relationship between workplace social support and psychological distress. A limitation of the study was that both exposure (social support) and outcome (psychological distress) variables were assessed simultaneously at baseline and follow-up and were both based on self-report. Although the study design was longitudinal, we cannot rule out the possibility that workers' evaluations of social support could have affected their mental health status when answering the questionnaire. For example, those with poor mental health may not be able to seek help and obtain workplace support. The second limitation was the sample configuration: although it included several companies and a wide variety of occupations, it comprised a higher percentage of employees from large-scale enterprises as well as permanent, nonmanual, and male workers compared with the general Japanese working population.²¹ Therefore, the present findings may strongly reflect the features of these demographic groups, while underestimating or neglecting the features of their counterparts (ie, employees at medium- or small-scale enterprises; nonpermanent, manual, and female workers). Therefore, generalizations of the findings should be made with caution. A third limitation is that the mechanism that support ameliorating psychological distress is unknown in this study. We did not obtain information about the causes of psychological distress or of mediators between support and reduced psychological distress, which would allow us to examine those mechanisms. Workplace support is known to have a buffering effect in situations in which work-related stressors lead to mental distress.⁶ Thus, when participants' psychological distress is caused by a lack of social support or workplace conflict, enhancing social support in the workplace may be more effective. Confining the study population to those who have less coworker support may provide a greater effect size.

Despite the limitations, the findings of the present study indicate that increased workplace social support, especially from coworkers, can help reduce workers' psychological distress. Encouraging coworker support may thus contribute to the secondary prevention of mental health problems for employees in the workplace.

ACKNOWLEDGMENTS

The authors thank Kazuhiko Enta, Norito Kawakami, Sumiko Kurioka, Yuki Kosugi, Koichi Miyaki, Akihito Shimazu, Masaya Takahashi, and Takafumi Totsuzaki for their contribution to the J-HOPE study.

REFERENCES

- Lerner D, Adler DA, Rogers WH, et al. Work performance of employees with depression: the impact of work stressors. *Am J Health Promot*. 2010;24:205–213.
- Kestel D. Mental health in the workplace [World Health Organization Web site]. January 2019. Volume 22. Available at: <https://www.who.int/news-room/commentaries/detail/mental-health-in-the-workplace>. Accessed January 19, 2022.
- Frese M. Social support as a moderator of the relationship between work stressors and psychological dysfunctioning: a longitudinal study with objective measures. *J Occup Health Psychol*. 1999;4:179–192.
- Peterson U, Bergström G, Samuelsson M, Åsberg M, Nygren Å. Reflecting peer-support groups in the prevention of stress and burnout: randomized controlled trial. *J Adv Nurs*. 2008;63:506–516.
- House JS, Robert LK. Measures and concepts of social support. In: Cohen S, Syme SL, eds. *Social Support and Health*. New York: Academic Press; 1985:83–108.
- Mathieu M, Eschleman KJ, Cheng D. Meta-analytic and multiwave comparison of emotional support and instrumental support in the workplace. *J Occup Health Psychol*. 2019;3:387–409.
- Weber BA, Roberts BL, Yarandi H, Mills TL, Chumbler NR, Wajzman Z. The impact of dyadic social support on self-efficacy and depression after radical prostatectomy. *J Aging Health*. 2007;19:630–645.
- Leung P, Orrell M, Orgeta V. Social support group interventions in people with dementia and mild cognitive impairment: a systematic review of the literature. *Int J Geriatr Psychiatry*. 2015;30:1–9.
- Chien LY, Chu H, Guo JL, et al. Caregiver support groups in patients with dementia: a meta-analysis. *Int J Geriatr Psychiatry*. 2011;26:1089–1098.
- J-HOPE Japanese study of Health, Occupation and Psychosocial factors related Equity [J-HOPE Web site]. Available at: <https://www.med.kitasato-u.ac.jp/lab/publichealth/eng/jhope.html>. Accessed February 23, 2022.
- Sakurai K, Nishi A, Kondo K, Yanagida K, Kawakami N. Screening performance of K6/K10 and other screening instruments for mood and anxiety disorders in Japan. *Psychiatry Clin Neurosci*. 2011;65:434–441.
- Furukawa TA, Kawakami N, Saitoh M, et al. The performance of the Japanese version of the K6 and K10 in the World Mental Health Survey Japan. *Int J Methods Psychiatr Res*. 2008;17:152–158.
- Kessler RC, Andrews G, Colpe LJ, et al. Short screening scales to monitor population prevalences and trends in non-specific psychological distress. *Psychol Med*. 2002;32:959–976.
- Karasek RA. *Job Content Questionnaire and User's Guide*. Lowell, MA: University of Massachusetts; 1985.
- Virtanen M, Jokela M, Madsen IE, et al. Long working hours and depressive symptoms: systematic review and meta-analysis of published studies and unpublished individual participant data. *Scand J Work Environ Health*. 2018;44:239–250.
- Lorant V, Delière D, Eaton W, Robert A, Philpott P, Anseau M. Socioeconomic inequalities in depression: a meta-analysis. *Ame J Epidemiol*. 2003;157:98–112.
- National Institute for Occupational Safety and Health. National occupational research agenda. Cincinnati, OH: US Department of Health and Human Services; 1996 (NIOSH publication no. 96-115).
- Rockhill B, Newman B, Weinberg C. Use and misuse of population attributable fractions. *Am J Public Health*. 1998;88:15–19.
- Rickwood D, Deane F, Wilson C, Ciarrochi J. Young people's help-seeking for mental health problems. *AeJAMH*. 2005;4:218–251.
- Tsutsumi A. Development of an evidence-based guideline for supervisor training in promoting mental health: literature review. *J Occup Health*. 2011;53:1–9.
- Summary of Census Results of 2016 Economic Census for Business Activity. Tokyo, Japan: Ministry of Internal Affairs and Communications, Ministry of Economy, Trade and Industry; 2018. Available at: https://www.stat.go.jp/english/data/e-census/2016/pdf/k_gaiyoe.pdf. Accessed February 25, 2022.

Low Adaptation to Management Philosophy and Refraining From Seeking Medical Care in Japanese Employees

A 1-Year Prospective Study

Akiomi Inoue, PhD, Hisashi Eguchi, MD, Yuko Kachi, PhD, and Akizumi Tsutsumi, MD

Objective: We examined the prospective association of low adaptation to management philosophy with refraining from seeking medical care (RSMC) among Japanese employees in a company with a management philosophy of “pursuing employees’ well-being.” **Methods:** We surveyed 2791 employees (2059 men and 732 women) from 2 factories of a Japanese manufacturing company following the management philosophy of “pursuing employees’ well-being.” Using a self-administered questionnaire, we measured adaptation to management philosophy at baseline and RSMC at a 1-year follow-up. We conducted robust Poisson regression analysis. **Results:** Low adaptation to management philosophy was significantly associated with RSMC (incidence rate ratio, 1.17; 95% confidence interval, 1.03–1.35). **Conclusions:** Adaptation to management philosophy may be an important factor associated with the decision of employees working at a company following the “pursuing employees’ well-being” management philosophy to seek medical care for their perceived health issues.

Keywords: access to medical care, corporate values, Japan, longitudinal studies, mission statement

Access to medical care is a fundamental human right granted to all people and an important determinant of health.¹ It has been reported that delayed access to medical care, often caused by refraining from seeking medical care (RSMC: reluctance to seek or avoidance of medical care),² has various adverse effects, such as reduced quality of life, prolonged hospitalization, and increased mortality.^{3–6} Studies on RSMC have been conducted mainly with community residents, but in recent years, these studies have been expanded to include employees. Previous studies on RSMC or access to medical care among employees have reported that psychosocial factors at work (eg, low job control, organizational justice, and workplace social capital)^{7–9} and occupational

CME Learning Objectives

After completing this enduring educational activity, the learner will be better able to:

- Discuss the association between low adaptation to management philosophy and refraining from seeking medical care among Japanese employees
- Discuss the importance of a management philosophy that focuses not only on revenue but also employee wellness
- Explain how a positive management philosophy can direct employee behavior and adherence

characteristics (eg, small company size, self-employment, and blue-collar employment)¹⁰ are key predictors of employees’ RSMC.

In such a situation, individual adaptation to management philosophy (ie, employees’ understanding and empathizing with the content of the management philosophy and including it in their actions)¹¹ of the company to which employees belong has recently been considered a predictor of each employee’s attitudinal and behavioral outcomes.¹² Takao and Wang¹¹ have described adaptation to management philosophy as the process of fusion of corporate identity officially asserted by management philosophy and individual identity, and the state of individual adaptation to management philosophy as “a state in which the individual not only recognizes management philosophy as the core of corporate identity, but also deeply incorporates it into their own identity, and the philosophy has become the core of both corporate and individual identities.” To date, Wang¹³ reported that adaptation to management philosophy affected high job involvement and organizational citizenship behavior among employees. However, that study focused on employees in a company with a management philosophy of “striving to contribute to the creation of a future where the aspirations of the people can be fulfilled.” The application of these findings to employees in companies with other management philosophies, and to other attitudinal or behavioral outcomes, such as access to medical care, is limited.

The present study focused particularly on a management philosophy of “pursuing employees’ well-being.” This is because, due to the growing interest in health and productivity management in recent years, an increasing number of companies have adopted the “pursuing well-being” or “maintenance and promotion of health” of employees as their management philosophy,¹⁴ and access to medical care at the time of ill-health is directly related to the right to health based on the right to the pursuit of well-being.

Scott¹⁵ and Hatvany and Pucik¹⁶ have argued that management philosophy provides direction for employees, sets constraints on their behavior, and enhances their motivation through the presentation of a clear picture of the organizational goals, norms, and values. As an example, Wang¹³ has noted that a management philosophy that emphasizes “ethics” may change the thoughts of employees from pure profit seeking to a concern for business ethics issues, making them a more socially

From the Institutional Research Center, University of Occupational and Environmental Health, Japan, Kitakyushu, Fukuoka, Japan (Dr Inoue), Department of Mental Health, Institute of Industrial Ecological Sciences, University of Occupational and Environmental Health, Japan, Kitakyushu, Fukuoka, Japan (Dr Eguchi), Department of Public Health, Kitasato University School of Medicine, Sagami-hara, Kanagawa, Japan (Dr Kachi, Dr Tsutsumi).

Funding sources: The present study was supported by Ministry of Education, Culture, Sports, Science and Technology (MEXT KAKENHI: grant number JP21119002), Japan Society for the Promotion of Science (JSPS KAKENHI: grant numbers JP26253042, JP17K09172, and JP20K10477), and Ministry of Health, Labour and Welfare (Industrial Disease Clinical Research Grants: grant numbers 200201-01 and 200401-01).

Ethical Considerations and Disclosures: Research Ethics Committee, Graduate School of Medicine and Faculty of Medicine, The University of Tokyo (no. 2772-(6)), Kitasato University Medical Ethics Organization (no. B12-103), and Ethics Committee of Medical Research, University of Occupational and Environmental Health, Japan (no. 10-004) reviewed and approved the aims and procedures of the present study.

Inoue, Eguchi, Kachi, and Tsutsumi have no relationships/conditions/circumstances that present potential conflict of interest.

The JOEM editorial board and planners have no financial interest related to this research.

Address correspondence to: Akiomi Inoue, PhD, Institutional Research Center, University of Occupational and Environmental Health, Japan, 1-1 Iseigaoka, Yahatanishi-ku, Kitakyushu, Fukuoka 807-8555, Japan (akiomi@med.uoeh-u.ac.jp).

Copyright © 2022 American College of Occupational and Environmental Medicine
DOI: 10.1097/JOM.0000000000000261

motivated person, and that such social motivation may also change the way of individual involvement with job, other persons, and the organization. On a similar principle, a management philosophy that emphasizes “employees’ well-being” may change the thoughts of employees from pure profit seeking to an interest in management issues that focus on employee health, making them more concerned about their own health. In addition, employees who adapt to such a philosophy may view the “pursuing well-being” as a core part of their own identity as well as that of the company, and thus see the maintenance and promotion of their own health as beneficial and essential for both the company and themselves, and may not hesitate to take action to seek medical care when they feel unwell.

Therefore, while a company’s management philosophy of “pursuing employees’ well-being” may play an important role in promoting employees’ action to seek medical care when they feel unwell, simply adopting such a philosophy may not be enough. Employees are more likely to exercise their right to health and seek medical care only when they adapt to the philosophy. A recent study of employees in a company with the management philosophy of “pursuing employees’ well-being” reported that adaptation to management philosophy predicted high work engagement,¹⁷ but the association with RSMC has not been reported.

The purpose of the present study is to examine the association of low adaptation to management philosophy with RSMC among Japanese employees in a company with a management philosophy of “pursuing employees’ well-being” using a 1-year prospective design. It was hypothesized that those who perceived lower adaptation to management philosophy at baseline would be more likely to refrain from seeking medical care during the 1-year follow-up.

METHODS

Study Design

We used data from a Japanese Study of Health, Occupation, and Psychosocial Factors Related Equity (J-HOPE). The J-HOPE is a large-scale Japanese occupational cohort study conducted over a period of 7 years and has so far reported approximately 50 findings on health among employees due to psychosocial factors at work. However, the data cleaning process is time consuming because of the large number of people surveyed and data obtained for the entire project; therefore, although the findings of the studies have been published sequentially, there has been a time lag between data acquisition and analysis in some studies. The J-HOPE was conducted in 13 companies, but only one company measured adaptation to management philosophy; therefore, we used data from that company in the present study. At that company, we obtained baseline data from April to June 2011 and 1-year follow-up data from April to June 2012.

Participants

We surveyed employees at 2 factories of a Japanese manufacturing company following the management philosophy of “pursuing employees’ well-being.” The surveyed company was founded in the 1950s. At the time, its management philosophy was “making its technology available to the world,” with no mention of “pursuing employees’ well-being.” However, in response to employee complaints about overtime work and concerns about the future, the company adopted “pursuing employees’ well-being” as its management philosophy in the 1960s. This philosophy has been introduced and explained to employees through management’s greeting on the foundation day or through the company newsletter. An invitation to the survey was sent to all employees ($N = 3630$) in February 2011. Because they were covered by the same corporate health insurance and the 2 factories were near each other, they had almost equal access to medical care. All variables used in the present study were measured using a self-administered questionnaire, except for em-

ployment status, which was obtained from the personnel records of the company surveyed. In the baseline survey, 3461 employees responded to the self-administered questionnaire (response rate, 95.3%). During the 1-year follow-up period, 336 employees transferred to other sites, took leave (ie, sick leave, maternity leave, or parental leave), resigned, or declined to participate. Overall, 3125 employees participated in the 1-year follow-up survey and responded to the follow-up questionnaire (follow-up rate, 90.3%). After excluding 334 employees who were missing at least one response on a variable relevant to the present study, we analyzed data from 2791 employees (2059 men, 732 women; Fig. 1). The analysis used the J-HOPE first wave and second wave data sets as of June 1, 2021. The study purposes and procedures were explained to the employees, and written informed consent was obtained from them before study initiation. Research ethics committee, Graduate School of Medicine and Faculty of Medicine, The University of Tokyo (no. 2772-6); Kitasato University Medical Ethics Organization (no. B12-103); and Ethics Committee of Medical Research, University of Occupational and Environmental Health, Japan (no. 10-004) reviewed and approved the aims and procedures of the present study.

Measures

Exposure: Adaptation to Management Philosophy (Baseline Survey)

Adaptation to management philosophy at baseline was measured using a 3-item scale derived from a scale developed by Wang.^{13,18} The original scale to measure adaptation to management philosophy comprises 11 items with the following 3 subscales: cognitive understanding of the content of the management philosophy (3 items: hereafter referred to as “cognitive understanding”), behavioral involvement reflecting the management philosophy (5 items: hereafter referred to as “behavioral involvement”), and emotional empathy with the management philosophy (3 items: hereafter referred to as “emotional empathy”).¹¹ When administering the survey in the workplace, it was necessary to narrow down the items to reduce the burden on the participants; therefore, one item from each subscale was selected, as follows: item #1 “I understand my company’s management philosophy” (cognitive understanding), item #2 “My company’s management philosophy has a strong effect on my attitudes towards my work” (behavioral involvement), and item #3 “My company’s management philosophy fits my sense of values” (emotional empathy).¹⁷ All items were measured on a 5-point Likert-type scale (1 = disagree, 2 = moderately disagree, 3 = neither agree nor disagree [NAND], 4 = moderately agree, and 5 = agree). The total score was calculated by summing the item scores (score range, 3–15). In the present sample, Cronbach α coefficient of the 3-item scale was 0.85. Participants were classified into tertiles (low, moderate, and high) based on the total score. In addition, participants were classified into 3 groups (disagree/moderately disagree [ie, those who answered 1 or 2], NAND [ie, those who answered 3], and agree/moderately agree [ie, those who answered 4 or 5]) for each item score.

Outcome: RSMC (1-Year Follow-up Survey)

The follow-up questionnaire included a single-item question measuring RSMC used in the Japanese General Social Survey conducted in 2008 (JGSS-2008).¹⁹ Participants were asked to respond, “In the past year, have you ever refrained from visiting a hospital, clinic, acupuncturist, or dentist despite your sickness (including a slight cold or cavity) or injury?” Those who answered “Yes, I have” were classified as those who refrained from seeking medical care.

Potential Confounders (Baseline Survey)

Based on a previous study,⁸ demographic characteristics, socioeconomic characteristics, and health-related behaviors were potential confounders. Demographic characteristics included sex, age (29 years or younger, 30–39 years, 40–49 years, 50–59 years, and 60 years or

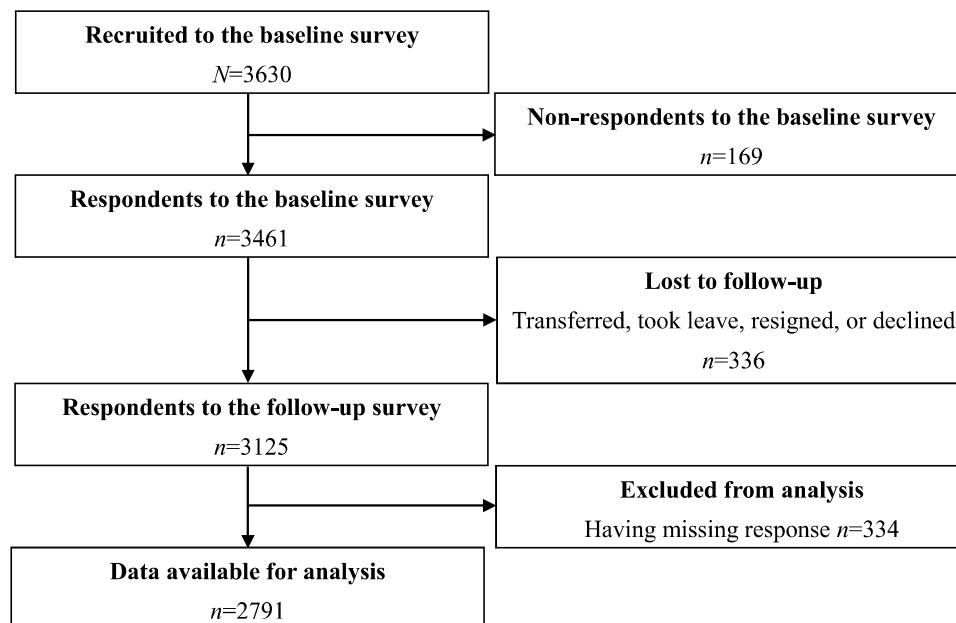


FIGURE 1. Recruitment and follow-up flow diagram.

older), medical history of stroke, myocardial infarction, hypertension, diabetes, hyperlipidemia, cancer, or mental disorders (any and none), household size (continuous variable), employee tenure (continuous variable), work shift (day shift, shift work with night duty, shift work without night duty, and night shift), and working hours per week (30 hours or less, 31–40 hours, 41–50 hours, 51–60 hours, and 61 hours or more). Socioeconomic characteristics included education (graduate school, college, junior college, and high school or junior high school), equivalent annual household income (continuous variable), occupational position (manager, nonmanual employee, manual employee, and other), and employment status (permanent employee and nonpermanent employee). Health-related behaviors included smoking habits (never smoker, ex-smoker, and current smoker), drinking habits (rarely, sometimes, and daily), and physical activity (none, light physical activity 1 or more times a week, intense physical activity once or twice a week, and intense physical activity thrice or more times a week).

Statistical Analysis

First, Student *t* test or Fisher exact test was performed to compare those who refrained from seeking medical care with those who did not refrain on potential confounders as well as on the total and each item scores for the adaptation to management philosophy scale. Second, using the high adaptation to management philosophy group as a reference, robust (or modified) Poisson regression analysis was performed to estimate the incidence rate ratios (IRRs) and their 95% confidence intervals (CIs) of RSMC for the moderate and low adaptation to management philosophy groups. In a series of analyses, we first adjusted for demographic characteristics (ie, sex, age, medical history, household size, employee tenure, work shift, and working hours per week; Model 1). Subsequently, we incrementally adjusted for socioeconomic characteristics (ie, education, equivalent annual household income, occupational position, and employment status; Model 2) and health-related behaviors (ie, smoking habits, drinking habits, and physical activity; Model 3). A linear trend test was also performed to examine the dose-response relationship between low adaptation to management philosophy and RSMC. Furthermore, as subanalysis, a similar analysis was performed by each item of the adaptation to management philosophy scale to examine which components of adaptation to management philosophy would be more greatly associated with

RSMC. In the subanalysis, the IRRs and their 95% CIs of RSMC for the NAND and disagree/moderately disagree groups were estimated, with the agree/moderately agree group as a reference. The linear trend test was also performed. The level of significance was 0.05 (2-tailed). The statistical analyses were performed using Stata/MP 17.0 for Windows (Stata Corp, College Station, TX).

RESULTS

Table 1 shows the detailed characteristics of the participants by those who did and did not refrain from seeking medical care. Those who refrained from seeking medical care were more likely to be male, be younger, have shorter employee tenure, work longer hours, have nonmanual or manual jobs, have permanent employment, and have no physical activity.

Table 2 shows the results of the main analysis. After adjusting for demographic characteristics (Model 1), the low adaptation to management philosophy group had a significantly higher IRR of RSMC compared with the high adaptation to management philosophy group (IRR, 1.18; 95% CI, 1.03–1.35). Furthermore, a significant dose-response relationship was observed between low adaptation to management philosophy and RSMC (*P* for linear trend = 0.012). These patterns remained unchanged after additionally adjusting for socioeconomic characteristics and health-related behaviors (Models 2 and 3).

Table 3 shows the results of the subanalysis. After adjusting for demographic characteristics (Model 1), the disagree/moderately disagree group had a significantly higher IRR of RSMC compared with the agree/moderately agree group for item #2 (behavioral involvement; IRR, 1.21; 95% CI, 1.03–1.41). Furthermore, a significant dose-response relationship was observed between disagreement with behavioral involvement and RSMC (*P* for linear trend = 0.002). On the other hand, this significant relationship was not observed for item #1 (cognitive understanding) or item #3 (emotional empathy). These patterns remained unchanged after additionally adjusting for socioeconomic characteristics and health-related behaviors (Models 2 and 3).

DISCUSSION

The present prospective study demonstrated a significant association of low adaptation to management philosophy with RSMC among employees in a company with the management philosophy of “pursuing employees’ well-being.” In the analysis by scale items, only

TABLE 1. Detailed Characteristics of Employees Who Participated in the Present Study (N = 2791)

	Refrained From Seeking Medical Care (n = 1265)		Did Not Refrain From Seeking Medical Care (n = 1526)		P*
	Mean (SD)	n (%)	Mean (SD)	n (%)	
Sex					0.014
Men		962 (76.0)		1097 (71.9)	
Women		303 (24.0)		429 (28.1)	
Age	37.7 (10.6)		40.1 (11.1)		<0.001
≤29 y		351 (27.7)		339 (22.2)	
30–39 y		366 (28.9)		371 (24.3)	
40–49 y		359 (28.4)		478 (31.3)	
50–59 y		171 (13.5)		291 (19.1)	
≥60 y		18 (1.4)		47 (3.1)	
Medical history†					0.928
Any		296 (23.4)		354 (23.2)	
None		969 (76.6)		1172 (76.8)	
Household size	3.17 (1.68)		3.17 (1.61)		0.987
Employee tenure, y	13.1 (10.4)		13.9 (10.7)		0.040
Work shift					0.249
Day shift		822 (65.0)		1046 (68.5)	
Shift work with night duty		329 (26.0)		361 (23.7)	
Shift work without night duty		68 (5.4)		70 (4.6)	
Night shift		46 (3.6)		49 (3.2)	
Working hours per week					0.001
≤30 h		227 (17.9)		365 (23.9)	
31–40 h		280 (22.1)		351 (23.0)	
41–50 h		473 (37.4)		501 (32.8)	
51–60 h		222 (17.5)		233 (15.3)	
≥61 h		63 (5.0)		76 (5.0)	
Education					0.503
Graduate school		114 (9.0)		122 (8.0)	
College		153 (12.1)		207 (13.6)	
Junior college		233 (18.4)		292 (19.1)	
High school or junior high school		765 (60.5)		905 (59.3)	
Equivalent annual household income, million JPY‡	3.64 (1.76)		3.69 (1.77)		0.501
Occupational position					0.005
Manager		108 (8.5)		142 (9.3)	
Nonmanual employee		369 (29.2)		403 (26.4)	
Manual employee		621 (49.1)		709 (46.5)	
Other		167 (13.2)		272 (17.8)	
Employment status					<0.001
Permanent employee		1089 (86.1)		1236 (81.0)	
Nonpermanent employee		176 (13.9)		290 (19.0)	
Smoking habits					0.097
Never smoker		701 (55.4)		907 (59.4)	
Ex-smoker		119 (9.4)		127 (8.3)	
Current smoker		445 (35.2)		492 (32.2)	
Drinking habits					0.102
Rarely		580 (45.8)		748 (49.0)	
Sometimes		418 (33.0)		448 (29.4)	
Daily		267 (21.1)		330 (21.6)	
Physical activity (PA)					<0.001
None		939 (74.2)		1020 (66.8)	
Light PA one or more times a week		190 (15.0)		330 (21.6)	
Intense PA once or twice a week		115 (9.1)		147 (9.6)	
Intense PA thrice or more times a week		21 (1.7)		29 (1.9)	
Scale Scores (Range)	Mean (SD)	Cronbach α	Mean (SD)	Cronbach α	P
Adaptation to management philosophy (3–15)	11.0 (2.05)	0.85	11.2 (2.04)	0.86	0.010
Item #1 (cognitive understanding, 1–5)	3.73 (0.74)	—	3.76 (0.71)	—	0.263
Item #2 (behavioral involvement, 1–5)	3.65 (0.80)	—	3.76 (0.78)	—	<0.001
Item #3 (emotional empathy, 1–5)	3.58 (0.81)	—	3.65 (0.81)	—	0.030

*Student *t* test and Fisher exact test were used for continuous and categorical variables, respectively.

†Defined as having a medical history of stroke, myocardial infarction, hypertension, diabetes, hyperlipidemia, cancer, or mental disorders.

‡If the JPY is converted into US dollar using the monthly exchange rate as of April 2011 (ie, 83 JPY per US dollar), the mean equivalent annual household incomes would be US \$43,855 and US \$44,458 for those who did and did not refrain from seeking medical care, respectively.

TABLE 2. Association Between Adaptation to Management Philosophy and RSMC Among Japanese Employees (N = 2791): The Results of Robust Poisson Regression Analysis

	n	No. Cases (%)	IRR (95% CI)		
			Model 1*	Model 2†	Model 3‡
Adaptation to management philosophy					
High (13–15)	452	186 (41.2)	1.00	1.00	1.00
Moderate (11–12)	1394	625 (44.8)	1.10 (0.97–1.24)	1.09 (0.96–1.24)	1.09 (0.96–1.23)
Low (3–10)	945	454 (48.0)	1.18 (1.03–1.35)	1.18 (1.03–1.36)	1.17 (1.03–1.35)
P for linear trend			0.012	0.012	0.015

CI, confidence interval; IRR, incidence rate ratio.

*Adjusted for sex, age, medical history, household size, employee tenure, work shift, and working hours per week.

†Additionally adjusted for education, equivalent annual household income, occupational position, and employment status.

‡Additionally adjusted for smoking habits, drinking habits, and physical activity.

disagreement with behavioral involvement was significantly associated with RSMC, while cognitive understanding and emotional empathy were not.

The main analysis supported our hypothesis that the lack of adaptation to management philosophy was significantly associated with a higher risk of RSMC. Our finding is reasonable, considering that in a previous study of employees in a company with the management philosophy of “pursuing employees’ well-being,” the lack of adaptation to management philosophy predicted a subsequent reduction in work engagement¹⁷ and that in other studies, quality of life (which was reported to be reduced by delayed access to medical care)⁶ was associated with or predicted work engagement.^{20,21} Given the previous finding that adaptation to management philosophy affected job involvement, as introduced earlier,¹³ those who are less adapted to management philosophy may be more likely to have low job involvement and less willing to contribute to the company while maintaining their own health. Our finding suggests that even if a company adopts the management philosophy of “pursuing employees’ well-being,” if employees do not adapt to that philosophy, they are less likely to exercise their right to health when they feel unwell and more likely to refrain from seeking medical care.

In the subanalysis, only disagreement with behavioral involvement was significantly associated with a higher risk of RSMC, while

cognitive understanding and emotional empathy were not. This finding is also reasonable considering that Takao and Wang¹¹ have argued that behavioral involvement is particularly important when adapting to a management philosophy and is the deepest state of adaptation. Wang¹³ has also reported that philosophy-oriented organizational practice promotes the adaptation to management philosophy among employees and leads to attitudinal and behavioral outcomes, such as job involvement and organizational citizenship behavior. Our finding suggests that even if employees understand and empathize with the management philosophy of “pursuing employees’ well-being,” this does not necessarily translate into the behavior of seeking medical care when they feel unwell. To encourage such behavior, the company needs to carry out practical activities based on such philosophy and to reach a level where it can be reflected in the actions and decisions of employees.

In the present study, those who refrained from seeking medical care were more likely to be male, be younger, have shorter employee tenure, work longer hours, have nonmanual or manual jobs, and have permanent employment. In the surveyed company, most of the men (98.9%; not shown in Table 1) had permanent employment. Because permanent employees have more responsibility in the company, it is possible that they tend to work longer hours²² and find it difficult to take time off from work to seek medical care even when they feel unwell.⁷ In addition, younger employees, employees with short tenure, and

TABLE 3. Association Between Each Item of Adaptation to Management Philosophy and RSMC Among Japanese Employees (N = 2791): The Results of Robust Poisson Regression Analysis

	n	No. Cases (%)	IRR (95% CI)		
			Model 1*	Model 2†	Model 3‡
Item #1 (cognitive understanding)					
Agree/moderately agree (4–5)	1946	868 (44.6)	1.00	1.00	1.00
NAND (3)	724	340 (47.0)	1.05 (0.95–1.15)	1.04 (0.95–1.15)	1.04 (0.95–1.15)
Disagree/moderately disagree (1–2)	121	57 (47.1)	1.02 (0.84–1.25)	1.01 (0.83–1.24)	0.99 (0.82–1.21)
P for linear trend			0.450	0.491	0.587
Item #2 (behavioral involvement)					
Agree/moderately agree (4–5)	1834	798 (43.5)	1.00	1.00	1.00
NAND (3)	794	380 (47.9)	1.13 (1.03–1.23)	1.13 (1.03–1.24)	1.12 (1.02–1.23)
Disagree/moderately disagree (1–2)	163	87 (53.4)	1.21 (1.03–1.41)	1.20 (1.02–1.40)	1.18 (1.01–1.38)
P for linear trend			0.002	0.003	0.005
Item #3 (emotional empathy)					
Agree/moderately agree (4–5)	1656	735 (44.4)	1.00	1.00	1.00
NAND (3)	940	431 (45.9)	1.04 (0.95–1.14)	1.05 (0.96–1.14)	1.05 (0.95–1.14)
Disagree/moderately disagree (1–2)	195	99 (50.8)	1.13 (0.97–1.31)	1.12 (0.97–1.30)	1.13 (0.97–1.30)
P for linear trend			0.108	0.118	0.110

CI, confidence interval; IRR, incidence rate ratio; NAND, neither agree nor disagree.

*Adjusted for sex, age, medical history, household size, employee tenure, work shift, and working hours per week.

†Additionally adjusted for education, equivalent annual household income, occupational position, and employment status.

‡Additionally adjusted for smoking habits, drinking habits, and physical activity.

nonmanagerial employees may have less control over their work^{23,24} and be more likely to report to work without seeking medical care if they are feeling a little sick.⁷ Another interesting finding is that those who had no physical activity were more likely to refrain from seeking medical care. It is possible that those who have a habit of physical activity are more likely to view seeking medical care when feeling unwell as part of their health behavior. Although the present study adjusted for these variables as covariates, thus removing their influence on the association of low adaptation to management philosophy with RSMC, information on the attributes of those who are more likely to refrain from seeking medical care may be useful in understanding which employees should be encouraged to seek medical care as a priority when they feel unwell.

The present study has some limitations. First, some employees dropped out at follow-up because of sick leave. These employees may have been less adapted to management philosophy at baseline and may have refrained from seeking medical care until their illness became more severe, which may have underestimated the true associations. Second, because we wanted to diminish the burden on employees, the scale we used to measure the adaptation to management philosophy was a simple 3-item scale with 1 item extracted from each of the three subscales that comprise the 11-item scale; therefore, future studies should replicate the present findings using the full 11-item scale. Furthermore, RSMC was measured by simply asking the participants to recall their experience over the past year. Those who evaluated their adaptation to management philosophy as low may have been more likely to recall their experience of RSMC during the follow-up period, which may have overestimated the true association because of recall bias. Third, the present study did not obtain information about regular hospital visits because of chronic disease. Because those who visit the hospital regularly are less likely to refrain from seeking medical care regardless of their adaptation to management philosophy, our findings may have underestimated the true associations. Fourth, as noted previously, the present study used data obtained approximately 10 years ago for its analysis; therefore, our results may not fully reflect the current situation. Considering the increased interest in well-being management as well as health and productivity management over the past decade, more recent data may show a greater association of low adaptation to management philosophy with RSMC. Finally, our study sample comprised Japanese employees in one specific large-sized manufacturing company following the management philosophy of “pursuing employees’ well-being.” Therefore, the application of the present findings to employees in other industries or small- and medium-sized companies following the “pursuing employees’ well-being” or similar management philosophy is limited.

In conclusion, the present study provides evidence that adaptation to management philosophy is an important factor associated with the decision of employees working at a company following the “pursuing employees’ well-being” management philosophy to seek medical care for their perceived health issues. In particular, our findings suggest that it is essential for a company to reach a level where such a philosophy can be reflected in employees’ actions and decisions to encourage them to seek medical care when they feel unwell.

ACKNOWLEDGMENTS

The authors thank Dr Gabriela Dye from ServiceScape (<https://www.servicescape.com>) for editing a draft of this manuscript.

REFERENCES

1. Mizuochi M. Social capital and refraining from medical care among elderly people in Japan. *BMC Health Serv Res*. 2016;16:331.
2. Taber JM, Leyva B, Persoskie A. Why do people avoid medical care? A qualitative study using national data. *J Gen Intern Med*. 2015;30:290–297.
3. Weissman JS, Stern R, Fielding SL, Epstein AM. Delayed access to health care: risk factors, reasons, and consequences. *Ann Intern Med*. 1991;114:325–331.
4. Prentice JC, Pizer SD. Delayed access to health care and mortality. *Health Serv Res*. 2007;42:644–662.
5. Rutherford ME, Dockerty JD, Jasseh M, et al. Access to health care and mortality of children under 5 years of age in the Gambia: a case-control study. *Bull World Health Organ*. 2009;87:216–224.
6. Chen J, Rizzo JA, Rodriguez HP. The health effects of cost-related treatment delays. *Am J Med Qual*. 2011;26:261–271.
7. Tsuda K, Tsutsumi A, Kawakami N. Work-related factors associated with visiting a doctor for a medical diagnosis after a worksite screening for diabetes mellitus in Japanese male employees. *J Occup Health*. 2004;46:374–381.
8. Inoue A, Tsutsumi A, Eguchi H, Kawakami N. Organizational justice and refraining from seeking medical care among Japanese employees: a 1-year prospective cohort study. *BMJ Open*. 2019;26:76–84.
9. Inoue A, Tsutsumi A, Eguchi H, et al. Workplace social capital and refraining from seeking medical care in Japanese employees: a 1-year prospective cohort study. *BMJ Open*. 2020;10:e036910.
10. Pei L, Toyokawa S, Kobayashi Y. Labor factor barriers to seeking medical services among metropolitan workers: a cross-sectional analysis by sex using the J-SHINE study. *J Occup Health*. 2017;59:418–427.
11. Takao Y, Wang Y. *Management Philosophy and Individuals: Unpacking the Dynamics of Identity Processes [in Japanese]*. Tokyo, Japan: Yuhikaku; 2012.
12. Watanabe K, Inoue A, Eguchi H, Iwata N, Odagiri Y, Tsutsumi A. Suggestions for new organizational-level item pools for the national stress check program from management philosophy and mission statement: a qualitative study using unsupervised learning. *J Occup Health*. 2022;64:e12335.
13. Wang Y. Mission-driven organizations in Japan: management philosophy and individual outcomes. *J Bus Ethics*. 2011;101:111–126.
14. Cullen MDM, Calitz AP. Happiness—a business strategy. In: Merwe SP van der, Jordaan JA, eds. *International Business Conference Proceedings*. Mauritius: North-West University; 2018:1272–1282.
15. Scott WE. Activation theory and task design. *Organ Behav Hum Perform*. 1966;1:3–10.
16. Hatvany N, Pucik V. An integrated management system: lessons from the Japanese experience. *Acad Manage Rev*. 1981;6:469–480.
17. Eguchi H, Inoue A, Kachi Y, Tsutsumi A. Association between adaptation of management philosophy and mission statement, and work engagement among Japanese workers: a 1-year prospective cohort study in a Japanese company. *J Occup Environ Med*. 2021;63:e601–e604.
18. Wang Y. Examination on philosophy-based management of contemporary Japanese corporations: philosophy, value orientation and performance. *J Bus Ethics*. 2009;85:1–12.
19. Hanibuchi T. Inequalities in health and health care access: analysis of access to medical care using JGSS-2008 [in Japanese]. *JGSS Res Ser*. 2010;7:99–110.
20. Kanten S, Sadullah O. An empirical research on relationship quality of work life and work engagement. *Procedia Soc Behav Sci*. 2012;62:360–366.
21. Alqarni SAY. Quality of work life as a predictor of work engagement among the teaching faculty at King Abdulaziz University. *Int J Humanit Soc Sci*. 2016;6:118–135.
22. Ono H. Why do the Japanese work long hours? Sociological perspectives on long working hours in Japan. *Jpn Labor Issues*. 2018;2:35–49.
23. Kawakami N, Kobayashi F, Araki S, Haratani Y, Furui H. Assessment of job stress dimensions based on the job demands-control model of employees of telecommunication and electric power companies in Japan: reliability and validity of the Japanese version of the Job Content Questionnaire. *Int J Behav Med*. 1995;2:358–375.
24. Kawakami N, Fujigaki Y. Reliability and validity of the Japanese version of Job Content Questionnaire: replication and extension in computer company employees. *Ind Health*. 1996;34:295–306.



Article

Usage of the Brief Job Stress Questionnaire: A Systematic Review of a Comprehensive Job Stress Questionnaire in Japan from 2003 to 2021

Kazuhiro Watanabe ¹, Kotaro Imamura ², Hisashi Eguchi ³, Yui Hidaka ⁴, Yu Komase ⁴, Asuka Sakuraya ², Akiomi Inoue ⁵, Yuka Kobayashi ⁶, Natsu Sasaki ⁴, Kanami Tsuno ⁷, Emiko Ando ⁸, Hideaki Arima ⁴, Hiroki Asaoka ⁹, Ayako Hino ³, Mako Iida ⁹, Mai Iwanaga ¹⁰, Reiko Inoue ¹, Yasumasa Otsuka ¹¹, Akihito Shimazu ¹², Norito Kawakami ² and Akizumi Tsutsumi ^{1,*}

- ¹ Department of Public Health, Kitasato University School of Medicine, 1-15-1 Kitazato, Minami-ku, Sagami-hara 252-0374, Japan
- ² Department of Digital Mental Health, Graduate School of Medicine, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan
- ³ Department of Mental Health, Institute of Industrial Ecological Sciences, University of Occupational and Environmental Health, 1-1 Iseigaoka, Yahatanishi-ku, Kitakyushu 807-8555, Japan
- ⁴ Department of Mental Health, Graduate School of Medicine, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan
- ⁵ Institutional Research Center, University of Occupational and Environmental Health, 1-1 Iseigaoka, Yahatanishi-ku, Kitakyushu 807-8555, Japan
- ⁶ Faculty of Social Policy & Administration, Hosei University, 4342 Aiharamachi, Machida, Tokyo 194-0298, Japan
- ⁷ School of Health Innovation, Kanagawa University of Human Services, 3-25-10 Tonomachi, Kawasaki-ku, Kawasaki 210-0821, Japan
- ⁸ Institute for Cancer Control, National Cancer Center, 5-1-1 Tsukiji, Chuo-ku, Tokyo 104-0045, Japan
- ⁹ Department of Psychiatric Nursing, Graduate School of Medicine, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan
- ¹⁰ Department of Community Mental Health & Law, National Center of Neurology and Psychiatry, National Institute of Mental Health, 4-1-1 Ogawahigashi, Kodaira, Tokyo 187-0031, Japan
- ¹¹ Faculty of Human Sciences, University of Tsukuba, 3-29-1 Otsuka, Bunkyo-ku, Tokyo 112-0012, Japan
- ¹² Faculty of Policy Management, Keio University, 5322 Endo, Fujisawa 252-0882, Japan
- * Correspondence: akizumi@kitasato-u.ac.jp; Tel.: +81-42-778-9352



Citation: Watanabe, K.; Imamura, K.; Eguchi, H.; Hidaka, Y.; Komase, Y.; Sakuraya, A.; Inoue, A.; Kobayashi, Y.; Sasaki, N.; Tsuno, K.; et al. Usage of the Brief Job Stress Questionnaire:

A Systematic Review of a Comprehensive Job Stress Questionnaire in Japan from 2003 to 2021. *Int. J. Environ. Res. Public Health* **2023**, *20*, 1814. <https://doi.org/10.3390/ijerph20031814>

Academic Editor: Alicja Bortkiewicz

Received: 23 December 2022

Revised: 13 January 2023

Accepted: 16 January 2023

Published: 18 January 2023



Copyright: © 2023 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

Abstract: The Brief Job Stress Questionnaire (BJSQ) is used widely in occupational health studies and practice. Summarizing scientific production based on measurement is crucial. This study aimed to systematically review observational studies that used the BJSQ and the New BJSQ to show their usability. A systematic search was conducted for studies investigating relationships between the BJSQ or the New BJSQ subscales and other validated measurements on 13 September 2021, in various literature databases. The BJSQ subscales, scoring methods, and other validated measurements in the studies were qualitatively summarized. In total, 145 published reports between 2003 and 2021 were included. Among the BJSQ subscales, job stressors ($n = 95$) such as quantitative job overload ($n = 65$) and job control ($n = 64$) were most often used. The subscales were utilized to investigate the relationships with several other measurements. Five reports used subscales from the New BJSQ. In the last two decades, the BJSQ and the New BJSQ help measure psychosocial factors (PF) at work and contribute to the publication of scientific papers in the occupational health field. This study would encourage the utilization of the questionnaires for future research and practice.

Keywords: questionnaire; psychometric; workplace; job demands; job control; social support

1. Introduction

1.1. Background and Previous Work

Conducting multidimensional identification, assessment, and control of psychosocial factors (PF) at work is important in psychosocial risk management for occupational safety and health. Exposure to psychosocial stressors at work leads to physical and mental health problems among workers. Scientific evidence has indicated that high job demands, low job control, low social support, effort–reward imbalance, and high job insecurity elevate the risk of coronary heart disease and mental disorders [1–3]. In practice, several countries and regions have guidance or standards, such as the Psychosocial Risk Management—European Framework (PRIMA-EF) [4], the United Kingdom (UK) Health and Safety Executive (HSE) management standards [5], the National Standard of Canada for Psychological Health and Safety [6], and standards by the International Organization for Standardization (ISO) [7], that emphasize the importance of assessing multidimensional risks related to PF at work.

Numerous questionnaires and scales are available to measure and identify multiple PF at work and used in both research and practice. For example, in UK HSE management standards [5], the indicator tool helps assess employee perceptions of six key stressor areas: demands, control, support, relationships, role, and organizational change. The Copenhagen Psychosocial Questionnaire (COPSOQ) [8–10] measures a broad range of PF, including stressors, health and well-being, and personality. The third version of COPSOQ covers eight domains and 26 dimensions using validated items [10]. The Generic Job Stress Questionnaire (GJSQ) from the United States of America National Institute for Occupational Safety and Health (USA NIOSH) also covers various job stressors, mental health, and personality [11]. The Korean Occupational Stress Scale (KOSS) was developed in Korea; it consists of eight subscales of job stressors: physical environment, job demand, insufficient job control, interpersonal conflict, job insecurity, organizational system, lack of reward, and occupational climate [12]. Multidimensional scales to measure PF at work in specific industries were also developed and reported such as for construction workers [13], teachers [14], nurses [15], and dentists [16].

1.2. Background in Japan

In Japan, the 57 items of the Brief Job Stress Questionnaire (BJSQ) was developed in 2000 [17] based on the GJSQ from the USA NIOSH [11], covering job stressors, stress responses, buffering factors (i.e., social support), and job satisfaction. Among job stressors, the BJSQ includes quantitative job overload (three items), qualitative job overload (three items), physical demands (one item), job control (three items), skill utilization (one item), interpersonal conflict (three items), poor physical environment (one item), suitable jobs (one item), and meaningfulness of work (one item). Stress responses include vigor (three items), anger-irritability (three items), fatigue (three items), anxiety (three items), depression (six items), and physical complaints (11 items). Buffering factors include support from supervisors (three items), coworkers (three items), and family and friends (three items). Job and life satisfaction are also measured by a single item for each. All items are rated on a four-point scale. The New BJSQ was developed in 2014, covering effort–reward imbalance, bullying, organizational factors, work–self balance, and positive outcomes [14]. Most subscales in the BJSQ and the New BJSQ showed acceptable levels of internal consistency, test–retest reliability, and structural validity [18].

In the last two decades, the BJSQ has been used widely for occupational health studies and practice and tests the associations with a broad range of outcomes, including biological markers. The New BJSQ has also been used in later studies. Recently, the Japanese government launched a new occupational health policy called the National Stress Check Program (NSCP); this policy mandates that workplaces with 50 or more employees conduct assessments of psychosocial stress in employees at least once a year [19]. This policy recommends the use of the BJSQ as a structured questionnaire for the assessment. Thereafter, the BJSQ has been used more frequently, and the publication of data measured by the BJSQ has increased rapidly.

1.3. Research Gaps and Objectives

However, no systematic review has reported on the usage of the BJSQ and the New BJSQ and the findings of studies that used these questionnaires. For the COPSOQ, systematic reviews for the usage of the measurements have already been reported [20,21], and the international scientific production was summarized. Moreover, a systematic review of the BJSQ and the New BJSQ is important to make a milestone of scientific production from these measurements. Additionally, the summary of published data measured using the BJSQ and the New BJSQ, including samples, subscales, and scoring methods, would be useful statistics for research and practice in occupational health in Japan. The correlates of the BJSQ and the New BJSQ would be useful for validating the questionnaires and accumulating scientific evidence of the association between PF at work and health. This study aimed to systematically review observational studies that used the BJSQ and the New BJSQ to show their usability. Published literature until 2021 was systematically reviewed using various databases. The BJSQ subscales, scoring methods, and other validated measurements were qualitatively summarized. This study significantly contributes to creating a new summary of the questionnaires and encouraging the utilization of the questionnaires in future research and practice in occupational health.

2. Materials and Methods

2.1. Study Design

This study was a systematic review of observational studies. The reporting in this study was conducted following the updated guideline for reporting systematic reviews (the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) 2020 statement) [22]. The study protocol was registered at the University Hospital Medical Information Network Clinical Trials Registry (UMIN-CTR, ID R000045091) in Japan.

2.2. Eligibility Criteria

For the systematic review, the authors included studies that (1) adopted observational study design; (2) sampled workers; (3) used at least one subscale of the BJSQ or the New BJSQ; (4) used other validated measurements and tested associations between the BJSQ or the New BJSQ subscales and other measurements; (5) were written in English or Japanese; and (6) were peer-reviewed. Studies were also included if they used the BJSQ and the New BJSQ subscales as non-primary variables and investigated the associations in preliminary analyses. Those studies that used other single-item measurements (e.g., smoking status), except for shift work, working hours, sleeping hours, subjective views of health, subjective well-being, and subjective satisfaction, were excluded.

2.3. Information Sources and Search Strategy

A systematic search of the literature on 13 September 2021 was conducted on databases such as MEDLINE (PubMed), EMBASE, PsycINFO/ARTICLES, and Japan Medical Abstract Society. For search terms, “brief job stress questionnaire” OR “BJSQ” was used, and no filter/limit was applied for any of the databases.

2.4. Study Selection and Data Collection Process

Identified records were managed in a Microsoft Excel (Washington, DC, USA) file. One investigator sorted the records by title and removed duplicates. Subsequently, each record was assigned to two reviewers from among 13 investigators. The investigators independently judged whether a record met the inclusion criteria of the systematic review. Records judged as not eligible by both of the two contributors were excluded, and other records were sought for retrieval of full texts. The full texts were judged by two independent reviewers, different from the initial screening, from 18 investigators. Reports assessed as eligible by both reviewers were included for review. When two investigators had inconsistent judgment at this full-text review stage, an agreement was reached through

discussions with the project directors. When a report was excluded at this stage, the primary reasons for exclusion were recorded.

One of the reviewers of each study collected data from that study. The data were then reviewed by KW. The collected data included the names of the first authors, study design (cross-sectional or longitudinal), samples, subscales of the BJSQ and the New BJSQ, scoring methods of the BJSQ and the New BJSQ, and other validated measurements.

2.5. Data Synthesis and Analysis

Since this study aimed to summarize the usage of the BJSQ and the New BJSQ, no statistical data synthesis was conducted. Assessments of risk of bias within individual studies, heterogeneity, reporting bias, and certainty of evidence were not required to be conducted either. The collected data in the text and tabulation were qualitatively summarized. In addition, the number of subscales of the BJSQ and the New BJSQ and other measurements used were counted and visually placed, classifying them into five categories according to the job stress model [11]: (1) job stressors or exposures that relate to work conditions which lead to stress responses; (2) health-related outcomes including physiological and psychological responses; (3) work-related outcomes such as job satisfaction, job performance, and burnout; (4) individual and behavioral factors that modify the associations between job stressors and outcomes; and (5) buffering and non-work factors such as social support.

3. Results

3.1. Study Selection

Figure 1 illustrates the selection process of this systematic review. A systematic search of databases resulted in 741 hits. After the initial screening and the full-text review by the independent reviewers, 145 reports published from 2003 to 2021 were included in this systematic review [23–167]. Of the included reports, 102 had digital object identifiers, and the main text of 52 reports was written in Japanese.

A total of 230 reports were excluded at the full-text review stage, although some of them might have met the inclusion criteria. For example, Eguchi et al. [168] investigated the association between psychological stress response measured by the BJSQ and workplace occupational mental health (OMH) and related activities. However, the items of OHM activities were derived from a paper by the Japanese government and were not psychometrically validated. Kawada and Otsuka [169] conducted a longitudinal study to examine changes in job stress and job satisfaction using the BJSQ. However, they only reported the associations among the subscales of the BJSQ, not with other validated measurements. Iguchi [170] examined the associations among job demands, job resources, and turnover intention among public health nurses using the BJSQ and the New BJSQ. However, this study conducted a factor analysis for the subscales and conceptualized new variables in the analysis. Some studies used the BJSQ overseas: China, India, and the USA [171–173]. These studies did not report the validity of the translated version of the BJSQ.

3.2. Study Characteristics

A summary of the included studies is shown in the Table A1. Most studies were conducted cross-sectionally ($n = 116$) [52–167], while the remaining were longitudinal studies ($n = 29$) [23–51]. The sample size ranged from 18 [83] to 69,805 [60]. In the included studies, recruitment of the participants was conducted from private companies ($n = 59$), hospitals ($n = 42$), nursing or welfare facilities ($n = 13$), healthcare centers ($n = 7$), web surveys ($n = 5$), public sectors ($n = 5$), existing cohorts ($n = 4$), fire defense stations/headquarters ($n = 4$), and a convenience sample of faculty staff members or alumni of universities ($n = 6$).

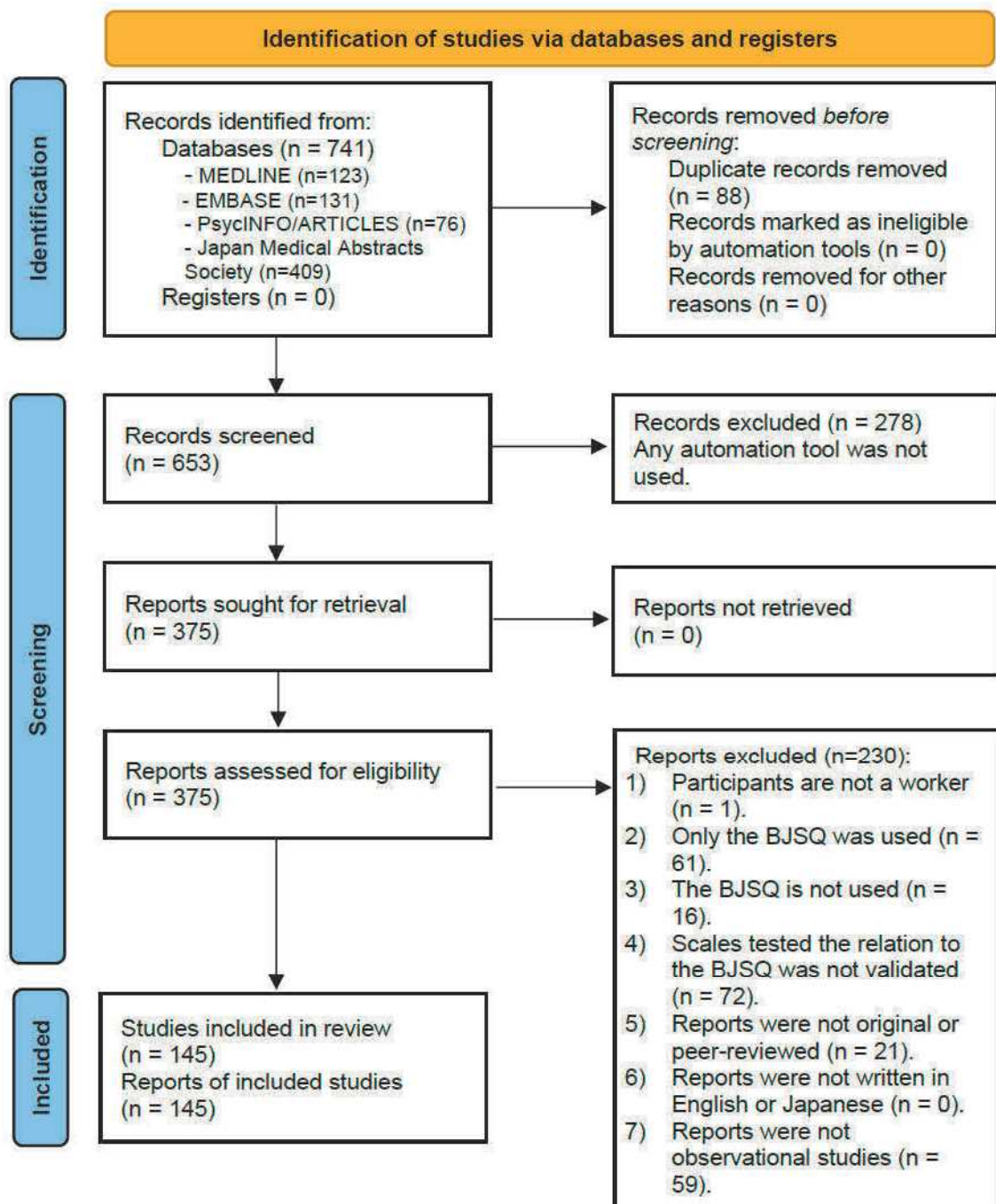


Figure 1. PRISMA 2020 flow diagram for new systematic reviews which included searches of databases and registers only.

3.3. Used Subscales and Other Measurements

Figure 2 shows the list of used subscales from the BJSQ, the New BJSQ, and other measurements in the included studies. Parenthesis in each subscale shows the number of times the measurements have been used.

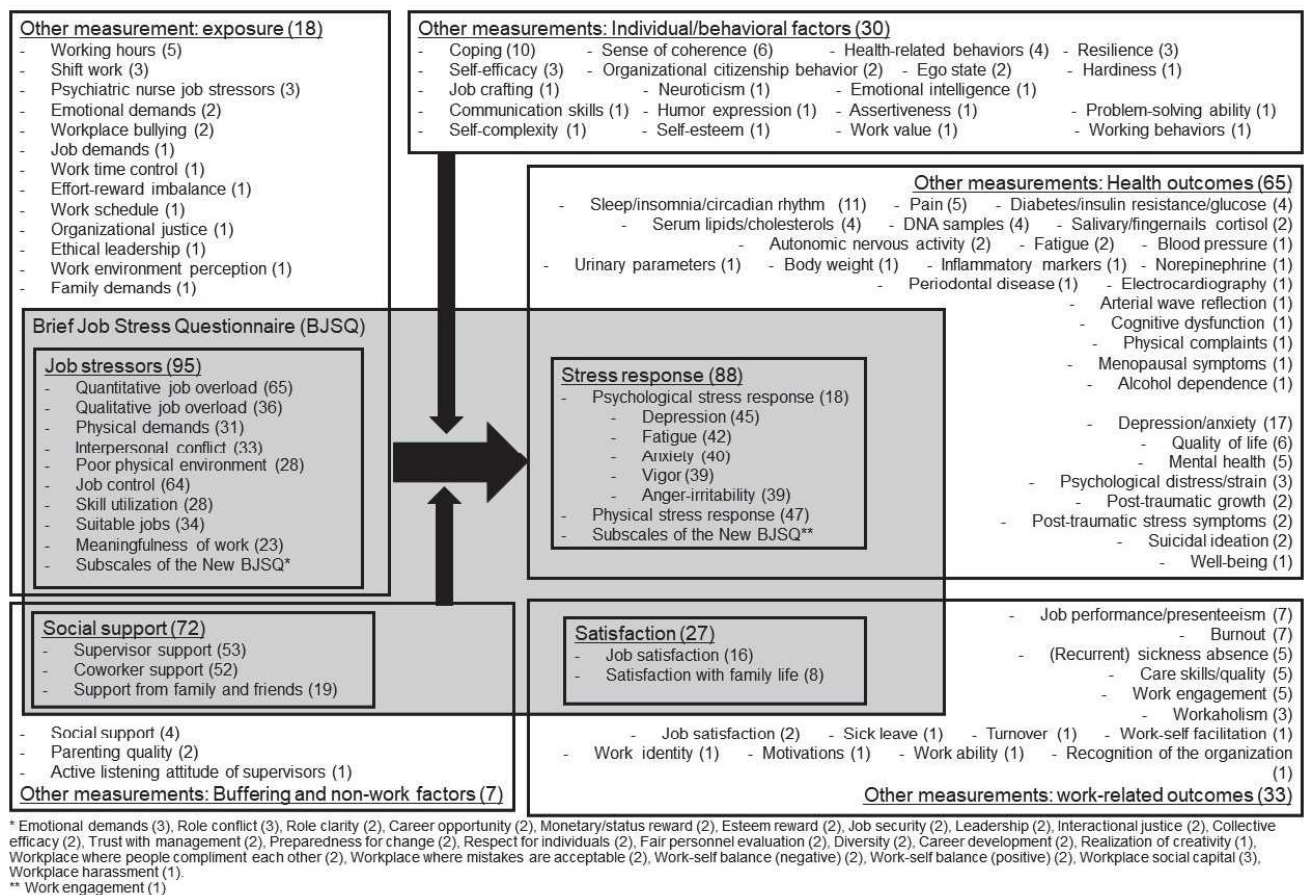


Figure 2. Used subscales from the BJSQ, the New BJSQ, and other measurements in the included studies. Note. Parenthesis in each subscale shows the number of times the measurements have been used.

For the subscales of the BJSQ, job stressors ($n = 95$), especially quantitative job overload ($n = 65$) and job control ($n = 64$), were most often used; stress responses ($n = 88$) and social support ($n = 72$) were frequently used as well. Most of the studies referred to the job stress model from the US NIOSH [11] or the job demands–control model by Karasek [174,175]. For example, Izawa et al. [95] used the subscales of quantitative job overload and job control from the BJSQ, calculated the job strain index by dividing quantitative job overload by job control, and investigated an association with cortisol levels in fingernails. Hidaka et al. [54] also adopted job strain through quantitative job overload and job control and social support from supervisors and coworkers of the BJSQ. They indicated those significant associations with health-related quality of life among Japanese workers. Stress responses were often used as the health outcomes explained by PF at work. A two-year follow-up study by Taniguchi et al. [37] investigated the association between workplace bullying and harassment and stress responses of the BJSQ among care workers at welfare facilities for the elderly. They reported multiple types of bullying and harassment were positively associated with psychological stress response at the follow-up. Shimazu and de Jonge [48] also used stress responses from the BJSQ as an outcome of the effort–reward imbalance and reported the reciprocal associations in a three-wave panel survey. Satisfaction ($n = 27$) was mainly utilized for examining associations with other health outcomes. Inoue et al. [28] investigated the prospective association between job satisfaction of the BJSQ and long-term sickness absence. They indicated that workers who perceived job dissatisfaction had a significantly higher risk of long-term sickness absence; however, after additionally adjust-

ing for the psychosocial work environment, this association was weakened and was no longer significant.

The subscales of the BJSQ were utilized for investigating the relationships among various kinds of other measurements: 13 job stressors and exposures, 28 health-related outcomes, 14 work-related outcomes, 19 individual and behavioral factors, and three buffering and non-work factors. For health outcomes, the most often used measurement was depression and anxiety ($n = 17$). For instance, Tsuboi et al. [51] investigated the association between job stressors and depressive symptoms measured by the center for epidemiologic studies with a depression scale. They compared and categorized female nurses into the most stressful group and the least stressful group and reported a significant difference in depressive symptoms between the two groups. Sakamoto et al. [75] investigated the structural differences among factors for psychological job stress among healthcare workers and reported that job stressors from the BJSQ were positively associated with depression and anxiety measured by the hospital anxiety depression scale. In addition, sleep/insomnia/circadian rhythm ($n = 11$) were frequently investigated for their association with job stressors. Toyoshima et al. [55] examined interrelationships among sleep reactivity, job-related stress, and subjective cognitive dysfunction and indicated that sleep reactivity significantly influenced subjective cognitive dysfunction directly and indirectly via job stressors and stress responses. Takahashi et al. [46] conducted a one-year longitudinal study to examine how a change in work time control was associated with sleep and health. They indicated that daytime sleepiness was positively associated with quantitative job overload and negatively associated with job control and social support from the BJSQ.

Physiological health outcomes were also tested using the subscales of the BJSQ, such as diabetes, insulin resistance, and blood glucose ($n = 4$), serum lipid and cholesterol ($n = 4$), salivary or fingernails cortisol ($n = 2$), and inflammatory markers ($n = 1$). For example, Sugito et al. [23] conducted a retrospective study with male workers to investigate the effects of job stressors on the onset of diabetes mellitus defined by HbA1c or using antidiabetic drugs. They indicated that low skill utilization from the BJSQ was associated with the risk of diabetes mellitus onset. Watanabe et al. [101] examined interrelationships between job resources, vigor, exercise habit, and serum lipids including triglyceride, high-density lipoprotein cholesterol, and low-density lipoprotein cholesterol. Multiple-group path analysis indicated that job resources and vigor from the BJSQ were inversely associated with triglyceride and low-density lipoprotein cholesterol and positively associated with high-density lipoprotein cholesterol through exercise habits in both sexes. Nakata et al. [121] investigated associations between job stressors and inflammatory markers including high-sensitive C-reactive protein, interleukin-6, tumor necrosis factor-alpha, monocyte, and leukocyte. The job strain index calculated by dividing quantitative job overload by job control was negatively associated with tumor necrosis factor-alpha.

For work-related outcomes, burnout ($n = 7$) and presenteeism ($n = 7$) were often investigated as those associations with PF at work. Saijo et al. [106] investigated the synergistic interaction of job demands, job control, and social support on mental health among local government employees. They indicated significant associations between these stressors from the BJSQ and burnout measured by the Japanese version of the Maslach Burnout Inventory-General Survey. Hayashida et al. [57] assessed the association between the irregularity of mealtimes and presenteeism measured by the Work Limitations Questionnaire. They indicated that the irregularity of mealtimes had a strong effect on presenteeism indirectly through psychological and physical stress responses from the BJSQ.

Coping ($n = 10$) and sense of coherence ($n = 6$) were frequently used as individual and behavioral factors. For instance, Shimazu et al. [49] examined the lagged effects of active coping on stress responses to explain the individual differences in the underlying mechanisms behind the association between job stressors and health outcomes. They measured active coping using the Brief Stress for Coping Scale and reported significant interactions of quantitative job overload, job control, and active coping on stress responses from the BJSQ. Urakawa et al. [45] examined the association between a sense of coherence

and psychological responses and reported that a sense of coherence was inversely associated with psychological and physical stress responses.

A total of five reports used subscales from the New BJSQ [30,36,81,94,111]. Morimoto et al. [30] investigated the adverse effects of role conflict on the psychological strain among employed family caregivers of people with dementia. They used the subscales of emotional demands and role conflict from the New BJSQ, in addition to the subscales from the BJSQ. They indicated that conflict between caregiving and work was positively associated with psychological strain and its association was moderated by formal support seeking and attentional control. Sakuraya et al. [36] used a three-item scale of workplace social capital and investigated its association with the onset of major depressive episodes through a three-year prospective cohort study. The study indicated that middle-level workplace social capital had the lowest risk of major depressive episodes. Inaba [81] and Inaba and Inoue [111] used multiple subscales from the short version of the New BJSQ and examined their associations with subjective well-being and burnout among female nurses. They indicated that burnout was significantly associated with role conflict, role clarity, and job security [111], and subjective well-being was significantly associated with career development [81]. Toyama and Mauno [94] used the three-item subscale of realization of creativity and reported a significant and positive association with emotional intelligence among eldercare nurses in special nursing homes.

3.4. Scoring Methods

Concerning scoring methods, most studies used continuous scores of the subscales ($n = 111$). Categorization using means, medians, tertiles, and quantiles was also adopted ($n = 12$). Standardized scores on a five-point scale ($n = 7$) were calculated based on the distribution of continuous scores in the representative sample [176]. For more practical and easier scoring, a simple scoring method was used ($n = 9$) [177]. In this method, the respondents were dichotomized into stressed or not stressed, by counting how many items of the BJSQ were scored as undesirable. The definition of “high-stress” employees according to the Japanese NSCP was also used ($n = 7$) [32]. This definition is conceptualized by the combination of high scores in stress response, high scores in job stressors, and low scores in social support. The predictive validity of the “high-stress” employees for long-term sickness absence at the one-year follow-up was confirmed in a previous study [32].

4. Discussion

4.1. Main Findings

In the last two decades, over 140 observational studies using the BJSQ and/or the New BJSQ have been published. Since 2015, when the NSCP was launched, large-scale data from more than 60,000 people have been published, as the assessment of psychosocial stress in employees became mandatory. Although not all reports were written in English, more than two-thirds were readable, at least with abstracts that were in English, and more than 100 articles were identifiable by digital object identifiers. Associations were established between a wide variety of factors, including job stressors, health-related outcomes, work-related outcomes, individual and behavioral factors, and buffering factors. The relationship with physical biomarkers was also examined. Although not all studies observed significant associations between factors, and not all study hypotheses were supported, the reported associations were generally reasonable and consistent with existing findings about job stress models. This means that the mechanism that exposure to job stressors evokes deterioration of health- and work-related outcomes and that some of these associations are modified by individual and behavioral factors. Therefore, the BJSQ and the New BJSQ are questionnaires that have made substantial contributions to the research and practice of occupational stress in Japan.

4.2. Theoretical Implications

The reasonable associations with validated measurements of health- and work-related outcomes were repeatedly observed in multiple subscales of the BJSQ. In particular, quantitative job overload, job control, supervisor and coworker support, and stress responses often had significant associations with depression and anxiety, quality of life, sleepiness, burnout, sickness absence, and physical biomarkers. These results may reflect the construct validity (concurrent and predictive) of the subscales, while the BJSQ is easy to answer because of the low number of items in each subscale (three at most). The subscales of quantitative job overload, job control, and social support at work can be used as the representative job stressors, referring to the job demands–control model [174,175] as the theoretical background. The subscales of the psychological and physical stress response may also be useful as the indicators of broad symptoms evoked by exposure to stressful PF at work. These subscales may be used as the outcomes of the intervention study. In contrast, compared to the subscales from the BJSQ, those from the New BJSQ were not much considered in the research. More studies are needed to confirm the psychometric validity using the subscales from the New BJSQ.

4.3. Practical Implications

Scoring methods are inconsistent among studies, which is partly because these were developed so that the BJSQ can be used for both research and practice. The predictive validity of sickness absence has been confirmed for “high-stress” employees in the NSCP. It is necessary to use the appropriate method according to the purpose of use.

Translation into other languages is the next interest in research and practice. Several studies were conducted in other countries but were not included because the validity of the translated scales could not be verified [171–173]. Recently, the BJSQ and the New BJSQ have been translated into English, Chinese, Portuguese, Myanmar, Vietnamese, Spanish, Tagalog, Nepali, Persian, and Indonesian [178,179], and the use of these scales in other countries have already been reported in a peer-reviewed journal [180]. The translated version of the scales can be used as tools to promote not only research on foreign workers in each region of Japan but also job stress research in other countries and international job stress research.

4.4. Limitations

There are several limitations to this study. The study quality and risk of bias of the included studies were not assessed because the objective of this study was limited to summarizing published information related to the BJSQ and the New BJSQ. Since most of the included studies were conducted cross-sectionally, the findings from each study could include substantial biases. Further, a body of evidence for the associations between the subscales from the BJSQ and other measurements could not be presented.

5. Conclusions

In conclusion, as a comprehensive questionnaire, the BJSQ and the New BJSQ have contributed to the measurement of PF at work and the publication of scientific papers in the occupational health field. The BJSQ can be one of the methodological tools to explore the mechanisms between job stress and several work-related disorders and can provide hints of intervention. Quantitative job overload, job control, and supervisor and coworker support were often used and may have the construct validity as the representative job stressors, referring to the job demands–control model. Regarding practical implication, using the appropriate scoring method according to the usage purpose is important. Prospective, interventional, and multilingual studies are expected to be published to accumulate more comprehensive and high-quality findings in the future.

Author Contributions: Conceptualization, K.W., K.I., A.S. (Akihito Shimazu), N.K. and A.T.; methodology, K.W., K.I., H.E., Y.H., Y.K. (Yu Komase), A.S. (Asuka Sakuraya), A.I., Y.K. (Yuka Kobayashi),

Y.O., N.S., K.T., E.A., H.A. (Hideaki Arima), H.A. (Hiroki Asaoka), A.H., M.I. (Mako Iida), M.I. (Mai Iwanaga) and R.I.; software, K.W.; writing—original draft preparation, K.W.; writing—review and editing, K.W., K.I., H.E., A.I., A.S. (Akihito Shimazu), N.K. and A.T.; supervision, A.S. (Akihito Shimazu), N.K. and A.T. All authors have read and agreed to the published version of the manuscript.

Funding: This study was supported by the Grant-in-Aid for Scientific Research from the Japan Society for the Promotion of Science (JP21K19672 and JP20K19671).

Institutional Review Board Statement: Ethical approval was not obtained because this study did not involve human subjects and only published and summarized data.

Informed Consent Statement: Not applicable.

Data Availability Statement: Since this study is a systematic review, no individual data is available. The summarized data for this systematic review can be obtained upon request.

Acknowledgments: We greatly thank Yumi Asai, Department of Mental Health, Graduate School of Medicine, The University of Tokyo, for shifting and full-text review.

Conflicts of Interest: The authors declare no conflict of interest for this study. The funder had no role in the study design, collection, analysis, and interpretation of data, the writing of the report, or the decision to submit this article for publication.

Appendix A

Table A1. Summary of the included studies that used the Brief Job Stress Questionnaire.

No.	Author	Study Design	Recruitment	Sample	Subscale Used	Scoring	Other Measurements
1 [23]	Sugito et al. (2021)	Longitudinal	Private companies	6620 male company workers aged 40 years or older who underwent routine annual health checkups and a stress check	Quantitative job overload (3 items) Qualitative job overload (3 items) Physical demands (1 item) Interpersonal conflict (3 items) Poor physical environment (1 item) Job control (3 items) Skill utilization (1 item) Suitable jobs (1 item) Meaningfulness of work (1 item) Vigor (3 items) Anger-irritability (3 items) Fatigue (3 items) Anxiety (3 items) Depression (6 items) Physical stress response (11 items) Supervisor support (3 items) Coworker support (3 items) Support from family and friends (3 items) Job and life satisfaction (2 items)	Standardized scores were calculated on a five-point scale, ranging from 1 (lowest) to 5 (highest).	Development of diabetes mellitus (HbA1c by blood sampling or using antidiabetic drugs)
2 [24]	Takahashi et al. (2020)	Longitudinal	Healthcare centers	6326 male workers who received annual health checkups	Vigor (3 items) Anger-irritability (3 items) Fatigue (3 items) Anxiety (3 items) Depression (6 items) Physical stress response (11 items)	Participants were dichotomized into positive or negative; points 1 and 2 received a score of 0, and points 3 and 4 received a score of 1. An individual was considered positive for depression when they scored at least 1 in each of the depression -related items.	Development of type 2 diabetes (HbA1c by blood sampling or diabetes medication)
3 [25]	Kachi et al. (2020)	Longitudinal	Private companies	9657 workers at a financial service company	Job stressors (17 items) Stress response (29 items) Social support (9 items)	Participants were categorized into high stress or not, as defined by the Stress Check Program in Japan.	Turnover (Human resource records)

Table A1. Contd.

No.	Author	Study Design	Recruitment	Sample	Subscale Used	Scoring	Other Measurements
4 [26]	Shimazaki et al. (2020)	Longitudinal	Private companies	635 workers of small- to medium-sized enterprises	Vigor (3 items) Anger-irritability (3 items) Fatigue (3 items) Anxiety (3 items) Depression (6 items)	Continuous score	Mental health promotion behaviors (Mental Health Promotion Behavior scale, MHPB)
5 [27]	Wang et al. (2020)	Longitudinal	Private companies	307 full-time and white-collar employees in wide-ranging occupations	Anger-irritability (3 items) Fatigue (3 items) Anxiety (3 items) Depression (6 items) Physical stress response (11 items)	Continuous score	Ethical leadership (Ethical Leadership Scale) Mutual support (Self-developed, validated previously)
6 [28]	Inoue et al. (2019)	Longitudinal	Private companies	14,687 employees in a financial service company	Job satisfaction (1 item)	Participants who answered 1 or 2 were dichotomized into “dissatisfied” and those who answered 3 or 4 into “satisfied” groups.	Long-term sickness absence (Personnel records)
7 [29]	Hino et al. (2019)	Longitudinal	Private companies	922 workers in a manufacturing company in Japan	Depression (6 items)	Continuous score	Overtime work hours (Personnel records)
8 [30]	Morimoto et al. (2019)	Longitudinal	Nursing or welfare facilities	379 employed family caregivers of people with dementia	Quantitative job overload (3 items) Qualitative job overload (3 items) Physical demands (1 item) Interpersonal conflict (3 items) Poor physical environment (3 items) Emotional demands (1 item) Role conflict (1 item)	Continuous score	Psychological strain (Stress Response Scale, SRS)

Table A1. Cont.

No.	Author	Study Design	Recruitment	Sample	Subscale Used	Scoring	Other Measurements
9 [31]	Ogawa et al. (2018)	Nested case-control study	Public sectors	382 public servants in the Kinki area	Quantitative job overload (3 items) Qualitative job overload (3 items) Physical demands (1 item) Interpersonal conflict (3 items) Poor physical environment (1 item) Job control (3 items) Skill utilization (1 item) Suitable jobs (1 item) Meaningfulness of work (1 item) Vigor (3 items) Anger-irritability (3 items) Fatigue (3 items) Anxiety (3 items) Depression (6 items) Physical stress response (11 items) Supervisor support (3 items) Coworker support (3 items) Support from family and friends (3 items) Job satisfaction (1 item) Satisfaction with family life (1 item)	Continuous score	Long-term sickness absence due to mental disorders (Doctor's medical certification)
10 [32]	BJSQ et al. (2018)	Longitudinal	Private companies	7356 male and 7362 female employees in a financial service company	Job stressors (17 items) Stress response (29 items) Social support (9 items)	Participants were categorized into high stress or not, as defined by the Stress Check Program in Japan.	Sickness absence (Human resources records)
11 [33]	Fukuda et al. (2018)	Longitudinal	Public sectors	16,032 public servants in the Kinki area	Job stressors (17 items) Stress responses (29 items) Social support (9 items)	Continuous score	Long-term sickness absence due to mental disorders in the same work unit (Medical certification)
12 [34]	Okita et al. (2017)	Longitudinal	Hospitals	42 female novice nurses at Kagoshima University Hospital	Psychological stress response (18 items) Physical stress response (11 items)	Continuous score	Physical examination parameters (Blood sampling) Urinary parameters (Urine sampling) One-year body weight change

Table A1. Cont.

No.	Author	Study Design	Recruitment	Sample	Subscale Used	Scoring	Other Measurements
13 [35]	Hino et al. (2016)	Longitudinal	Healthcare centers	1815 male workers who underwent health checkups at a healthcare center in the Kanto (east coast) region	Quantitative job overload (3 items) Job control (3 items) Supervisor support (3 items) Coworker support (3 items)	A four-category variable for each psychosocial work characteristic was created (1) stable low, (2) increased, (3) decreased, and (4) stable high group. The demands/control ratio was also calculated.	Insulin resistance (Blood sampling)
14 [36]	Sakuraya et al. (2016)	Longitudinal	Private companies	929 employees from a thinktank company	Workplace social capital (3 items)	Respondents were grouped into tertiles (high, middle, and low). Further, respondents were categorized into tertiles based on the distribution of each item score.	Onset of major depressive episode (World Health Organization's version of Composite International Diagnostic Interview 3.0, WHO-CIDI 3.0)
15 [37]	Taniguchi et al. (2016)	Longitudinal	Nursing or welfare facilities	543 workers at welfare facilities for the elderly.	Psychological stress response (18 items) Physical stress response (11 items)	The participants were dichotomized into high and low stress groups. For psychological stress response, >13 and >12 indicated a high score in men and women, respectively. For physical stress response, >4 or >5 indicated a high score in men or women, respectively.	Workplace bullying (Japanese version of the Negative Acts Questionnaire, NAQ)
16 [38]	Watanabe et al. (2016)	Longitudinal	Private companies	126 employees from 15 worksites	Psychological stress response (18 items)	Continuous score	Physical activity (Japanese version of the International Physical Activity Questionnaire, IPAQ)

Table A1. Cont.

No.	Author	Study Design	Recruitment	Sample	Subscale Used	Scoring	Other Measurements
17 [39]	Endo et al. (2015)	Longitudinal	Private companies	540 employees from one of the biggest telecommunication companies	Quantitative job overload (3 items) Job control (3 items)	Based on the means of “organizational job demands” or “organizational job control” scores, the departments were dichotomized into two groups (high/low).	Recurrent sickness absence due to depression (Psychiatric certification)
18 [40]	Shimazu et al. (2015)	Longitudinal	Private companies	1196 employees in an industrial machinery company	Psychological stress response (18 items) Physical stress response (11 items) Job satisfaction (1 item) Satisfaction with family life (1 item)	Continuous score	Work engagement (Utrecht Work Engagement Scale, UWES) Workaholism (Dutch Workaholism Scale, DUWAS)
19 [41]	Matsudaira et al. (2014)	Longitudinal	Existing cohorts	3811 workers from a prospective cohort of the “The Japan epidemiological research of Occupation-related Back pain (JOB)” study.	Quantitative job overload (3 items) Qualitative job overload (3 items) Physical demands (1 item) Interpersonal conflict (3 items) Poor physical environment (1 item) Job control (3 items) Skill utilization (1 item) Suitable jobs (1 item) Vigor (3 items) Anger-irritability (3 items) Fatigue (3 items) Anxiety (3 items) Depression (6 items) Physical stress response (11 items) Supervisor support (3 items) Coworker support (3 items) Support from family and friends (3 items) Job satisfaction (1 item) Satisfaction with family life (1 item)	For each factor, standardized scores were developed on a five-point scale ranging from 1 (lowest) to 5 (highest) based on a sample of more than 10,000 Japanese workers. The five original responses were reclassified into “not feeling stressed,” where low, slightly low, and moderate were combined, and “feeling stressed,” where slightly high and high were combined.	Low back pain (Von Korff’s grading method)
20 [42]	Wada et al. (2013)	Longitudinal	Web surveys	1810 participants aged 20–70 years from a marketing survey	Stress responses (29 items)	The participants were divided into quartiles according to the total stress response score at baseline.	Sick leave due to depression (Medical certificates)

Table A1. Cont.

No.	Author	Study Design	Recruitment	Sample	Subscale Used	Scoring	Other Measurements
21 [43]	Demerouti et al. (2013)	Longitudinal	Existing cohorts	471 Japanese employees with young children from the Tokyo Work-family INterface (TWIN) study	Supervisor support (3 items)	Continuous score	Work–self facilitation (Four items based on the Survey Work–home Interference Nijmegen, SWING)
22 [44]	Okuno et al. (2013)	Longitudinal	Hospitals	105 nurses in from a hospital	Quantitative job overload (3 items) Qualitative job overload (3 items) Physical demands (1 item) Interpersonal conflict (3 items) Poor physical environment (1 item) Job control (3 items) Skill utilization (1 item) Suitable jobs (1 item) Meaningfulness of work (1 item) Supervisor support (3 items) Coworker support (3 items)	Continuous score	Post-traumatic growth (Japanese version of Posttraumatic Growth Inventory, PTGI-J)
23 [45]	Urakawa et al. (2012)	Longitudinal	Private companies	299 employees in small enterprises	Vigor (3 items) Anger-irritability (3 items) Fatigue (3 items) Anxiety (3 items) Depression (6 items) Physical stress response (11 items)	Continuous score	Sense of coherence (Japanese version of Sense of Coherence Scale, SOC)
24 [46]	Takahashi et al. (2012)	Longitudinal	Web surveys	2382 daytime workers selected randomly from a market research panel	Quantitative job overload (3 items) Job control (3 items) Supervisor and coworker support (6 items)	Continuous score	Fatigue (An 11-item scale from the Checklist for Accumulated Fatigue due to Overwork) Depressive symptoms (Center for Epidemiologic Studies for Depression scale, CES-D) Work time control (A five-item scale from Takahashi et al. (2011)) Daytime sleepiness (Epworth Sleepiness Scale)

Table A1. *Contl.*

No.	Author	Study Design	Recruitment	Sample	Subscale Used	Scoring	Other Measurements
25 [47]	Sugimura and Thériault (2010)	Cross-sectional Longitudinal	Private companies	1157 male employees in an information technology company	Supervisor support (3 items)	Cross-sectional survey: supervisor support score was categorized into four groups for every quartile score. Longitudinal survey: supervisor support scores of each survey period were dichotomized based on the median score to create four dual categories that take into account the changes in supervisor support between the survey periods (i.e., low [T1]–low [T2], low [T1]–high [T2], high [T1]–low [T2], and high [T1]–high [T2]). Continuous score	Work ability (Work Ability Index, WAI)
26 [48]	Shimazu and de Jonge (2009)	Longitudinal	Private companies	211 employees in a construction machinery company	Psychological stress response (18 items) Physical stress response (11 items)	Continuous score	Effort–reward imbalance (Japanese version of Effort–Reward Imbalance Questionnaire, ERI-Q)
27 [49]	Shimazu et al. (2008)	Longitudinal	Private companies	193 employees working in a construction machinery company	Quantitative job overload (3 items) Job control (3 items) Psychological stress response (18 items) Physical stress response (11 items)	Continuous score	Active coping (Brief Stress for Coping Scale, BSCP)
28 [50]	Shimazu and Schaufeli (2007)	Longitudinal	Private companies	488 male employees in a construction machinery company	Job stressors (17 items) Stress responses (29 items)	Continuous score	Coping (Brief Stress for Coping Scale, BSCP) Job performance (World Health Organization Health and Work Performance Questionnaire, WHO-HPQ)

Table A1. Cont.

No.	Author	Study Design	Recruitment	Sample	Subscale Used	Scoring	Other Measurements
29 [51]	Tsuboi et al. (2006)	Longitudinal	Hospitals	33 female nurses working in Fujita Health University Hospital	Job stressors (17 items)	Those who scored more "1"s were placed in a high job stress group and those who scored more "5"s were placed in a low job stress group, according to the manual of the BJSQ.	Cholesterol Lipid peroxidation antioxidants in the plasma (Blood sampling) Depressive symptoms (Center for Epidemiologic Studies for Depression scale, CES-D)
30 [52]	Hirokawa et al. (2022) (Epub was published in 2021)	Cross-sectional	Healthcare centers	766 healthy workers enrolled in mental health checkups	Quantitative job overload (3 items) Qualitative job overload (3 items) Physical demands (1 item) Job control (3 items) Skill utilization (1 item) Suitable jobs (1 item) Supervisor support (3 items) Coworker support (3 items) Job satisfaction (1 item)	Continuous score	Salivary cortisol (Saliva sampling)
31 [53]	Takaesu et al. (2021)	Cross-sectional	Private companies	4645 office workers from 29 companies	Job stressors (17 items) Stress response (29 items) Social support (9 items)	Participants were categorized into high stress or not, defined by the Stress Check Program in Japan.	Sleep duration (Self-reported)
32 [54]	Hidaka et al. (2021)	Cross-sectional	Web surveys	1986 workers from the Internet survey	Quantitative job overload (3 items) Job control (3 items) Supervisor support (3 items) Coworker support (3 items)	Job strain was calculated by dividing quantitative job overload by job control. Social support was used in continuous score.	Health-related quality of life (EQ-5D-5L)
33 [55]	Toyoshima et al. (2021)	Cross-sectional	Convenience sample of faculty staff members or alumni of universities	536 workers from the recruitment that performed through the word of mouth, using poster at the Tokyo Medical University	Job stressors (17 items) Stress response (29 items) Social support (9 items) Job and life satisfaction (2 items)	Continuous score	Sleep reactivity (The Ford Insomnia Response to Stress Test, FIRST) Cognitive dysfunction (The Cognitive Complaints in Bipolar Disorder Rating Assessment, COBRA)

Table A1. Cont.

No.	Author	Study Design	Recruitment	Sample	Subscale Used	Scoring	Other Measurements
34 [56]	Adachi et al. (2021)	Cross-sectional	Healthcare centers	2739 university workers who underwent an annual health checkup at the Health and Counseling Center, Osaka University	Job stressors (17 items) Stress response (29 items) Social support (9 items)	Continuous score	Sleep duration (Self-reported)
35 [57]	Hayashida et al. (2021)	Cross-sectional	Private companies	2905 workers from 17 offices at companies	Stress response (29 items)	Continuous score	Presenteeism (Work Limitations Questionnaire, WLQ) Sleep quality (Pittsburgh Sleep Quality Index, PSQI)
36 [58]	Ôga and Chiba (2021)	Cross-sectional	Hospitals	765 nurses from eight hospitals that have 100 or more beds in Tohoku, Japan	Vigor (3 items) Anger-irritability (3 items) Fatigue (3 items) Anxiety (3 items) Depression (6 items) Physical stress response (11 items) Coworker support (3 items)	Continuous score	Humor expression (Humor Expression Scale)
37 [59]	Adachi (2021)	Cross-sectional	Private companies	114 workers in a manufacturing company	Quantitative job overload (3 items) Qualitative job overload (3 items) Physical demands (1 item) Interpersonal conflict (3 items) Poor physical environment (1 item) Job control (3 items) Skill utilization (1 item) Suitable jobs (1 item) Meaningfulness of work (1 item) Vigor (3 items) Anger-irritability (3 items) Fatigue (3 items) Anxiety (3 items) Depression (6 items) Physical stress response (11 items) Supervisor support (3 items) Coworker support (3 items) Support from family and friends (3 items) Job and life satisfaction (2 items)	Continuous score	Shift work (Self-reported)

Table A1. Cont.

No.	Author	Study Design	Recruitment	Sample	Subscale Used	Scoring	Other Measurements
38 [60]	Ooka et al. (2021)	Cross-sectional	Healthcare centers	69,805 workers in 117 companies that conducted the national Stress Check Program through Public Health Research Center	Job stressors (17 items) Stress response (29 items) Social support (9 items)	Participants were categorized into high stress or not, as defined by the Stress Check Program in Japan.	Shift work (Self-reported) Overtime work hours (Self-reported)
39 [61]	Terada and Nagamine (2020)	Cross-sectional	Public sectors	326 male workers of the Japan Ground Self-Defense Force	Job stressors (17 items) Stress response (29 items)	Continuous score	Coping (Tri-Axial Coping Scale, TAC-24) Resilience (Japanese Short version of Resilience Competency Scale, RCS-JS) Hardiness (Validated scale)
40 [62]	Sameshima et al. (2020)	Cross-sectional	Convenience sample of faculty staff members or alumni of universities	528 nonclinical workers recruited by convenience sampling through our acquaintances at Tokyo Medical University	Job stressors (17 items) Stress response (29 items)	Continuous score	Parenting quality (Parental Bonding Instrument) Resilience (Connor-Davidson Resilience Scale)
41 [63]	Shimura et al. (2020)	Cross-sectional	Private companies	5640 workers from 29 companies in Tokyo	Job stressors (17 items) Social support (9 items)	Continuous score	Sleep schedule (Self-reported) Sleep quality (Pittsburgh Sleep Quality Index, PSQI)
42 [64]	Furuichi et al. (2020)	Cross-sectional	Private companies	2899 workers from 17 companies in Tokyo, Japan	Job stressors (17 items) Stress response (29 items) Social support (9 items)	Continuous score	Presenteeism (Work Limitation Questionnaire, WLQ) Sleep quality (Pittsburgh Sleep Quality Index, PSQI)

Table A1. Cont.

No.	Author	Study Design	Recruitment	Sample	Subscale Used	Scoring	Other Measurements
43 [65]	Miyama et al. (2020)	Cross-sectional	Convenience sample of faculty staff members or alumni of universities	535 nonclinical workers recruited by convenience sampling through our acquaintances at Tokyo Medical University	Job stressors (17 items) Stress response (29 items) Social support (9 items) Job and life satisfaction (2 items)	Continuous score	Diurnal type (Diurnal Type Scale, DTS) Sleep quality (Pittsburgh Sleep Quality Index, PSQI)
44 [66]	Seki et al. (2020)	Cross-sectional	Convenience sample of faculty staff members or alumni of universities	528 workers recruited by convenience sampling through our acquaintances at Tokyo Medical University	Job stressors (17 items) Stress response (29 items)	Continuous score	Parenting quality (Parental Bonding Instrument) Neuroticism (Eysenck Personality Questionnaire-Revised, EPQ-R)
45 [67]	Kikuchi et al. (2020)	Cross-sectional	Healthcare centers	59,021 workers in 117 companies that implemented the national Stress Check Program	Vigor (3 items) Anger-irritability (3 items) Fatigue (3 items) Anxiety (3 items) Depression (6 items) Physical stress response (11 items)	Continuous score	Overtime work hours (Self-reported)
46 [68]	Taya et al. (2020)	Cross-sectional	Private companies	2905 workers from 17 worksites in Tokyo, Japan	Job stressors (17 items) Stress response (29 items) Social support (9 items)	Continuous score	Presenteeism (Work Limitation Questionnaire, WLQ)
47 [69]	Hayasaki et al. (2020)	Cross-sectional	Hospitals	284 nurses from 12 wards in a hospital	Job stressors (17 items) Stress response (29 items) Social support (9 items)	The participants were dichotomized into high and low groups. For each subscale, high stress was defined by counting the number of non-desirable answers.	Ethical behaviors of nurses (Validated scale)
48 [70]	Saito et al. (2020)	Cross-sectional	Nursing or welfare facilities	49 teachers who have been employed for 5–10 years by nursing schools in an area in Japan	Stress response (29 items)	Continuous score	Self-efficacy (Generalized Self-Efficacy Scale, GSES)

Table A1. Cont.

No.	Author	Study Design	Recruitment	Sample	Subscale Used	Scoring	Other Measurements
49 [71]	Okamoto et al. (2020)	Cross-sectional	Nursing or welfare facilities	616 healthcare workers from 217 welfare facilities for the disabled in the Chugoku area, Japan	Supervisor support (3 items) Coworker support (3 items)	Respondents were grouped into tertiles (high, middle, and low).	Inappropriate care (Validated scale)
50 [72]	Nagata et al. (2019)	Cross-sectional	Private companies	2693 employees at a pharmaceutical company	Quantitative job overload (3 items) Qualitative job overload (3 items) Job control (3 items) Supervisor support (3 items) Coworker support (3 items)	Continuous score	Psychological distress (K6) Work engagement (Utrecht Work Engagement Scale, UWES)
51 [73]	Okawa et al. (2019)	Cross-sectional	Private companies	103 employees at 17 corporations in Kanagawa Prefecture, Japan	Job stressors (17 items) Stress response (29 items) Social support (9 items)	Participants were defined as high stress or not based on the Stress Check Program in Japan.	Autonomic nervous activity (Electrocardiography, photoplethysmography)
52 [74]	Maeda et al. (2019)	Cross-sectional	Web surveys	2000 female workers from an online research panel living with a partner	Quantitative job overload (3 items) Job control (3 items) Supervisor support (3 items) Coworker support (3 items)	Continuous score	Psychological health (mental health and vitality) (SF-36)
53 [75]	Sakamoto et al. (2019)	Cross-sectional	Hospitals	205 healthcare workers from a core hospital	Quantitative job overload (3 items) Qualitative job overload (3 items) Physical demands (1 item) Interpersonal conflict (3 items) Poor physical environment (1 item) Job control (3 items) Skill utilization (1 item) Suitable jobs (1 item) Meaningfulness of work (1 item) Vigor (3 items) Anger-irritability (3 items) Fatigue (3 items) Anxiety (3 items) Depression (6 items) Physical stress response (11 items) Supervisor support (3 items) Coworker support (3 items) Support from family and friends (3 items) Job and life satisfaction (2 items)	Continuous score	Depression and anxiety (Hospital Anxiety Depression Scale, HADS) Chronic pain (Pain Catastrophizing Scale, PCS)

Table A1. Cont.

No.	Author	Study Design	Recruitment	Sample	Subscale Used	Scoring	Other Measurements
54 [76]	Matsumoto and Yoshioka (2019)	Cross-sectional	Hospitals	577 psychiatric nurses working at 13 psychiatric hospitals with more than 150 beds in the Chugoku area	Job stressors (17 items) Supervisor support (3 items) Coworker support (3 items) Job satisfaction (1 item)	Continuous score	Negative Feeling toward patient (Negative Feeling toward Patient Frequency scale) Emotional, evaluative, informative, and instrumental support (Support-in-workplace scale)
55 [77]	Kurebayashi (2019)	Cross-sectional	Hospitals	271 general and 316 psychiatric nurses from seven hospitals in Japan	Quantitative job overload (3 items) Qualitative job overload (3 items) Physical demands (1 item) Interpersonal conflict (3 items) Poor physical environment (1 item) Job control (3 items) Skill utilization (1 item) Suitable jobs (1 item) Meaningfulness of work (1 item) Vigor (3 items) Anger-irritability (3 items) Fatigue (3 items) Anxiety (3 items) Depression (6 items) Physical stress response (11 items) Supervisor support (3 items) Coworker support (3 items) Support from family and friends (3 items) Job and life satisfaction (2 items)	Continuous score	Nursing skills (Self-Evaluation Scale of Oriented Problem Solving Behavior, OPSN)
56 [78]	Watanabe and Yamauchi (2019)	Cross-sectional	Hospitals	1075 full-time nurses working in four hospitals in Japan	Fatigue (3 items)	Continuous score	Motivation for overtime work (Self-developed, validated in the study)

Table A1. Cont.

No.	Author	Study Design	Recruitment	Sample	Subscale Used	Scoring	Other Measurements
57 [79]	Fukunaga et al. (2019)	Cross-sectional	Nursing or welfare facilities	312 teachers who intended to change occupations from nursing schools in eight prefectures	Quantitative job overload (3 items) Job control (3 items) Fatigue (3 items) Anxiety (3 items) Depression (3 items) Physical stress response (2 items) Supervisor support (3 items) Coworker support (3 items)	Continuous score	Identity of nurses and nursing teachers (Validated scale)
58 [80]	Yoneyama et al. (2019)	Cross-sectional	Hospitals	215 female nurses from advanced treatment hospitals in Kanto area, Japan	Quantitative job overload (3 items) Qualitative job overload (3 items) Physical demands (1 item) Interpersonal conflict (3 items) Poor physical environment (1 item) Job control (3 items) Skill utilization (1 item) Suitable jobs (1 item) Meaningfulness of work (1 item) Vigor (3 items) Anger-irritability (3 items) Fatigue (3 items) Anxiety (3 items) Depression (6 items) Physical stress response (11 items) Supervisor support (3 items) Coworker support (3 items) Support from family and friends (3 items) Job and life satisfaction (2 items)	Continuous score	Recognition of the organization (Validated scale)

Table A1. Cont.

No.	Author	Study Design	Recruitment	Sample	Subscale Used	Scoring	Other Measurements
59 [81]	Inaba (2018)	Cross-sectional	Hospitals	318 female nurses working in a private hospital for one or more years	Quantitative job overload (3 items) Qualitative job overload (3 items) Physical demands (1 item) Job control (3 items) Interpersonal conflict (3 items) Poor physical environment (1 item) Skill utilization (1 item) Suitable jobs (1 item) Meaningfulness of work (1 item) Emotional demands (1 item) Role conflict (1 item) Work–self balance (negative) (1 item) Role clarity (1 item) Career opportunity (1 item) Supervisor support (3 items) Coworker support (3 items) Support from family and friends (3 items) Monetary/status reward (1 item) Esteem reward (1 item) Job security (1 item) Leadership (1 item) Interactional justice (1 item) Workplace where people compliment each other (1 item) Workplace where mistakes are acceptable (1 item) Collective efficacy (1 item) Trust with management (1 item) Preparedness for change (1 item) Respect for individuals (1 item) Fair personnel evaluation (1 item) Diversity (1 item) Career development (1 item) Work–self balance (positive) (1 item) Vigor (3 items) Anger-irritability (3 items) Fatigue (3 items) Anxiety (3 items) Depression (6 items) Physical stress response (11 items) Job satisfaction (1 item) Satisfaction with family life (1 item) Workplace harassment (1 item) Workplace social capital (1 item)	Continuous score	Subjective well-being (Single item)

Table A1. Cont.

No.	Author	Study Design	Recruitment	Sample	Subscale Used	Scoring	Other Measurements
60 [82]	Sato (2018)	Cross-sectional	Private companies	109 workers from four worksites	Quantitative job overload (3 items) Qualitative job overload (3 items) Physical demands (1 item) Interpersonal conflict (3 items) Poor physical environment (1 item) Job control (3 items) Skill utilization (1 item) Suitable jobs (1 item) Meaningfulness of work (1 item) Vigor (3 items) Anger-irritability (3 items) Fatigue (3 items) Anxiety (3 items) Depression (6 items) Physical stress response (11 items) Supervisor support (3 items) Coworker support (3 items) Support from family and friends (3 items)	Continuous score Participants were defined as high stress or not based on the Stress Check Program in Japan.	Risk of periodontal disease (Saliva sampling)
61 [83]	Horie et al. (2018)	Cross-sectional	Nursing or welfare facilities	18 faculty staff members from care worker schools	Quantitative job overload (3 items) Qualitative job overload (3 items) Physical demands (1 item) Interpersonal conflict (3 items) Poor physical environment (1 item) Job control (3 items) Skill utilization (1 item) Suitable jobs (1 item) Meaningfulness of work (1 item) Vigor (3 items) Anger-irritability (3 items) Fatigue (3 items) Anxiety (3 items) Depression (6 items) Physical stress response (11 items)	Continuous score	Burnout (Maslach Burnout Inventory, MBI)

Table A1. Cont.

No.	Author	Study Design	Recruitment	Sample	Subscale Used	Scoring	Other Measurements
62 [84]	Nakamura and Mizukami (2018)	Cross-sectional	Nursing or welfare facilities	657 healthcare workers at nine elderly nursing homes	Vigor (3 items) Anger-irritability (3 items) Fatigue (3 items) Anxiety (3 items) Depression (6 items) Physical stress response (11 items)	Continuous score	Work value (Work value scale) Assertive mind (Assertive Mind Scale) Self-efficacy (Generalized Self-efficacy Scale, GSES) Sense of coherence (Japanese sense of coherence scale: SOC-13) Communication skills (ENDCOREs) Working behaviors (Working behavior scale) Problem solution ability (Problem solution ability scale)
63 [85]	Enoki et al. (2018)	Cross-sectional	Private companies	664 workers from a call center	Quantitative job overload (3 items) Job control (3 items) Supervisor support (3 items) Coworker support (3 items)	Continuous score	Sleeping time (Self-reported)
64 [86]	Okada et al. (2018)	Cross-sectional	Hospitals	108 female nurses who are wives or mothers from two general hospitals in Fukuoka Prefecture, Japan	Job stressors (17 items) Stress response (29 items) Social support (9 items)	Continuous score	Mental health (28-item General Health Questionnaire, GHQ-28)
65 [87]	Adachi and Inaba (2018)	Cross-sectional	Private companies	368 workers from a single worksite	Vigor (3 items) Anger-irritability (3 items) Fatigue (3 items) Anxiety (3 items) Depression (6 items) Physical stress response (11 items)	Continuous score	Depression (Center for Epidemiologic Studies for Depression scale, CES-D)

Table A1. Contd.

No.	Author	Study Design	Recruitment	Sample	Subscale Used	Scoring	Other Measurements
66 [88]	Sakamoto et al. (2018)	Cross-sectional	Hospitals	38 workers of the rehabilitation department of a core hospital	Quantitative job overload (3 items) Qualitative job overload (3 items) Physical demands (1 item) Interpersonal conflict (3 items) Poor physical environment (1 item) Job control (3 items) Skill utilization (1 item) Suitable jobs (1 item) Meaningfulness of work (1 item) Vigor (3 items) Anger-irritability (3 items) Fatigue (3 items) Anxiety (3 items) Depression (6 items) Physical stress response (11 items)	Continuous score	Pain catastrophizing (The Pain Catastrophizing Scale, PCS) Depression and anxiety (Hospital Anxiety Depression Scale, HADS)
67 [89]	Yada et al. (2017)	Cross-sectional	Hospitals	68 psychiatric assistant nurses and 140 psychiatric registered nurses from six psychiatric hospitals.	Vigor (3 items) Anger-irritability (3 items) Fatigue (3 items) Anxiety (3 items) Depression (6 items) Physical stress response (11 items)	Continuous score	Psychiatric nurse job stressor (Psychiatric Nurse Job Stressor Scale, PNJSS)
68 [90]	Enoki et al. (2017)	Cross-sectional	Private companies	538 employees from a call center	Quantitative job overload (3 items) Job control (3 items) Supervisor support (3 items) Coworker support (3 items)	Continuous score	Electrocardiography (EDG-9130 electrocardiograph)
69 [91]	Tsutsumi et al. (2017)	Cross-sectional	Web surveys	1650 workers via an online survey	Job stressors (17 items) Stress response (29 items) Social support (9 items)	Participants were defined as high stress or not based on the Stress Check Program in Japan.	Psychological distress (K6 scale)
70 [92]	Saijo et al. (2017)	Cross-sectional	Public sectors	2535 employees in local government, Asahikawa city, Hokkaido	Quantitative job overload (3 items) Job control (3 items) Supervisor support (3 items) Coworker support (3 items) Support from family and friends (3 items)	Continuous score	Work impairment Work output (13-item Stanford Presenteeism Scale, SPS-13)
71 [93]	Sakuraya et al. (2017)	Cross-sectional	Private companies	894 employees from a manufacturing company	Psychological stress response, except vigor (15 items)	Continuous score	Job crafting (Japanese version of the Job Crafting Questionnaire)