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Original Article

Relationship among work–treatment balance, job stress, and work engagement in Japan: a cross-sectional study

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Abstract: There is a drive to support workers in Japan undergoing medical treatment who wish to continue working, known as the work–treatment balance. This support for the work–treatment balance is expected to boost their mental health. This study examines the relationship among the work–treatment balance, job stress, and work engagement. This study was conducted in December 2020 in Japan, with 27,036 participants. We divided the participants into three groups by the receipt state of support for work–treatment balance: control group (do not need support), unsupported group, and supported group. The scores on the parameters of the job content questionnaire and the Utrecht Work Engagement Scale (UWES-3) were compared among groups using a multilevel regression with age-sex or multivariate-adjusted models. In the two models, the job control score of the unsupported group was significantly lower than that of the control group. The two social support scores of the supported group were significantly higher than those of the control group. The scores on the UWES-3 of the unsupported group were significantly lower than those of the control group. The support of work–treatment balance for workers could have a positive impact on their mental health.

Key words: Job stress, Work engagement, Work–treatment balance, Mental health, Worker

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Introduction

Fitness to work (FTW), the process of assuring that an employee can complete a task without risk to their health and safety or those of others, is one of the occupational health issues. In Japan, support for the return to work (RTW) or FTW in the workplace has been promoted for workers with mental health disturbances such as depressive disorders since early 2000[1, 2]. In recent years, systems to support balance between working life and medical treatment (the work–treatment balance) have been promoted to reinforce FTW for workers with various chronic diseases, including cancer, brain disease, and intractable diseases. There is a widespread movement to support workers willing to continue working while receiving treatment for their chronic diseases[3].

The development and reinforcement of occupational health services (OHS) at the national level play an important role in ensuring sustainable health, well-being, and work engagement for workers[4]. As one of the OHS to address workers' health and work capacity, support for work–treatment balance is also promoted through cooperation among workers, workplace staff, occupational physicians, and attending physicians. When sharing information among these stakeholders, employment considerations such as changing the work location or the work content and shortening the working hours according to the worker's condition will be considered. In addition, the support related to the mental health of workers receiving support for work–treatment balance is considered important[3].

Japan is one of the countries where OHS are provided in many enterprises, partly because OHS systems are regulated by the law[5]. However, the allocation rules pertaining to professionals and staff responsible for OSH, such as eligibility requirements and number of staff, stipulated by Japan's Occupational Safety and Health Law differ by the company size, and therefore it is necessary to consider the company size when assessing the support for work-treatment balance. In detail, a company with 1,000 or more employees must employ a full-time occupational physician, a full-time health officer, and a few health officers who concurrently perform other duties. A health officer is a national qualification. A company with 50 or more employees must have a part-time occupational physician and one or more health officers who concurrently perform other duties. Further, a company with 10 or more employees must appoint a health promoter who has been trained in occupational health. Meanwhile, workplaces with less than nine employees do not need to appoint a worker in charge of occupational health[6]. Therefore, promoting and enhancing various occupational health programs, including the support for work-treatment balance, may be based on the company size[7].

The coronavirus disease 2019 (COVID-19) pandemic has had a major impact on health, life style, and work[8–10]. People with chronic diseases are concerned about the risk of severe acute respiratory disease due to the COVID-19 infection[11, 12]. Additionally, they have faced the risk of their diseases worsening due to interruption of treatment, or have suffered a deterioration of their physical and mental health status due to numerous restrictions on daily living and work practice related to COVID-19, including social distancing and self-quarantine[13, 14]. From these aspects, the work–treatment balance of workers with chronic diseases could be important for reducing mental distress by enabling them to continue work.

Increased job stress and decreased work engagement may contribute to increased risks for diseases (e.g., cardiovascular diseases) and unhealthy conditions, and these have become occupational health issues in many countries[15, 16]. We focused on the work–treatment balance and job stress and hypothesized that workers who receive support for the work–treatment balance will have lower job stress and higher work engagement. We used data from the Collaborative Online Research on Novel-coronavirus and Work study (CORONaWork study) to clarify the relationship among the work–treatment balance, job stress, and work engagement. We believe that the relationships among the work-treatment balance, job stress, and work engagement could differ by the characteristics of the company, especially company size. We aimed to evaluate these relationships according to company size.

Subjects and Methods

Study design and setting

We conducted a prospective cohort study by a research group consisting of the University of Occupational and Environmental Health, the CORoNaWork study. This study was conducted as a self-administered questionnaire survey by a Japanese Internet survey company (Cross Marketing Inc. Tokyo) from December 22 to 25, 2020. Incidentally, during the baseline survey, the number of COVID-19 infections and deaths were overwhelmingly higher than in the first and second waves; therefore, Japan was on maximum alert during the third wave.

This study design is a cross-sectional study using a part

of a baseline survey of the CORoNaWork study. Fujino *et al.* introduced the details of this study protocol[17].

Participants

Participants were aged between 20 and 65 and were working at the time of the baseline survey. A total of 33,087 participants, who were stratified by cluster sampling by gender, age, region, and occupation, participated in the CORoNaWork study. Of this total number, only 27,036 responses were eligible for the analysis.

Questionnaire

The questionnaire items used in this study were described in detail by Fujino *et al.*[17] We used questionnaire data on sex, age, educational background, area of participants' residence, occupation, company size where participants work, working hours per day, family structure, the receipt state of support for work–treatment balance, work-related questionnaires like the Japanese version of the Job Content Questionnaire (JCQ)[18, 19], and the three-item Japanese version of the Utrecht Work Engagement Scale (UWES-3)[20, 21].

Regarding the receipt state of support for work–treatment balance, we asked, "have you received any support from your company to continue working in your current health condition?". The responses were the following three options: Not necessary (those who do not need that support), No, I do not receive despite I need the support (those who need that support but were not receiving it), and Yes, I do (those who needed that support and were receiving it).

The JCQ, developed by Karasek, is based on the job demands–control (or demand–control–support) model[18]. The reliability and validity of the Japanese version of the JCQ were demonstrated by Kawakami *et al.*[19] We used a shortened version of the 22 items in the JCQ, in which each item was rated on a 4-point scale (1 = strongly disagree, 4 = strongly agree). The JCQ includes a five-item job demands scale (score range 12–48, Cronbach's alpha in the present sample = 0.63), a nine-item job control scale (score range 24–96, Cronbach's alpha in the present sample = 0.74), a four-item supervisor support scale (score range 4–12, Cronbach's alpha in the present sample = 0.94), and a four-item coworker support scale (score range, 4–12; Cronbach's alpha, 0.90).

The three-item Japanese version of the Utrecht Work Engagement Scale (UWES-3) was used to assess work engagement[20, 21]. The items of the UWES-3 were selected from among those included in the UWES-9. The UWES-3 has been validated in five countries, including Japan, and includes measures of vigor (one item), dedication (one item), and absorption (one item), with each item measured on a seven-point response scale ranging from 0 (never) to 6 (always/every day). Overall scores on the UWES-3 (range: 0–6) were calculated by averaging the individual item scores.

Outcomes and measures

We used the scores on the four parameters of the JCQ and UWES-3 as outcome variables. We divided the participants into three groups according to the receipt state of support for work–treatment balance: control group (those who do not need support), unsupported group (those who need support but were not receiving it), and supported group (those who needed support and were actually receiving it). These variables were used as the exposure variables.

The following items, surveyed using a questionnaire, were used as confounding factors. Sex, age (20–29 yr, 30–39 yr, 40–49 yr, 50–59 yr, ≥60 yr), and educational background (junior or senior high school, junior college or vocational school, university, or graduate school) were personal characteristics. Occupation (regular employees, managers, executives, public service workers, temporary workers, freelancers or professionals, others), company size where participants worked (≤ 9 employees, 10–49, 50–99, 100–499, 500–999, 1,000–9,999, ≥ 10,000), working hours per day (< 8h/d, 8≤ and< 9h/d, 9 ≤ and < 11h/d, ≥ 11h/d) were used as work-related factors. In addition, the prefecture of participants' residence participants was used as another variable.

Statistical method

First, to analyze the relationships between the four scales of the JCQ or UWES-3 and the three groups according to the receipt state of support for work–treatment balance, we used a multilevel mixed-effects regression with the two models nested in the prefecture of residence as random effects. The two models were analyzed for each predictor variable. In the age-sex adjusted model, we treated the three groups, age, and sex as fixed effects and treated the prefecture of residence as random effects. In the multivariate model, we added educational background as personal characteristics, occupation, company size where participants work, working hours per day as work-related variables to the fixed effects of the age-sex adjusted model.

Second, to analyze these relationships according to company size, we performed multilevel mixed effects regressions using two models for the four classifications (≤ 9 employees, 10–49, 50–999, ≥ 1,000) based on the sizes of the

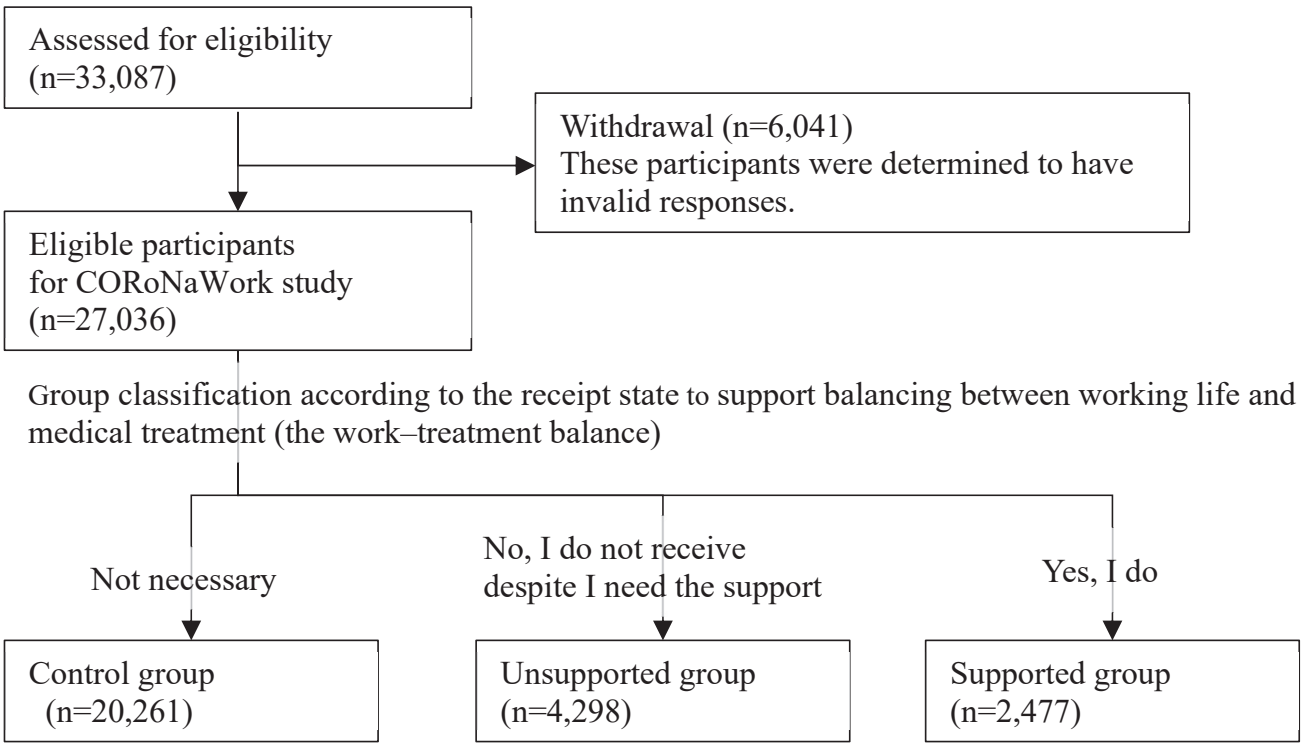

Fig. 1. Flow chart of the selection of the study sample.

companies where participants worked. In the multivariate model, we added educational background as personal characteristics and occupation and working hours per day as work-related variables to the fixed effects of the age-sex adjusted model.

In all tests, the threshold for significance was set at $p<0.05$. We used Stata/SE Ver.15.1 (StataCorp LLC, Station College, TX, USA) for statistical analyses.

Results

Participants and descriptive data

A total of 20,261 participants answered that they did not need any support for the work–treatment balance because of their current good health condition. A total of 4,298 answered that they needed support for the work–treatment balance but were not receiving it, and 2,477 answered that they needed the support and were receiving it (Fig. 1).

Table 1 displays the characteristics of the three groups according to the receipt state of support for work–treatment balance. The supported group had a high proportion of women, college graduates, and those working less than 9 hours a day, and those belonging to company size with ≥1,000 employees. The proportion of the participants in the unsupported group who needed that support tended to gradually decrease as company size increased. However, the proportion was 59.4% in companies with 1,000–9,999 employees, and 56.1% in companies with ≥10,000 employees. The unsupported group was the proportion of junior high school or high school graduates and those belonging to a company size between 10 and 500 employees.

Comparison of the scores on the JCQ subscales among the groups

The scores on the JCQ subscales among the groups were compared according to the receipt state of support for work–treatment balance. In the supported group, the mean scores for supervisor support and coworker support were the highest at 10.9 (2.7) and 11.1 (2.4) in the three groups. In the unsupported group, the mean score (SD) of the job demands was the highest of 32.5 (6.1), and those of the Job control, the supervisor support and the coworker support were the lowest of 60.9 (11.6), 8.7 (3.1), and 9.5 (2.8) (Table 1).

We statistically compared each subscale score of the JCQ among the groups by the receipt state of support for work–treatment balance (Table 2). The job demand scores for supported and unsupported groups were significantly higher than those of the control group in both age-sex and multivariate adjustment models (all $p<0.001$). There was

Table 1. Characteristics of participants in each group according to the receipt state of support for work–treatment balance

Items	Total		Groups by the receipt state of the support for the work–treatment balance					
			Control		Unsupported		Supported	
	n (%) / M(SD)		n (%) /M (SD)		n (%) /M (SD)		n (%) /M (SD)	
n	27,036	(100.0)	20,261	(100.0)	4,298	(100.0)	2,477	(100.0)
Sex								
Male	13,814	(51.1)	10,476	(51.7)	2,171	(50.5)	1,167	(47.1)
Female	13,222	(48.9)	9,785	(48.3)	2,127	(49.5)	1,310	(52.9)
Generation								
20–29 yr	1,905	(7.0)	1,352	(6.7)	316	(7.4)	237	(9.6)
30–39 yr	4,858	(18.0)	3,481	(17.2)	817	(19.0)	560	(22.6)
40–49 yr	8,011	(29.6)	5,980	(29.5)	1,334	(31.0)	697	(28.1)
50–59 yr	9,012	(33.3)	6,809	(33.6)	1,457	(33.9)	746	(30.1)
≥60 yr	3,250	(12.0)	2,639	(13.0)	374	(8.7)	237	(9.6)
Educational background								
Junior or senior high schools	7,321	(27.1)	5,477	(27.0)	1,218	(28.3)	626	(25.3)
Junior college or vocational school	6,544	(24.2)	4,826	(23.8)	1,101	(25.6)	617	(24.9)
University or graduate school	13,171	(48.7)	9,958	(49.1)	1,979	(46.0)	1,234	(49.8)
Occupation								
Regular employee	12,575	(46.5)	9,141	(45.1)	2,220	(51.7)	1,214	(49.0)
Manager	2,541	(9.4)	1,947	(9.6)	394	(9.2)	200	(8.1)
Executive	862	(3.2)	722	(3.6)	56	(1.3)	84	(3.4)
Public service worker	2,810	(10.4)	2,090	(10.3)	420	(9.8)	300	(12.1)
Temporary worker	2,894	(10.7)	2,160	(10.7)	489	(11.4)	245	(9.9)
Freelances or professional	4,454	(16.5)	3,491	(17.2)	591	(13.8)	372	(15.0)
Other	900	(3.3)	710	(3.5)	128	(3.0)	62	(2.5)
Company size								
≤9 employees	6,165	(22.8)	4,865	(24.0)	830	(19.3)	470	(19.0)
10–49 employees	4,390	(16.2)	3,243	(16.0)	755	(17.6)	392	(15.8)
50–99 employees	2,550	(9.4)	1,879	(9.3)	437	(10.2)	234	(9.4)
100–499 employees	5,156	(19.1)	3,822	(18.9)	893	(20.8)	441	(17.8)
500–999 employees	1,997	(7.4)	1,433	(7.1)	355	(8.3)	209	(8.4)
1,000–9,999 employees	4,719	(17.5)	3,472	(17.1)	741	(17.2)	506	(20.4)
≥10,000 employees	2,059	(7.6)	1,547	(7.6)	287	(6.7)	225	(9.1)
Working hours per day								
<8h/d	5,334	(19.7)	4,142	(20.4)	682	(15.9)	510	(20.6)
8≤and<9h/d	14,848	(54.9)	11,175	(55.2)	2,252	(52.4)	1,421	(57.4)
9≤and<11h/d	5,541	(20.5)	4,055	(20.0)	1045	(24.3)	441	(17.8)
≥11h/d	1,313	(4.9)	889	(4.4)	319	(7.4)	105	(4.2)
Job contents questionnaire								
Job demands	30.1	(5.9)	29.5	(5.7)	32.5	(6.1)	30.4	(5.6)
Job control	63.4	(11.5)	63.9	(11.6)	60.9	(11.6)	63.9	(10.9)
Supervisor support	10.0	(3.0)	10.2	(3.0)	8.7	(3.09)	10.9	(2.7)
Coworker support	10.5	(2.6)	10.6	(2.6)	9.51	(2.8)	11.1	(2.4)
Utrecht Work Engagement Scale-3	2.4	(1.5)	2.5	(1.5)	2.0	(1.5)	2.6	(1.6)

Control group comprised those who did not need support for work–treatment balance; unsupported group comprised those who needed support but were not receiving it; supported group comprised those who needed support and were actually receiving it.

Table 2. Comparison of the scores on the JCQ subscale and the UWES-3 for each group according to the receipt state of support for work–treatment balance

Parameters	Group	Sex-age adjusted			Multivariate *		
		Coef.	95%CI	*p*	Coef.	95%CI	*p*
JCQ subscales							
Job demands	Supported	0.81	[0.57 – 1.05]	<0.001	0.78	[0.55 – 1.01]	<0.001
	Unsupported	2.92	[2.73 – 3.11]	<0.001	2.69	[2.51 – 2.88]	<0.001
	Control		Reference			Reference	
Job control	Supported	0.39	[−0.09 – 0.86]	0.111	0.57	[0.12 – 1.02]	0.013
	Unsupported	−2.78	[−3.16 – −2.41]	<0.001	−2.32	[−2.67 – −1.96]	<0.001
	Control		Reference			Reference	
Supervisor support	Supported	0.70	[0.58 – 0.82]	<0.001	0.66	[0.54 – 0.78]	<0.001
	Unsupported	−1.45	[−1.55 – −1.36]	<0.001	−1.42	[−1.52 – −1.32]	<0.001
	Control		Reference			Reference	
Coworker support	Supported	0.43	[0.32 – 0.54]	<0.001	0.41	[0.30 – 0.51]	<0.001
	Unsupported	−1.11	[−1.20 – −1.03]	<0.001	−1.08	[−1.16 – −1.00]	<0.001
	Control		Reference			Reference	
UWES-3	Supported	0.05	[−0.01 – 0.11]	0.125	0.06	[−0.01 – 0.12]	0.072
	Unsupported	−0.53	[−0.57 – −0.48]	<0.001	−0.50	[−0.55 – −0.45]	<0.001
	Control		Reference			Reference	

CI: Confidence interval. JCQ, Job Contents Questionnaire, UWES-3: Utrecht Work Engagement Scale-3.
Control group comprised those who did not need support for work–treatment balance; unsupported group comprised those who needed support but were not receiving it; supported group comprised those who needed support and were actually receiving it.
* The multivariate model was adjusted for age, sex, educational background, occupation, company size where participants work, working hours per day.

no significant difference in the job control score between the supported and control groups in the sex-age-adjusted models; however, the job control score of the supported group was significantly higher than that of the control group in the multivariate model (p=0.013). The job control scores of the unsupported group were significantly lower than those of the control group in both models (both p<0.001).

In the two models, the supervisor support scores of the supported group were significantly higher than those of the control group (both p<0.001), and those of the unsupported group were significantly lower than those of the control group (both p<0.001). There were no significant differences in the coworker support scores between the supported and control groups in the two models. The job control scores of the unsupported group were significantly lower than those of the control group in the two models (both p<0.001).

Comparison of the scores on the UWES-3 among the groups

The scores on the UWES-3 among the groups were compared according to the receipt state of support for work–treatment balance. The mean UWES-3 score of the supported group was the highest at 2.6 (1.6), and that of the unsupported group was the lowest at 2.0 (1.5) in the three groups (Table 1). We statistically compared each UWES-3 score among the groups by the receipt state of support for work–treatment balance (Table 2). There were no significant differences in the UWES-3 scores between the control and supported groups in the two models. The UWES-3 scores of the unsupported group were significantly lower than those of the control group in both models (both p<0.001).

Comparison of the scores on the JCQ subscales and the UWES-3 among the groups according to company size

Table 3 shows the distribution of participants' mean scores and standard deviations on the JCQ subscales and the UWES-3 for each group by both receipt state of support for work-treatment balance and company size. Among all participants in the supported group, those working in companies with ≤ 9 employees, had lowest mean job demands score at 29.1 (5.6), while their mean scores for job control, supervisor support, and coworker support were the highest at 67.2 (11.2), 11.2 (3.0), and 11.4 (2.7), respectively.

We compared the scores on the JCQ subscales and the

Table 3. Distribution of participants' mean scores (SD) on the JCQ subscales and the UWES-3 by both receipt state of support for work-treatment balance and company size

Parameters	Company size (# of employees)	Total			Control			Unsupported			Supported		
		n	M	(SD)	n	M	(SD)	n	M	(SD)	n	M	(SD)
JCQ subscales													
Job demands	≤9	6,165	28.5	(5.8)	4,865	28.1	(5.7)	830	30.9	(5.9)	470	29.1	(5.6)
	10–49	4,390	30.2	(5.8)	3,243	29.6	(5.6)	755	32.7	(6.0)	392	30.6	(5.3)
	50–999	9,703	30.5	(5.8)	7,134	30.0	(5.7)	1,685	32.9	(6.1)	884	30.7	(5.5)
	≥1000	6,778	30.7	(5.8)	5,019	30.2	(5.6)	1,028	33.0	(6.2)	731	30.9	(5.6)
Job control	≤9	6,165	67.1	(11.8)	4,865	67.6	(11.6)	830	64.2	(12.7)	470	67.2	(11.2)
	10–49	4,390	62.9	(11.1)	3,243	63.2	(11.2)	755	61.0	(10.9)	392	63.7	(10.0)
	50–999	9,703	61.7	(11.3)	7,134	62.1	(11.3)	1,685	59.7	(11.1)	884	62.4	(11.1)
	≥1000	6,778	62.8	(11.2)	5,019	63.2	(11.2)	1,028	60.2	(11.2)	731	63.8	(10.5)
Supervisor support	≤9	6,165	9.7	(3.5)	4,865	9.7	(3.5)	830	8.7	(3.2)	470	11.2	(3.0)
	10–49	4,390	9.9	(3.0)	3,243	10.1	(2.9)	755	8.5	(3.0)	392	11.0	(2.4)
	50–999	9,703	10.0	(2.9)	7,134	10.3	(2.7)	1,685	8.8	(3.1)	884	10.6	(2.8)
	≥1,000	6,778	10.4	(2.8)	5,019	10.6	(2.7)	1,028	8.9	(3.1)	731	11.0	(2.5)
Coworker support	≤ 9	6,165	10.3	(3.2)	4,865	10.3	(3.2)	830	9.5	(3.0)	470	11.4	(2.7)
	10–49	4,390	10.5	(2.5)	3,243	10.7	(2.4)	755	9.5	(2.7)	392	11.1	(2.2)
	50–999	9,703	10.5	(2.4)	7,134	10.6	(2.3)	1,685	9.5	(2.7)	884	10.9	(2.5)
	≥1,000	6,778	10.7	(2.3)	5,019	10.9	(2.2)	1,028	9.6	(2.7)	731	11.1	(2.2)
UWES-3	≤9	6,165	2.6	(1.6)	4,865	2.7	(1.5)	830	2.2	(1.6)	470	2.7	(1.6)
	10–49	4,390	2.4	(1.5)	3,243	2.5	(1.5)	755	2.0	(1.5)	392	2.6	(1.6)
	50–999	9,703	2.4	(1.5)	7,134	2.4	(1.5)	1,685	1.9	(1.5)	884	2.5	(1.5)
	≥1,000	6,778	2.4	(1.5)	5,019	2.5	(1.5)	1,028	1.9	(1.4)	731	2.5	(1.6)

JCQ, Job Contents Questionnaire, UWES-3: Utrecht Work Engagement Scale-3.
Control group comprised those who did not need support for work–treatment balance; unsupported group comprised those who needed support but were not receiving it; supported group comprised those who needed support and were actually receiving it.

UWES-3 by the receipt state of support for work–treatment balance for each classification of company size (Table 4). The relationship among outcomes and exposure variables showed a similar trend to that of the overall analysis described above, and we did not find any major differences between these results. A minor finding was that the supported group from companies with ≤ 9 employees tended to be more strongly associated with supervisor support and coworker support (Coef. [95% confidence interval] = 1.37 [1.04–1.69], 1.01 [0.71–1.31], respectively).

Discussion

This study evaluated the relationship among the work–treatment balance, job stress, and work engagement. Regarding job demand–control, we found that the group of participants who received support for the work–treatment balance tended to be aware of lower job demand and higher job control than those who did not receive support. In particular, the group of participants who received support for work–treatment balance was aware of higher job control than those who did not need support for work–treatment balance when adjusting for multivariate. In a previous study of patients with inflammatory bowel disease, it was reported that work practices that negatively affect patients' physical condition and health care behaviors and lack of consideration in the workplace are associated with decreased motivation to work and depression[22]. Specific items of work considerations related to the work–treatment balance in Japan include the assignment of appropriate work practices, reduction of working hours such as limiting overtime work, change of work location, and consideration of hospital treatment and health care behaviors[3]. For those who receive support, these work considerations may reduce the psychological stress of work.

Regarding social support, we found that the group of participants who received support for work–treatment balance had a higher perception of supervisors and coworker support. For the work–treatment balance, the collaboration between the worker and the related parties (workplace staff, occupational physician, etc.) and the understanding of their coworkers toward the worker with the disease are important[3]. We observed that the those who received support for work–treatment balance were more likely to be in large workplaces with more than 1,000 employees because these larger companies have better health management systems[23]. In particular, in Japan, workplaces with more than 1,000 employees employ dedicated occupational physi-

Table 4. Comparison of the JCQ and UWES-3 scores for the receipt state of support for work–treatment balance groups by company size

Parameters	Company size (# of employees)	Group	Sex-age adjusted			Multivariate *		
			Coef.	95% CI	*p*	Coef.	95% CI	*p*
JCQ subscales								
Job demands	≤9	Supported	0.96	[0.42 – 1.51]	<0.001	0.95	[0.42 – 1.48]	<0.001
		Unsupported	2.73	[2.31 – 3.15]	<0.001	2.51	[2.09 – 2.92]	<0.001
		Control		Reference			Reference	
	10–49	Supported	0.96	[0.37 – 1.55]	0.002	0.84	[0.26 – 1.41]	0.004
		Unsupported	3.05	[2.60 – 3.49]	<0.001	2.91	[2.48 – 3.35]	<0.001
		Control		Reference			Reference	
	50–999	Supported	0.65	[0.25 – 1.05]	0.001	0.67	[0.28 – 1.05]	0.001
		Unsupported	2.87	[2.56 – 3.17]	<0.001	2.68	[2.38 – 2.97]	<0.001
		Control		Reference			Reference	
	≥1,000	Supported	0.61	[0.17 – 1.05]	0.007	0.64	[0.21 – 1.06]	0.004
		Unsupported	2.81	[2.43 – 3.19]	<0.001	2.59	[2.22 – 2.96]	<0.001
		Control		Reference			Reference	
Job control	≤9	Supported	0.16	[−0.95 – 1.26]	0.782	0.58	[−0.48 – 1.63]	0.285
		Unsupported	−3.09	[−3.95 – −2.24]	<0.001	−2.29	[−3.11 – −1.46]	<0.001
		Control		Reference			Reference	
	10–49	Supported	0.83	[−0.32 – 1.98]	0.158	0.47	[−0.63 – 1.57]	0.400
		Unsupported	−2.15	[−3.02 – −1.29]	<0.001	−1.82	[−2.65 – −0.98]	<0.001
		Control		Reference			Reference	
	50–999	Supported	0.52	[−0.26 – 1.30]	0.192	0.51	[−0.23 – 1.26]	0.179
		Unsupported	−2.30	[−2.89 – −1.70]	<0.001	−2.08	[−2.64 – −1.51]	<0.001
		Control		Reference			Reference	
	≥1,000	Supported	0.71	[−0.14 – 1.57]	0.101	0.86	[0.04 – 1.68]	0.040
		Unsupported	−2.86	[−3.59 – −2.12]	<0.001	−2.84	[−3.55 – −2.13]	<0.001
		Control		Reference			Reference	
Supervisor support	≤9	Supported	1.45	[1.12 – 1.77]	<0.001	1.37	[1.04 – 1.69]	<0.001
		Unsupported	−1.05	[−1.3 – −0.80]	<0.001	−1.04	[−1.30 – −0.79]	<0.001
		Control		Reference			Reference	
	10–49	Supported	0.90	[0.59 – 1.20]	<0.001	0.88	[0.58 – 1.18]	<0.001
		Unsupported	−1.61	[−1.84 – −1.38]	<0.001	−1.54	[−1.77 – −1.31]	<0.001
		Control		Reference			Reference	
	50–999	Supported	0.35	[0.16 – 0.55]	<0.001	0.33	[0.14 – 0.53]	0.001
		Unsupported	−1.48	[−1.63 – −1.33]	<0.001	−1.43	[−1.58 – −1.28]	<0.001
		Control		Reference			Reference	
	≥1,000	Supported	0.38	[0.17 – 0.59]	<0.001	0.41	[0.20 – 0.62]	<0.001
		Unsupported	−1.70	[−1.88 – −1.52]	<0.001	−1.68	[−1.86 – −1.50]	<0.001
		Control		Reference			Reference	
Coworker support	≤9	Supported	1.07	[0.77 – 1.36]	<0.001	1.01	[0.71 – 1.31]	<0.001
		Unsupported	−0.87	[−1.1 – −0.64]	<0.001	−0.84	[−1.07 – −0.61]	<0.001
		Control		Reference			Reference	
	10–49	Supported	0.38	[0.12 – 0.64]	0.004	0.36	[0.10 – 0.61]	0.006
		Unsupported	−1.18	[−1.38 – −0.99]	<0.001	−1.12	[−1.31 – −0.93]	<0.001
		Control		Reference			Reference	
	50–999	Supported	0.24	[0.07 – 0.41]	0.005	0.22	[0.05 – 0.39]	0.009
		Unsupported	−1.15	[−1.28 – −1.02]	<0.001	−1.12	[−1.25 – −0.99]	<0.001
		Control		Reference			Reference	
	≥1,000	Supported	0.19	[0.02 – 0.37]	0.032	0.21	[0.03 – 0.39]	0.02
		Unsupported	−1.23	[−1.39 – −1.08]	<0.001	−1.23	[−1.38 – −1.07]	<0.001
		Control		Reference			Reference	

Table 4. Continued

Parameters	Company size (# of employees)	Group	Sex-age adjusted			Multivariate *		
			Coef.	95% CI	*p*	Coef.	95% CI	*p*
UWES-3	≤9	Supported	0.08	[−0.07 – 0.22]	0.312	0.10	[−0.04 – 0.25]	0.164
		Unsupported	−0.39	[−0.51 – −0.28]	<0.001	−0.34	[−0.45 – −0.22]	<0.001
		Control		Reference			Reference	
	10–49	Supported	0.13	[−0.03 – 0.29]	0.118	0.09	[−0.06 – 0.25]	0.233
		Unsupported	−0.48	[−0.6 – −0.35]	<0.001	−0.44	[−0.55 – −0.32]	<0.001
		Control		Reference			Reference	
	50–999	Supported	0.05	[−0.05 – 0.15]	0.331	0.04	[−0.06 – 0.14]	0.434
		Unsupported	−0.52	[−0.6 – −0.45]	<0.001	−0.50	[−0.58 – −0.43]	<0.001
		Control		Reference			Reference	
	≥1,000	Supported	−0.01	[−0.12 – 0.11]	0.898	0.01	[−0.10 – 0.13]	0.804
		Unsupported	−0.65	[−0.75 – −0.55]	<0.001	−0.65	[−0.75 – −0.55]	<0.001
		Control		Reference			Reference	

CI: Confidence interval. JCQ, Job Contents Questionnaire, UWES-3: Utrecht Work Engagement Scale-3. Control group comprised those who did not need support for work–treatment balance; unsupported group comprised those who needed support but were not receiving it; supported group comprised those who needed support and were actually receiving it.

* The multivariate model was adjusted for age, sex, educational background, occupation, working hours per day.

cians, and their interventions and awareness-raising about the work–treatment balance may have a significant positive impact on increasing social support.

We found that the work engagement of the participants who have received support for the work–treatment balance is higher than that of those who need that support but are not receiving it, and is almost the same level as that of those who do not need that support. Based on the job demands-resources model (JD-R model), we believe that appropriate job demands and high social support as job resources contributed to the higher work engagement of the group. A meta-analysis examining the relationship between work engagement and outcomes reported that high work engagement has a positive impact on physical and mental health, organizational commitment, and job performance[24]. In addition, Chan *et al.* suggest that workplace interventions can improve various modifiable factors that reduce work engagement, such as psychological distress and bullying in workplace, which may help increase work engagement among workers[25]. We suggest that the approach to work–treatment balance could contribute significantly not only to the health condition of workers with diseases but also to their positive attitude toward work.

This study was conducted in December 2020 during the COVID-19 pandemic, and there are concerns that the psychological impact of the COVID-19 pandemic may worsen the health status of individuals[9, 10]. We believe that work–treatment balance could be necessary during pandemics. For example, in Sweden, sick-leave rates almost doubled during March and April 2020, which was the first COVID-19 wave, compared with the previous year, suggesting that this increase in sick leave is largely due to prolonged COVID-19 symptoms[26]. COVID-19-related symptoms can be protracted and require intensive medical care[27–29]. In addition, it has been reported that the fear of COVID-19 infection or the government's encouragement to avoid going out unnecessarily may lead to refraining from taking action to seek medical care[13]. Meanwhile, it has been reported that the aftermath of tragic events, such as the current COVID-19 pandemic, may also yield positive outcomes including enhanced resilience and stress coping skills and that organizational interventions could be important in bringing about these positive outcomes[30–32]. The organizational intervention such as the work–treatment balance will become increasingly important due to the major impact of the COVID-19 pandemic on human psychosomatic health.

Concerning the company size, participants receiving support for work–treatment balance in micro-scaled companies had the highest mean scores for supervisor support or coworker support. Moreover, the relationship between these scores and the receipt state of support for work–treatment balance also was stronger in micro-scaled companies. The organizational characteristics of small-sized companies include multiple roles, long working hours, and emotional and financial commitment, which may exacerbate job stress[33]. However, if small-sized companies have adequate support measures for workers' diseases, employees might find it easier to recognize social support owing of their close, frequent communication with other workers.

This, in turn, may reduce job stress and affect employees' mental health positively.

Through company size evaluation, we found that more than half of the participants who needed support for work-treatment balance were unable to receive it, even in companies of larger size. To explain this, we consider the issue of occupational health staff placement as required by the Occupational Safety and Health Law. The Occupational Safety and Health Law determines the requirements for the allocation of occupational health staff[6, 34]. For a company with 50–999 employees, there is one part-time occupational physician, and the number of health officers gradually increases from one to three, depending on company size. The number of staff slowly increases to one full-time occupational physician and four health officers for a company with 1,000–1,999 employees, and one full-time occupational physician and five health officers for a company with 2,000–2,999 employees. When the company size is 3,000 employees or more, the maximum number of occupational health staff required is one full-time occupational physician, one part-time occupational physician, and six health officers, and this number does not increase regardless of company size. Therefore, the number of occupational health staff might not have sufficient outreach for all the employees as company sizes increase, and the employees who need support for work-treatment balance might not fully receive it.

This study has some limitations. First, because this study was an Internet-based survey, generalizability may be insufficient. We attempted to reduce bias in recruiting participants. Second, this study is a cross-sectional study, and the causal relationship between work–treatment balance and job stress or work engagement is not clear. Third, the concrete disease diagnoses of the participating workers receiving the support of the work–treatment balance is unknown. In Japan, the proportion of workers with mental health disorders is higher than that of brain and heart diseases[3], and it cannot be denied that there was a bias in these results. Fourth, this study was conducted during a COVID-19 epidemic, and we cannot deny the possibility that this may have modified these results. Further research should be conducted at normal times.

Conclusion

This study has shown an association among support for the work–treatment balance, job stress, and work engagement in Japan. Those who received support for work–treatment balance reported lower job stress and higher work engagement, and this trend was more pronounced for those working at micro-sized companies. Ensuring work–treatment balance could have a positive impact on workers' mental health.

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Author Contributions

KI created the questionnaire, analyzed the data, and wrote the manuscript. HA and AO reviewed the manuscript, analyzed the data, and provided advice on interpretation. HE, MT, ST, TN, and SM reviewed the manuscript. YF reviewed the manuscript and contributed to the overall survey planning, questionnaire creation, and securing funding for research.

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Ethical Approval

This study was approved by the ethics committee of the University of Occupational and Environmental Health, Japan (reference No. R2-079). Participants' informed consent was obtained through a form on a website.

Conflict of Interests

The authors have no conflicts of interest to declare regarding this study.

References

1) Japan Ministry of Health, Labour and Welfare. [Support to return to work for employees of sick leave suffering from mental disorders.] https://www.mhlw.go.jp/stf/seisakunitsuite/bunya/0000055195_00005.html (in Japanese). Accessed July 3, 2021.
2) Japan Ministry of Health, Labour and Welfare. [Roles of Psychiatrists and Psychosomatic Physicians in the Mental Health Support to Workers (Preventive Activities for Mental Health of Workers: From the Perspective of Psychosomatic Medicine).] https://www.mhlw.go.jp/content/000560416.pdf (in Japanese). Accessed July 3, 2021.
3) Japan Ministry of Health, Labour and Welfare. [Guideline for Support of Balancing Medical Treatment and Occupational Life in the Workplace (Revised edition).] https://www.mhlw.go.jp/content/11200000/000912019.pdf (in Japanese). Accessed July 1, 2021.
4) Rantanen J, Lehtinen S, Iavicoli S (2013) Occupational health services in selected International Commission on Occupational Health (ICOH) member countries. Scand J Work Environ Health **39**, 212–6.
5) Jain A, Hassard J, Leka S, Di Tecco C, Iavicoli S (2021) The role of occupational health services in psychosocial risk management and the promotion of mental health and well-being at work. Int J Environ Res Public Health **18**, 3632.
6) e-Gov. [Industrial Safety and Health Law.] https://elaws.e-gov.go.jp/document?lawid=347AC0000000057 (in Japanese). Accessed January 27 2022.
7) Mills A, Lin J (2004) Effect of company size on occupational health and safety. Int J Constr Manag **4**, 29–39.
8) World Health Organization. Coronavirus Disease (COVID-19) Pandemic. https://www.who.int/emergencies/diseases/novel-coronavirus-2019. Accessed 25 December, 2020
9) Vindegaard N, Benros ME (2020) COVID-19 pandemic and mental health consequences: systematic review of the current evidence. Brain Behav Immun **89**, 531–42.
10) Giorgi G, Lecca LI, Alessio F, Finstad GL, Bondanini G, Lulli LG, Arcangeli G, Mucci N (2020) COVID-19-related mental health effects in the workplace: a narrative review. Int J Environ Res Public Health **17**, 7857.
11) Wu Z, McGoogan JM (2020) Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: summary of a report of 72 314 cases from the Chinese Center for Disease Control and Prevention. JAMA **323**, 1239–42.
12) Williamson EJ, Walker AJ, Bhaskaran K, Bacon S, Bates C, Morton CE, Curtis HJ, Mehrkar A, Evans D, Inglesby P, Cockburn J, McDonald HI, MacKenna B, Tomlinson L, Douglas IJ, Rentsch CT, Mathur R, Wong AYS, Grieve R, Harrison D, Forbes H, Schultze A, Croker R, Parry J, Hester F, Harper S, Perera R, Evans SJW, Smeeth L, Goldacre B (2020) Factors associated with COVID-19-related death using OpenSAFELY. Nature **584**, 430–6.
13) Takakubo T, Odagiri Y, Machida M, Takamiya T, Fukushima N, Kikuchi H, Amagasa S, Nakamura I, Watanabe H, Inoue S (2021) Changes in the medical treatment status of Japanese outpatients during the coronavirus disease 2019 pandemic. J Gen Fam Med **22**, 246–61.
14) Ammar A, Brach M, Trabelsi K, Chtourou H, Boukhris O, Masmoudi L, Bouaziz B, Bentlage E, How D, Ahmed M (2020) Effects of COVID-19 home confinement on eating behaviour and physical activity: results of the ECLB-COVID19 international online survey. Nutrients **12**, 1583.
15) Lupien SJ, McEwen BS, Gunnar MR, Heim C (2009) Effects of stress throughout the lifespan on the brain, behaviour and cognition. Nat Rev Neurosci **10**, 434–45.
16) Black JK, Balanos GM, Whittaker Previously Phillips AC (2017) Resilience, work engagement and stress reactivity in a middle-aged manual worker population. Int J Psychophysiol **116**, 9–15.
17) Fujino Y, Ishimaru T, Eguchi H, Tsuji M, Tateishi S, Ogami A, Mori K, Matsuda S (2021) Protocol for a nationwide Internet-based health survey of workers during the COVID-19 pandemic in 2020. J UOEH **43**, 217–25.
18) Karasek R (1985) Job content questionnaire and users guide Lowell. University of Massachusetts, Massachusetts.
19) Kawakami N, Kobayashi F, Araki S, Haratani T, Furui H (1995) 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 **2**, 358–75.
20) Shimazu A, Schaufeli W, Kosugi S, Suzuki A, Nashiwa H, Kato A, Sakamoto M, Irimajiri H, Amano S, Hirohata K (2008) Work engagement in Japan: validation of the Japanese version of the Utrecht Work Engagement Scale. J App Psychol **57**, 510–23.
21) Schaufeli WB, Shimazu A, Hakanen J, Salanova M, De Witte H (2019) An ultra-short measure for work engagement: the UWES-3 validation across five countries. Eur J Psychol Assess **35**, 577.
22) Ito M, Togari T, Jeong Park M, Yamazaki Y (2008) Difficulties at work experienced by patients with inflammatory bowel disease (IBD) and factors relevant to work motivation and depression. Japanese Journal of Health and Human Ecology **74**, 290–310.
23) Hirata M, Kumagai S, Tabuchi T, Tainaka H, Andoh K, Oda H (1999) Actual conditions of occupational health activities in small-scale enterprises in Japan: system for occupational health, health management and demands by small-scale

enterprises. Sangyo Eiseigaku Zasshi **41**, 190–201.
24) Halbesleben JR (2010) A meta-analysis of work engagement: relationships with burnout, demands, resources, and consequences. In: Work engagement: A handbook of essential theory and research, Bakker AB, Leiter MP (Eds), 102–17. Psychology Press, London.
25) Chan CMH, Wong JE, Wee LH, Jamil NA, Yeap LLL, Swarna Nantha Y, Siau CS (2020) Psychological and work-related factors predicting work engagement in Malaysian employees. Occup Med (London) **70**, 400–6.
26) Westerlind E, Palstam A, Sunnerhagen KS, Persson HC (2021) Patterns and predictors of sick leave after Covid-19 and long Covid in a national Swedish cohort. BMC Public Health **21**, 1023.
27) Carvalho-Schneider C, Laurent E, Lemaignen A, Beaufils E, Bourbao-Tournois C, Laribi S, Flament T, Ferreira-Maldent N, Bruyere F, Stefic K, Gaudy-Graffin C, Grammatico-Guillon L, Bernard L (2021) Follow-up of adults with noncritical COVID-19 two months after symptom onset. Clin Microbiol Infect **27**, 258–63.
28) Davis HE, Assaf GS, McCorkell L, Wei H, Low RJ, Re'em Y, Redfield S, Austin JP, Akrami A (2021) Characterizing long COVID in an international cohort: 7 months of symptoms and their impact. eClinicalMedicine **38**, 101019.
29) Huang C, Huang L, Wang Y, Li X, Ren L, Gu X, Kang L, Guo L, Liu M, Zhou X, Luo J, Huang Z, Tu S, Zhao Y, Chen L, Xu D, Li Y, Li C, Peng L, Li Y, Xie W, Cui D, Shang L, Fan G, Xu J, Wang G, Wang Y, Zhong J, Wang C, Wang J, Zhang D, Cao B (2021) 6-month consequences of COVID-19 in patients discharged from hospital: a cohort study. Lancet **397**, 220–32.
30) Brooks S, Amlôt R, Rubin GJ, Greenberg N (2020) Psychological resilience and post-traumatic growth in disaster-exposed organisations: overview of the literature. BMJ Mil Health **166**, 52–6.
31) Tedeschi RG, Calhoun LG (1996) The Posttraumatic Growth Inventory: measuring the positive legacy of trauma. J Trauma Stress **9**, 455–71.
32) Finstad GL, Giorgi G, Lulli LG, Pandolfi C, Foti G, León-Perez JM, Cantero-Sánchez FJ, Mucci N (2021) Resilience, coping strategies and posttraumatic growth in the workplace following COVID-19: a narrative review on the positive aspects of trauma. Int J Environ Res Public Health **18**, 9453.
33) Cocker F, Martin A, Scott J, Venn A, Sanderson K (2013) Psychological distress, related work attendance, and productivity loss in small-to-medium enterprise owner/managers. Int J Environ Res Public Health **10**, 5062–82.
34) e-Gov. [Ordinance on Industrial Safety and Health.] https://elaws.e-gov.go.jp/document?lawid=347M50002000032 (in Japanese). Accessed February 20 2022.