The Mediating and Moderating Effects of Workplace Social Capital on the Associations between Adverse Work Characteristics and Psychological Distress among Japanese Workers

Takashi OSHIO[1]*, Akiomi INOUE[2] and Akizumi TSUTSUMI[3]

[1]Institute of Economic Research, Hitotsubashi University, Japan
[2]Department of Mental Health, Institute of Industrial Ecological Sciences, University of Occupational and Environmental Health, Japan
[3]Department of Public Health, Kitasato University School of Medicine, Japan

Abstract: Our current study investigated how workplace social capital (WSC) mediates and moderates the associations between adverse work characteristics and psychological distress among Japanese workers. We collected cross-sectional data (*N*=9,350) from a baseline survey of an occupational Japanese cohort study. We focused on individual WSC and considered job demands/control, effort/reward, and two types (i.e., procedural and interactional) of organizational justice as work-characteristic variables. We defined psychological distress as a score of ≥5 on the Kessler Psychological Distress Scale (K6 scale). Multivariate logistic regression analyses predicted a binary variable of psychological distress by individual WSC and adverse work characteristics, adjusting for individual-level covariates. Individual WSC mediated the associations between adverse work characteristics and psychological distress in almost all model specifications. Additionally, individual WSC moderated the associations of psychological distress with high job demands, high effort, and low interactional justice when we used a high WSC cutoff point. In contrast, individual WSC did not moderate such interactions with low job control, reward, or procedural justice. We concluded that individual WSC mediated the associations between adverse work characteristics and psychological distress among Japanese workers while selectively moderating their associations at high levels of WSC.

Key words: Workplace social capital, Psychological distress, K6 scale, Organizational justice, Logistic regression

Introduction

Workplace social capital (WSC) refers to the contextual psychological conditions in a workplace. This construct has multifold aspects, including the extent and intensity of associational links or activities, as well as perceptions of support, reciprocity, and trust in the workplace[1–9].

---

*To whom correspondence should be addressed.
E-mail: oshio@ier.hit-u.ac.jp

Specifically, WSC has gained attention as a key variable associated with workers' health, and empirical studies have found associations of low WSC with depression[2, 11], hypertension[6, 7], poor self-rated health[4, 11], smoking[3, 12], and high mortality[8]. However, it is possible that WSC serves as a moderator of the impact of job stressors and other adverse work characteristics on individual health outcomes. Indeed, WSC has been found to buffer the association between high job demands and smoking[9], suggesting that it moderates the effects of various types of adverse work characteristics on a wide range of health outcomes. Furthermore, WSC is likely to serve as not only a moderator but also a mediator of the associations between adverse work characteristics and psychological distress, an issue that has been largely unexplored. Indeed, some studies have found that social capital, in general, mediates the associations between external shocks and health-related outcomes[13, 14].

The current study examined whether, and to what extent, individual WSC mediates and moderates the associations between adverse work characteristics and psychological distress, an issue that has not been well examined. We used cross-sectional data collected from an occupational cohort study conducted in Japan from October 2010 to December 2011. We were especially interested in the bonding aspect of WSC. In general, social capital has three types: *bonding, bridging,* and *linking*[15, 16]. *Bonding* refers to the value assigned to social relationships among individuals with similar socioeconomic attributes. *Bridging* describes relationships between dissimilar persons at the same hierarchical level. *Linking* refers to relationships between persons across hierarchical levels. It is widely believed that Japanese workplaces consist of homogeneous workers and that the business culture in Japan stresses teamwork or collectivism[17, 18]. Hence, it is reasonable to characterize WSC in the Japanese workplace as being of the binding type, and it is of interest to examine how WSC affects the impact of adverse work characteristics on Japanese workers' psychological distress.

We concentrated on individual WSC subjectively assessed at the individual level. Although WSC was originally developed as a contextual concept of psychological conditions in the workplace, it is likely that workers assess WSC differently, even in the same work unit, depending on their individual attributes. Moreover, their subjective perceptions of WSC are likely to affect their individual health—in particular, their psychological wellbeing. In addition, some multi-level studies have found that certain aspects of workers' health were more closely associated

with individual, rather than contextual, WSC[2, 11, 12]. As a more general concept, an individual assessment of social capital has been increasingly considered an important determinant of individual health[19–21]. Hence, we examined whether, and to what extent, individual WSC was associated with workers' mental health. Moreover, we assumed, in the current study, that individual WSC was affected by work characteristics, considering that it is an individual assessment of social capital and is not exogenously given to individuals in nature.

Regarding adverse work characteristics, we considered the levels of job demand and control, effort and reward, and two types of organizational justice (i.e., procedural and interactional). We used these variables because they are well-supported in existing models that address the association between adverse work characteristics and health. First, the job demands-control (JD-C) model argues that workers with high job demands and/or low job control have a higher risk of psychological distress[22]. This model has been generally supported by empirical studies[23–25]. Second, the effort-reward imbalance (ERI) model claims that an imbalance between effort expended at work and the rewards received leads to health risks[26]. Empirical studies have provided evidence in support of this model[27–30], and some studies have jointly investigated the validity of both the JD-C and the ERI models[31, 32]. Third, it is well established that lack of organizational justice is negatively associated with workers' mental health status[33–40]. Researchers have often treated procedural and interactional justice as the two primary aspects of organizational justice[33].

We tested three hypotheses regarding the potential roles played by individual WSC in workers' mental health:

1) Low individual WSC will be positively associated with psychological distress (H1), as has been suggested by many previous studies that focused on different health outcomes.

2) Individual WSC will mediate the associations between adverse work characteristics and psychological distress (H2), as suggested by preceding studies that found that social capital serves as a mediator of the associations between external shocks and health[13, 14].

3) Individual WSC will moderate the associations between adverse work characteristics and psychological distress (H3), since it has been found that individual WSC moderates the effects of job demand and strain on smoking behavior[9].

We attempted to examine whether the same is true for the effects of a wider variety of adverse work character-

Table 1. Basic sample features

	Number		Number
Gender		Firm code and type of industry	
Men	7,268	1. Information technology	1,080
Women	2,082	2. Hospital	129
Educational attainment		3. Manufacturing	2,163
High school or below	3,610	4. Information	125
Junior college	1,626	5. Pharmaceutical	249
College or above	4,113	6. Service	34
Job classification		7. Veterinary	6
Managerial workers	1,663	8. Medical	24
Researchers and professionals	1,317	9. Service	797
Engineers and technicians	1,031	10. Manufacturing	3,085
Clerical workers	1,031	11. Transportation	1,040
Service workers	509	12. Real estate	618
Manufacturing workers (technical)	585		
Manufacturing workers (operational)	1,003	N	9,350
Manufacturing workers (manual)	796		
Other	1,106		

Household income (annual, equivalized, million yen) $M=183.2$; $SD=221.7$; $Min=1.9$; $Max=2,100$
Age: $M=40.7$; $SD=10.5$; $Min=18$; $Max=64$

istics and psychological distress. We further predicted that individual WSC will moderate the effects of adverse work characteristics selectively, rather than uniformly. In general, job demands and control, effort and reward, and organizational justice are different characteristics in terms of their situational levels and/or sources; thus, it is reasonable to predict that individual WSC would moderate some, but not all, of these work characteristics.

One possible suspicion is that the results may be sensitive to the choice of cutoff points for the individual WSC scores. Previous studies have used the mean[3–6, 9, 10] or another reasonable, but tentative, criterion[11, 12] as a cutoff point when using individual WSC as a binary variable, while the observed associations between individual WSC and mental health were quite different across WSC levels[1, 2, 7]. Hence, in the current study, we alternatively used high and low WSC cutoff points to examine the sensitivity of the results to their choices.

Subjects and Methods

Study sample

We used cross-sectional data from the baseline survey of an occupational cohort study on social class and health in Japan (Japanese Study of Health, Occupation, and Psychosocial Factors Related Equity; J-HOPE), which was conducted from October 2010 to December 2011. The study population consisted of employees representing several different industries and a wide variety of occupations. The original sample included 10,807 workers from 12 companies (the companies employed between 8 and 3,462 of the respondents, with a mean corporation size of 901 employees, as represented by our sample). The response rate was 77.4%. The basic composition of the sample is summarized in Table 1.

Participants completed the Job Content Questionnaire (JCQ), the Effort-Reward Imbalance Questionnaire (ERIQ), the Organizational Justice Questionnaire (OJQ), the K6 scale, and a self-administered questionnaire that measured WSC, additional work-related psychological variables, and other individual attributes. We analyzed the data collected from 9,350 respondents (7,265 men; 2,085 women; 86.5% of the original sample), after the responses with missing data were removed.

The Ethics Committee of the Graduate School of Medicine/Faculty of Medicine at the University of Tokyo, Kitasato University School of Medicine/Hospital, and the University of Occupational and Environmental Health, Japan, reviewed and approved the aims and procedures of this study (No. 2772, B12-103 and 10-004, respectively).

Measures

Workplace social capital

We assessed WSC specifically at an individual level using the following three items scored on a four-point scale (1=*disagree*, 2=*somewhat disagree*, 3=*somewhat agree*, and 4=*agree*): (i) "We have a 'we are together' attitude," (ii) "People feel understood and accepted by each other," and (iii) "People keep each other informed about work-related issues in the work unit." These three items were adapted from Kouvonen *et al.*[1, 2] and were intended to measure the degrees of the WSC bonding aspects. Whereas Kouvonen and her colleagues used five-point scales, we used a four-point scale. Cronbach's alpha coefficient for these three items was 0.83 in this study sample. We combined the responses to these items into a single index (range: 3–12) and constructed two types of binary variables that allocated a one to low WSC scores and a zero to high scores—one with a low cutoff point (8) that divided the sample into low (24.6% of the respondents) and high (75.4% of the respondents) WSC, and the other with a high cutoff point (10) that divided the sample into low (79.4% of the respondents) and high (20.6% of the respondents) WSC. We chose these two thresholds, 8 and 10, considering that more than a half (54.9%) of the respondents reported 8 or 9 as WSC scores (17.2% for 8 and 37.7% for 9).

Job demands and control

We utilized the items investigating job demands and control from the Japanese version of the JCQ. The JCQ, developed by Karasek[41], is based on the JD-C and includes scales for job demands (five items) and job control (nine items) rated on a four-point scale (1=*strongly disagree* to 4=*strongly agree*). The internal consistency, reliability, and validity of the Japanese version of the JCQ are acceptable, as shown by Kawakami *et al*[42]. In the present study's sample, Cronbach's alpha coefficients were 0.69 and 0.76 for the job demands and control scales, respectively. We summed the responses to these items into single indices of job demands (range: 12–48) and control (range: 24–96), according to the weights established by Karasek[41]. We also calculated the job demands/control ratio to measure the extent of job strain, as did Landsbergis *et al*[43]. We used the medians as the cutoff points of the binary variables that classified each worker as having either high or low job demands, job control, and job strain.

Effort and reward

To assess effort and reward, we utilized data collected from a simplified Japanese version of the ERIQ. A simplified version of the original ERIQ was developed by Siegrist *et al.*[44] based on their ERI model. Tsutsumi *et al.*[45] reported that the Japanese version of the ERIQ had acceptable internal consistency, reliability, and validity scores. Siegrist *et al.*[46] developed a simplified version of the ERIQ; we used its Japanese version in the current study. This version includes scales for effort (three items) and reward (seven items) rated on a four-point scale (1=*strongly disagree* to 4=*strongly agree*). Cronbach's alpha coefficients were 0.78 and 0.74 for the effort and reward scales, respectively. We summed the responses to these items into single indices for effort (range: 3–12) and reward (range: 7–28). We also calculated the effort/reward ratio and adjusted for differences between the two items to measure the extent of the ERI. We used the medians as the cutoff points for the binary variables classifying each worker as exhibiting either high or low efforts, rewards, and ERI scores.

Procedural and interactional justice

Two aspects (i.e., procedural and interactional) of organizational justice were measured by the Japanese version of the OJQ. The OJQ was developed by Moorman[47] and was modified by Elovainio *et al.*[34]; the reliability and validity of the Japanese version were largely confirmed by Inoue *et al*[48]. The OJQ comprises a seven-item scale for measuring procedural justice and a six-item scale for measuring interactional justice, both of which are rated on a five-point scale (1=*strongly disagree* to 5=*strongly agree*). In this sample, Cronbach's alpha coefficients were 0.88 and 0.94 for procedural and interactional justice scales, respectively. For each justice type, we summed all item scores and divided that number by the number of items in that category to yield a variable with a range of 1–5. We used the medians as the cutoff points for the binary variables classifying each worker as either high or low in procedural and interactional justice.

Psychological distress

We measured psychological distress using the K6 six-item psychological distress questionnaire, which is rated on a five-point scale (0=*none of the time* to 4=*all of the time*)[49, 50]. Cronbach's alpha coefficient for this sample was 0.89. We calculated the total score (range: 0–24) and adopted ≥5 as the threshold for psychological distress, since scores ≥5 on this scale have been correlated to mood/anxiety disorders in Japanese people[51, 52]. The proportion of those with K6 ≥5 in this sample was 51.2%.

Table 2.   Pairwise correlation matrix among key variables[a]

	1	2	3	4	5	6	7	8	9
1. Individual workplace social capital									
2. Job demands	−0.063								
3. Job control	0.227	0.234							
4. Job strain (job demands/control)	−0.225	0.586	−0.610						
5. Effort	−0.097	0.602	0.189	0.301					
6. Reward	0.389	−0.087	0.307	−0.303	−0.108				
7. Effort reward imbalance (effort/reward)	−0.281	0.494	−0.022	0.393	0.774	−0.651			
8. Procedural justice	0.519	−0.132	0.273	−0.319	−0.135	0.464	−0.360		
9. Interactional justice	0.470	−0.070	0.310	−0.305	−0.093	0.489	−0.340	0.635	
10. Psychological distress	−0.283	0.265	−0.109	0.287	0.285	−0.354	0.418	−0.249	−0.244

[a]Computed for the originally categorized or continuous (i.e., not dichotomized) variables. $p<0.001$ for all pairs, except for job control and effort/reward ($p<0.1$).

Covariates

We used gender, age group (20s–60s), educational attainment (high school or below, junior college, or college and above), and nine job types as covariates. Further, the J-HOPE asked respondents to report their pre-tax annual household income according to six brackets (≤2.99 million yen, 3–4.99 million yen, 5–7.99 million yen, 8–9.99 million yen, 10–14.99 million yen, and ≥15 million yen). We divided the mean values in each bracket by the number of family members to adjust for household size. Subsequently, we categorized the respondents into quintiles.

Analytic strategy

We employed multivariate logistic regression models to predict a binary variable capturing psychological distress by individual WSC and adverse work characteristics, adjusting for individual-level covariates. To complete our statistical analysis, we used the Stata data analysis software (version 11; StataCorp). Ideally, we would conduct multilevel analyses to examine both individual and contextual WSC; however, the number of companies (12) seemed too small to apply multilevel analysis to the current large sample (N=9,350). We also found that the interclass correlation (ICC) was relatively low (1.63%), even for an "empty model," which predicted psychological distress without any explanatory variable. Hence, we conducted an individual-level analysis, rather than a multilevel one. Furthermore, we found no significant change in results when including company dummies to capture company-level fixed effects.

We estimated four models for each adverse work characteristic, including individual-level covariates, in all regression models. Model 1 predicted the probability of psychological distress related to each work characteristic.

Model 2 predicted low individual WSC related to each work characteristic, while Model 3 predicted psychological distress by both work characteristic and low individual WSC. By combining the results from Models 1, 2, and 3, we were able to examine the mediating effects of individual WSC on the associations between each work characteristic and psychological distress in the framework of mediation analysis[53, 54]. Specifically, after checking the statistical significance of the association between individual WSC and each work characteristic in Model 2, we examined how much the odds ratios (ORs) associated with each work characteristic in Model 1 were reduced in Model 3. We also computed the proportion of the mediated association between each work characteristic and psychological distress, along with the 95% confidence interval obtained from our bootstrap estimation (with 2,000 replications). Finally, Model 4 added the interaction term between high job demands and low individual WSC to Model 3 to assess the moderating effect of individual WSC. To assess the moderating effect, we focused on the OR of the interaction term. We estimated these four models according to both low and high WSC cutoff points.

Results

Table 2 summarizes the pairwise correlations between individual WSC, work characteristics, and psychological distress, all of which were expressed in terms of their originally categorized (not dichotomized) values. Psychological distress was positively associated with higher values for job demands, job strain (job demands/control), effort, and ERI (effort/reward), but it was negatively associated with higher values for job control, rewards, and organizational justice. We observed a negative association

Table 3. Estimated associations across adverse work characteristics, low individual WSC, and psychological distress using a low WSC cutoff point[a] (Models 1–3)

Model	Model 1	Model 2	Model 3		Proportion (%) of Mediating effect
Dependent variable	Psychological distress	Low individual WSC	Psychological distress		
Independent variable	Work characteristic	Work characteristic	Work characteristic	Low individual WSC	
	OR[c] 95% CI[d]	OR[c] 95% CI[d]	OR[c] 95% CI[d]	OR[c] 95% CI[d]	% 95% CI[e]
Job demands (high)	2.09 (1.92–2.28)	1.38 (1.25–1.52)	2.04 (1.87–2.22)	2.18 (1.97–2.41)	7.8 (5.7– 10.4)
Job control (low)	1.41 (1.29–1.54)	1.98 (1.78–2.19)	1.29 (1.18–1.41)	2.17 (1.97–2.40)	34.4 (25.5–47.1)
Job strain (high)	2.27 (2.09–2.47)	1.89 (1.71–2.08)	2.13 (1.95–2.32)	2.06 (1.86–2.28)	12.2 (9.7–14.8)
Effort (high)	2.49 (2.28–2.72)	1.39 (1.26–1.54)	2.43 (2.23–2.66)	2.17 (1.96–2.41)	6.8 (4.9–8.9)
Reward (low)[b]	2.90 (2.66–3.17)	3.50 (3.14–3.90)	2.60 (2.38–2.85)	1.76 (1.59–1.96)	15.4 (12.3–18.5)
Effort reward imbalance (high)[b]	3.36 (3.07–3.67)	2.26 (2.04–2.50)	3.12 (2.86–3.42)	1.88 (1.69–2.09)	9.8 (8.0–11.9)
Procedural justice (low)	1.90 (1.75–2.07)	2.35 (2.16–2.57)	1.61 (1.48–1.76)	1.90 (1.71–2.11)	32.5 (26.3–38.7)
Interactional justice (low)	2.02 (1.85–2.20)	2.51 (2.30–2.74)	1.73 (1.58–1.89)	1.89 (1.70–2.09)	29.6 (24.0–35.7)

[a]Adjusted for gender, age, educational attainment, household income, and job classification in all models. The cutoff point was 8 (in the range 3–12), and the proportion of respondents with WSC below the cutoff point was 24.6%. [b]N=9,157 for reward and effort/reward. [c]OR: Odds ratio. [d]CI: Confidence interval. [e]Bias-corrected and accelerated confidence interval based on bootstrap estimation with 2,000 replications.

Table 4. Estimated associations across adverse work characteristics, low individual WSC, and psychological distress using a high WSC cutoff point[a] (Models 1–3)

Model	Model 1	Model 2	Model 3		Proportion (%) of Mediating effect
Dependent variable	Psychological distress	Low individual WSC	Psychological distress		
Independent variable	Work characteristic	Work characteristic	Work characteristic	Low individual WSC	
	OR[c] 95% CI[d]	OR[c] 95% CI[d]	OR[c] 95% CI[d]	OR[c] 95% CI[d]	% 95% CI[e]
Job demands (high)	2.09 (1.92–2.28)	1.11 (1.00–1.23)	2.10 (1.93–2.30)	2.31 (2.07–2.57)	2.3 (–0.2– 4.5)
Job control (low)	1.41 (1.29–1.54)	2.28 (2.03–2.56)	1.28 (1.17–1.41)	2.20 (1.98–2.45)	39.1 (29.5–52.1)
Job strain (high)	2.27 (2.09–2.47)	1.82 (1.64–2.02)	2.15 (1.98–2.35)	2.11 (1.89–2.34)	11.0 (8.7–13.7)
Effort (high)	2.49 (2.28–2.72)	1.41 (1.27–1.57)	2.43 (2.23–2.66)	2.20 (1.98–2.46)	6.4 (4.5–8.4)
Reward (low)[b]	2.90 (2.66–3.17)	3.06 (2.74–3.43)	2.65 (2.42–2.90)	1.83 (1.64–2.05)	13.7 (11.1–16.8)
Effort reward imbalance (high)[b]	3.36 (3.07–3.67)	2.03 (1.83–2.26)	3.18 (2.91–3.47)	1.96 (1.76–2.19)	8.4 (6.6–10.3)
Procedural justice (low)	1.90 (1.75–2.07)	2.35 (2.16–2.57)	1.65 (1.51–1.80)	1.94 (1.74–2.17)	30.3 (24.7–36.6)
Interactional justice (low)	2.02 (1.85–2.20)	2.51 (2.30–2.74)	1.75 (1.60–1.91)	1.90 (1.70–2.12)	28.0 (22.5–34.2)

[a]Adjusted for gender, age, educational attainment, household income, and job classification in all models. The cutoff point was 10 (in the range 3–12), and the percentage of respondents with WSC below the cutoff point was 79.4%. [b]N=9,157 for reward and effort/reward. [c]OR: Odds ratio. [d]CI: Confidence interval. [e]Bias-corrected and accelerated confidence interval based on bootstrap estimation with 2,000 replications.

between individual WSC and psychological distress. Further, we found significant correlations between the work characteristics.

Table 3 summarizes the results of Models 1–3, using a low WSC cutoff point. To conserve space, the results regarding the covariates are not reported. As seen in this table, Model 1 confirmed a positive association between each adverse work characteristic and psychological distress. Model 2 showed a positive association between

each adverse work characteristic and low individual WSC. Model 3 indicated that both adverse work characteristics and low individual WSC were positively related to psychological distress. The estimated associations in Models 1–3 were all highly significant. More importantly, the ORs of adverse work characteristics in Model 3 were somewhat lower than those observed in Model 1, suggesting that individual WSC served as a mediator in the associations between adverse work characteristics and psychologi-

Table 5. Estimated associations of psychological distress with adverse work characteristics, low individual WSC, and their interactions using a low WSC cutoff point[a] (Model 4)

	Work characteristics	Low individual WSC	Work characteristics × Low individual WSC
	OR[c] 95% CI[d]	OR[c] 95% CI[d]	OR[c] 95% CI[d]
Job demands (high)	1.98 (1.79–2.18)	2.04 (1.77–2.35)	1.14 (0.93–1.40)
Job control (low)	1.32 (1.20–1.47)	2.32 (1.91–2.70)	0.89 (0.73–1.09)
Job strain (high)	2.11 (1.91–2.33)	2.01 (1.73–2.33)	1.04 (0.85–1.28)
Effort (high)	2.51 (2.27–2.78)	2.35 (2.02–2.74)	0.87 (0.71–1.06)
Reward (low)[b]	2.56 (2.32–2.84)	1.67 (1.41–1.99)	1.08 (0.87–1.34)
Effort reward imbalance (high)[b]	3.19 (2.88–3.53)	1.97 (1.69–2.31)	0.91 (0.74–1.13)
Procedural justice (low)	1.68 (1.53–1.86)	2.22 (1.84–2.68)	0.80 (0.64–1.00)
Interactional justice (low)	1.78 (1.61–1.96)	2.09 (1.72–2.53)	0.86 (0.69–1.09)

[a]Adjusted for gender, age, educational attainment, household income, and job classification in all models. The cutoff point was 8 (in the range 3–12), and the proportion of respondents with WSC below the cutoff point was 24.6%. [b]N=9,157 for reward and effort/reward. [c]OR: Odds ratio. [d]CI: Confidence interval.

Table 6. Estimated associations of psychological distress with adverse work characteristics, low individual WSC, and their interactions using a high WSC cutoff point[a] (Model 4)

	Work characteristics	Low individual WSC	Work characteristics × Low individual WSC
	OR[c] 95% CI[d]	OR[c] 95% CI[d]	OR[c] 95% CI[d]
Job demands (high)	1.67 (1.38–2.03)	1.98 (1.69–2.31)	1.33 (1.07–1.64)
Job control (low)	1.26 (1.03–1.55)	2.18 (1.91–2.50)	1.02 (0.82–1.27)
Job strain (high)	1.79 (1.48–2.18)	1.91 (1.66–2.20)	1.25 (1.01–1.56)
Effort (high)	2.03 (1.67–2.46)	1.95 (1.66–2.28)	1.25 (1.01–1.55)
Reward (low)[b]	2.46 (2.00–2.96)	1.77 (1.54–2.03)	1.09 (0.87–1.38)
Effort reward imbalance (high)[b]	2.61 (2.14–3.18)	1.76 (1.52–2.04)	1.28 (1.02–1.59)
Procedural justice (low)	1.58 (1.26–1.99)	1.92 (1.69–2.18)	1.05 (0.82–1.35)
Interactional justice (low)	1.31 (1.05–1.63)	1.72 (1.51–1.96)	1.41 (1.11–1.80)

[a]Adjusted for gender, age, educational attainment, household income, and job classification in all models. The cutoff point was 10 (in the range 3–12), and the percentage of respondents with WSC below the cutoff point was 79.4%. [b]N=9,157 for reward and effort/reward. [c]OR: Odds ratio. [d]CI: Confidence interval.

cal distress. The rightmost column reports the estimated proportions of the mediated association, underscoring the significant mediating effects of individual WSC for all work characteristics. Notably, the proportion of the mediated association was about 30% or more for job control, procedural justice, and interactional justice.

Table 4 provides the results obtained when replacing a low WSC cutoff point with a high one. The results were almost similar to those in Table 3, with one exception: job demand, for which individual WSC did not significantly mediate its associations with psychological distress. The proportion of the mediating effect was higher for job control, procedural justice, and interactional justice, in line with the results found in Table 3.

Then, we turned to the moderation analysis. Table 5

summarizes the estimated ORs for psychological distress in response to each work characteristic, low individual WSC, and their interactions; these estimated ORs were obtained from Model, 4 with a low WSC cutoff point. For all work characteristics, we observed that psychological distress was positively associated with adverse work characteristics and low individual WSC, as already observed in Table 3. The more noteworthy finding was that the ORs of none of the interaction terms were different from one at the 5% significance level, indicating that individual WSC did not have a moderating effect.

Finally, Table 6 provides the results of the moderation analysis with a high WSC cutoff. Unlike the results presented in Table 5, we observed significantly higher-than-one ORs for job demands, job strain, and effort, ERI,

interactional justice, but not for job control, reward, or procedural justice. Considering the lack of moderating effects on job control and reward, we can argue that the moderating effects of individual WSC on job strain and ERI were attributable to WSC's moderating effects on job demands and effort, respectively.

Discussion

We focused on individuals' WSC and used cross-sectional data collected from a Japanese occupational survey to investigate its importance in maximizing workers' mental health. We tested the following three hypotheses—H1: low levels of individual WSC are positively associated with psychological distress, H2: individual WSC mediates the associations between adverse work characteristics and psychological distress, and H3: individual WSC works as a moderator in these associations. The estimation results supported H1 and H2 but did not fully support H3, as is summarized in the following discussion.

First, individual WSC was negatively associated with psychological distress. This result supported H1 and agreed with the observations of preceding studies on the association between individual WSC and depression[2, 10]. Second, individual WSC mediated the associations between adverse job characteristics and psychological distress in almost all model specifications. This result supported H2 and suggested that an individual assessment of WSC was affected by various job characteristics. These two results, which held true regardless of whether WSC cutoff levels were high or low, confirmed the validity of H1 and H2.

In contrast, the results regarding the moderating effects were mixed and were not fully supportive of H3. We first found that the moderating effect of individual WSC was observed with only a high WSC cutoff point, implying that intensive efforts to enhance WSC are necessary to increase its effectiveness as a moderator of adverse work characteristics.

We also observed that individual WSC selectively moderated the associations between adverse work characteristics and psychological distress, even with a high WSC cutoff point. Individual WSC moderated the associations of psychological distress with high job demands, high effort, and low interactional justice, but no moderation effects were observed in the case of associations between psychological distress and low job control, reward, and procedural justice. These results seem to reflect differences in work characteristics. Job demands and effort basically

refer to the external pressures exerted upon workers by supervisors, co-workers, or institutions. In contrast, job control and reward are supportive resources with which workers can cope with job stresses, such as individual WSC. Individual WSC tends to react to changes in workplace conditions in a similar direction as job control and reward, as suggested by the results of Model 2, which demonstrated that the ORs of job control and reward were higher than those of job demand and effort, respectively (Tables 3 and 4). Hence, the moderating effects of individual WSC on the associations of psychological distress with job control and reward tended to be weaker than the moderating effects between distress and job demand and effort.

The relationships between individual WSC and organizational justice were mixed, as well. Individual WSC moderated the association of psychological distress with interactional justice, but not with procedural justice. These differences in the moderating effects of individual WSC on the two types of organizational justice can be attributed to the different types of job stress to which they refer. Interactional justice mainly refers to the extent to which workers are treated with respect by their supervisors, while procedural justice refers to the fairness and transparency of corporate decision-making processes. Hence, interactional justice is external in nature, as it relates to interactions between co-workers, while procedural justice is internally determined and is affected by these interactions. Consequently, bonding WSC, which concerns the social network in the workplace, buffers against the external pressure that is derived from a lack of interactional justice but moves in the same direction as procedural justice.

We recognize that this study has several limitations. First, our analyses were based on a cross-sectional data set; thus, it was difficult to identify causal relationships between key variables. For example, employees with psychological distress likely tend to underestimate their work characteristics and WSC more than those who do not have psychological distress. Second, we should examine the mediating/moderating effects of other aspects of WSC (that is, bridging and linking), because we assumed that Japanese WSC is mainly a bonding type. Bridging and linking WSC likely affect the impact of adverse work characteristics on workers' mental health differently than does bonding WSC.

Finally, our study sample was not a random sample of Japanese workers; thus, the results may not apply to the general Japanese working population. Although the workers in question were selected from a diverse employee

population and the sample size was the largest among surveys of its kind in Japan, replication should be attempted with a representative sample of employed workers.

Although further studies are necessary to explore the functions of WSC in general, we conclude that individual WSC mediates the associations between adverse work characteristics and psychological distress among Japanese workers and moderates them selectively only at high levels. The findings of the current study, which highlight the role of WSC, have clear implications to occupational health strategy; personnel management aimed at enhancing communication, mutual help, and knowledge sharing in workplace is expected to improve workers' mental health via strengthened WSC.

Acknowledgement

References

1) Kouvonen A, Kivimäki M, Vahtera J, Oksanen T, Elovainio M, Cox T, Virtanen M, Pentti J, Cox SJ, Wilkinson RG (2006) Psychometric evaluation of a short measure of social capital at work. BMC Public Health **6**, 251. [Medline] [CrossRef]

2) Kouvonen A, Oksanen T, Vahtera J, Stafford M, Wilkinson R, Schneider J, Väänänen A, Virtanen M, Cox SJ, Pentti J, Elovainio M, Kivimäki M (2008) Low workplace social capital as a predictor of depression: the Finnish Public Sector Study. Am J Epidemiol **167**, 1143–51. [Medline] [CrossRef]

3) Kouvonen A, Oksanen T, Vahtera J, Väänänen A, De Vogli R, Elovainio M, Pentti J, Leka S, Cox T, Kivimäki M (2008) Work-place social capital and smoking cessation: the Finnish Public Sector Study. Addiction **103**, 1857–65. [Medline] [CrossRef]

4) Oksanen T, Kouvonen A, Kivimäki M, Pentti J, Virtanen M, Linna A, Vahtera J (2008) Social capital at work as a predictor of employee health: multilevel evidence from work units in Finland. Soc Sci Med **66**, 637–49. [Medline] [CrossRef]

5) Oksanen T, Kouvonen A, Vahtera J, Virtanen M, Kivimäki M (2010) Prospective study of workplace social capital and depression: are vertical and horizontal components equally important? J Epidemiol Community Health **64**, 684–9. [Medline] [CrossRef]

6) Oksanen T, Kawachi I, Jokela M, Kouvonen A, Suzuki E, Takao S, Virtanen M, Pentti J, Vahtera J, Kivimäki M (2012) Workplace social capital and risk of chronic and severe hypertension: a cohort study. J Hypertens **30**, 1129–36. [Medline] [CrossRef]

7) Oksanen T, Kawachi I, Kouvonen A, Suzuki E, Takao S, Sjösten N, Virtanen M, Pentti J, Vahtera J, Kivimäki M (2011) Workplace social capital and adherence to antihypertensive medication: a cohort study. PLoS ONE **6**, e24732. [Medline] [CrossRef]

8) Oksanen T, Kivimäki M, Kawachi I, Subramanian SV, Takao S, Suzuki E, Kouvonen A, Pentti J, Salo P, Virtanen M, Vahtera J (2011) Workplace social capital and all-cause mortality: a prospective cohort study of 28,043 public-sector employees in Finland. Am J Public Health **101**, 1742–8. [Medline] [CrossRef]

9) Sapp AL, Kawachi I, Sorensen G, LaMontagne AD, Subramanian SV (2010) Does workplace social capital buffer the effects of job stress? A cross-sectional, multilevel analysis of cigarette smoking among U.S. manufacturing workers. J Occup Environ Med **52**, 740–50. [Medline] [CrossRef]

10) Jung J, Ernstmann N, Nitzsche A, Driller E, Kowalski C, Lehner B, Stieler-Lorenz B, Friepörtner K, Schmidt A, Pfaff H (2012) Exploring the association between social capital and depressive symptoms: results of a survey in German information and communication technology companies. J Occup Environ Med **54**, 23–30. [Medline] [CrossRef]

11) Suzuki E, Takao S, Subramanian SV, Komatsu H, Doi H, Kawachi I (2010) Does low workplace social capital have detrimental effect on workers' health? Soc Sci Med **70**, 1367–72. [Medline] [CrossRef]

12) Suzuki E, Fujiwara T, Takao S, Subramanian SV, Yamamoto E, Kawachi I (2010) Multi-level, cross-sectional study of workplace social capital and smoking among Japanese employees. BMC Public Health **10**, 489. [Medline] [CrossRef]

13) Cattell V (2001) Poor people, poor places, and poor health: the mediating role of social networks and social capital. Soc Sci Med **52**, 1501–16. [Medline] [CrossRef]

14) Kim D, Kawachi I (2007) U.S. state-level social capital and health-related quality of life: multilevel evidence of main, mediating, and modifying effects. Ann Epidemiol **17**, 258–69. [Medline] [CrossRef]

15) Kim D, Subramanian SV, Kawachi I (2006) Bonding versus bridging social capital and their associations with self rated health: a multilevel analysis of 40 US communities. J Epidemiol Community Health **60**, 116–22. [Medline] [CrossRef]

16) Szreter S, Woolcock M (2004) Health by association? Social capital, social theory, and the political economy of public health. Int J Epidemiol **33**, 650–67. [Medline] [CrossRef]

17) Brislin RW, MacNab B, Worthley R, Kabigting F Jr, Zukis B (2005) Evolving perceptions of Japanese workplace motivation: an employee-manager comparison. Int J Cross

Cult Manag **5**, 87–104. [CrossRef]

18) Oyserman D, Coon HM, Kemmelmeier M (2002) Rethinking individualism and collectivism: evaluation of theoretical assumptions and meta-analyses. Psychol Bull **128**, 3–72. [Medline] [CrossRef]

19) Aida J, Kondo K, Hirai H, Subramanian SV, Murata C, Kondo N, Ichida Y, Shirai K, Osaka K (2011) Assessing the association between all-cause mortality and multiple aspects of individual social capital among the older Japanese. BMC Public Health **11**, 499. [Medline] [CrossRef]

20) Hyyppä MT, Mäki J, Impivaara O, Aromaa A (2007) Individual-level measures of social capital as predictors of all-cause and cardiovascular mortality: a population-based prospective study of men and women in Finland. Eur J Epidemiol **22**, 589–97. [Medline] [CrossRef]

21) Verhaeghe PP, Tampubolon G (2012) Individual social capital, neighbourhood deprivation, and self-rated health in England. Soc Sci Med **75**, 349–57. [Medline] [CrossRef]

22) Karasek RA (1979) Job demands, job decision latitude, and mental strain: implications for job redesign. Adm Sci Q **24**, 285–308. [CrossRef]

23) Clays E, De Bacquer D, Leynen F, Kornitzer M, Kittel F, De Backer G (2007) Job stress and depression symptoms in middle-aged workers—prospective results from the Belstress study. Scand J Work Environ Health **33**, 252–9. [Medline] [CrossRef]

24) Griffin JM, Fuhrer R, Stansfeld SA, Marmot M (2002) The importance of low control at work and home on depression and anxiety: do these effects vary by gender and social class? Soc Sci Med **54**, 783–98. [Medline] [CrossRef]

25) Kawakami N, Haratani T, Araki S (1992) Effects of perceived job stress on depressive symptoms in blue-collar workers of an electrical factory in Japan. Scand J Work Environ Health **18**, 195–200. [Medline] [CrossRef]

26) Siegrist J (1996) Adverse health effects of high-effort/ low-reward conditions. J Occup Health Psychol **1**, 27–41. [Medline] [CrossRef]

27) Inoue M, Tsurugano S, Yano E (2011) Job stress and mental health of permanent and fixed-term workers measured by effort-reward imbalance model, depressive complaints, and clinic utilization. J Occup Health **53**, 93–101. [Medline] [CrossRef]

28) Tsutsumi A, Kawakami N (2004) A review of empirical studies on the model of effort-reward imbalance at work: reducing occupational stress by implementing a new theory. Soc Sci Med **59**, 2335–59. [Medline] [CrossRef]

29) Niedhammer I, Tek ML, Starke D, Siegrist J (2004) Effort-reward imbalance model and self-reported health: cross-sectional and prospective findings from the GAZEL cohort. Soc Sci Med **58**, 1531–41. [Medline] [CrossRef]

30) van Vegchel N, de Jonge J, Bosma H, Schaufeli W (2005) Reviewing the effort-reward imbalance model: drawing up the balance of 45 empirical studies. Soc Sci Med **60**, 1117–31. [Medline] [CrossRef]

31) de Jonge J, Bosma H, Peter R, Siegrist J (2000) Job strain,

effort-reward imbalance and employee well-being: a large-scale cross-sectional study. Soc Sci Med **50**, 1317–27. [Medline] [CrossRef]

32) Dragano N, He Y, Moebus S, Jöckel KH, Erbel R Siegrist J, Heinz Nixdorf Recall Study (2008) Two models of job stress and depressive symptoms. Results from a population-based study. Soc Psychiatry Psychiatr Epidemiol **43**, 72–8. [Medline] [CrossRef]

33) Elovainio M, Kivimäki M, Helkama K (2001) Organization justice evaluations, job control, and occupational strain. J Appl Psychol **86**, 418–24. [Medline] [CrossRef]

34) Elovainio M, Kivimäki M, Vahtera J (2002) Organizational justice: evidence of a new psychosocial predictor of health. Am J Public Health **92**, 105–8. [Medline] [CrossRef]

35) Hayashi T, Odagiri Y, Ohya Y, Tanaka K, Shimomitsu T (2011) Organizational justice, willingness to work, and psychological distress: results from a private Japanese company. J Occup Environ Med **53**, 174–81. [Medline] [CrossRef]

36) Inoue A, Kawakami N, Ishizaki M, Shimazu A, Tsuchiya M, Tabata M, Akiyama M, Kitazume A, Kuroda M (2010) Organizational justice, psychological distress, and work engagement in Japanese workers. Int Arch Occup Environ Health **83**, 29–38. [Medline] [CrossRef]

37) Inoue A, Kawakami N, Tsuno K, Tomioka K, Nakanishi M (2013) Organizational justice and psychological distress among permanent and non-permanent employees in Japan: a prospective cohort study. Int J Behav Med **20**, 265–76. [Medline] [CrossRef]

38) Kivimäki M, Elovainio M, Vahtera J, Ferrie JE (2003) Organisational justice and health of employees: prospective cohort study. Occup Environ Med **60**, 27–33, discussion 33–4. [Medline] [CrossRef]

39) Kivimäki M, Vahtera J, Elovainio M, Virtanen M, Siegrist J (2007) Effort-reward imbalance, procedural injustice and relational injustice as psychosocial predictors of health: complementary or redundant models? Occup Environ Med **64**, 659–65. [Medline] [CrossRef]

40) Ndjaboué R, Brisson C, Vézina M (2012) Organisational justice and mental health: a systematic review of prospective studies. Occup Environ Med **69**, 694–700. [Medline] [CrossRef]

41) Karasek RA (1985) Job content questionnaire and user's guide. University of Massachusetts at Lowell, Lowell.

42) 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. [Medline] [CrossRef]

43) Landsbergis PA, Schnall PL, Warren K, Pickering TG, Schwartz JE (1994) Association between ambulatory blood pressure and alternative formulations of job strain. Scand J Work Environ Health **20**, 349–63. [Medline] [CrossRef]

44) Siegrist J, Starke D, Chandola T, Godin I, Marmot M, Niedhammer I, Peter R (2004) The measurement of effort-reward imbalance at work: European comparisons. Soc Sci Med **58**, 1483–99. [Medline] [CrossRef]

45) Tsutsumi A, Ishitake T, Peter R, Siegrist J, Matoba T (2001) The Japanese version of the effort-reward imbalance questionnaire: a study in dental technicians. Work Stress **15**, 86–96. [CrossRef]

46) Siegrist J, Wege N, Pühlhofer F, Wahrendorf M (2009) A short generic measure of work stress in the era of globalization: effort-reward imbalance. Int Arch Occup Environ Health **82**, 1005–13. [Medline] [CrossRef]

47) Moorman RH (1991) Relationship between organizational justice and organizational citizenship behaviors: do fairness perceptions influence employee citizenship? J Appl Psychol **76**, 845–55. [CrossRef]

48) Inoue A, Kawakami N, Tsutsumi A, Shimazu A, Tsuchiya M, Ishizaki M, Tabata M, Akiyama M, Kitazume A, Kuroda M, Kivimäki M (2009) Reliability and validity of the Japanese version of the Organizational Justice Questionnaire. J Occup Health **51**, 74–83. [Medline] [CrossRef]

49) Kessler RC, Andrews G, Colpe LJ, Hiripi E, Mroczek DK, Normand SL, Walters EE, Zaslavsky AM (2002) Short screening scales to monitor population prevalences and trends in non-specific psychological distress. Psychol Med **32**, 959–76. [Medline] [CrossRef]

50) Kessler RC, Green JG, Gruber MJ, Sampson NA, Bromet E, Cuitan M, Furukawa TA, Gureje O, Hinkov H, Hu CY, Lara C, Lee S, Mneimneh Z, Myer L, Oakley-Browne M, Posada-Villa J, Sagar R, Viana MC, Zaslavsky AM (2010) Screening for serious mental illness in the general population with the K6 screening scale: results from the WHO World Mental Health (WMH) survey initiative. Int J Methods Psychiatr Res **19** Suppl 1, 4–22. [Medline] [CrossRef]

51) Furukawa TA, Kawakami N, Saitoh M, Ono Y, Nakane Y, Nakamura Y, Tachimori H, Iwata N, Uda H, Nakane H, Watanabe M, Naganuma Y, Hata Y, Kobayashi M, Miyake Y, Takeshima T, Kikkawa T (2008) The performance of the Japanese version of the K6 and K10 in the World Mental Health Survey Japan. Int J Methods Psychiatr Res **17**, 152–8. [Medline] [CrossRef]

52) Sakurai K, Nishi A, Kondo K, Yanagida K, Kawakami N (2011) Screening performance of K6/K10 and other screening instruments for mood and anxiety disorders in Japan. Psychiatry Clin Neurosci **65**, 434–41. [Medline] [CrossRef]

53) Baron RM, Kenny DA (1986) The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. J Pers Soc Psychol **51**, 1173–82. [Medline] [CrossRef]

54) MacKinnon DP, Fairchild AJ, Fritz MS (2007) Mediation analysis. Annu Rev Psychol **58**, 593–614. [Medline] [CrossRef]