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ORIGINAL ARTICLE

Role ambiguity as an amplifier of the association between job stressors and workers' psychological ill-being: Evidence from an occupational survey in Japan

Takashi Oshio[1] | **Akiomi Inoue**[2] | **Akizumi Tsutsumi**[3]

[1]Institute of Economic Research, Hitotsubashi University, Kunitachi, Japan

[2]Institutional Research Center, University of Occupational and Environmental Health, Japan, Kitakyushu, Japan

[3]Department of Public Health, Kitasato University School of Medicine, Sagamihara, Japan

Correspondence
Takashi Oshio, Institute of Economic Research, Hitotsubashi University, 2-1 Naka, Kunitachi, Tokyo 186-8603, Japan.
Email: oshio@ier.hit-u.ac.jp

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Abstract

Objectives: We aim to examine the extent to which role ambiguity modifies the association between job stressors and workers' psychological ill-being.

Methods: We used data from 41 962 observations from 13 811 individuals (10 269 males and 3542 females) who participated in three to eight waves of an occupational survey conducted in Japan. We estimated fixed-effects models to explain psychological distress (defined by Kessler 6 score ≥13) by role ambiguity. Four types of job stressors (i.e., high job demands, low job control, high effort, and low reward), and their interactions were examined along with potential confounders. We repeated a similar analysis for job dissatisfaction.

Results: The fixed-effects models showed that role ambiguity as well as the four job stressors were positively associated with psychological distress, albeit somewhat more modestly than the results of the pooled cross-sectional models. More notably, we found that role ambiguity substantially amplified the association between job stressors and psychological distress; for example, a combination of high job demands and high role ambiguity added to the risk of psychological distress by 3.5% (95% confidence interval [CI]: 2.5%–4.5%), compared with 1.4% (95% CI: 0.4%–2.3%) for a combination of high job demands and low role ambiguity. In contrast, we did not find a modifying effect of role ambiguity on the association between low job control and psychological distress. Similar results were observed for job dissatisfaction.

Conclusion: The results underscore the importance of reducing role ambiguity to mitigate the adverse impact of job stressors on workers' psychological ill-being.

KEYWORDS

fixed-effects model, job dissatisfaction, job stressors, Kessler 6 score, psychological distress, role ambiguity

1 | INTRODUCTION

Role ambiguity (RA) is defined as the lack of clarity in understanding the actions to be taken to achieve the proposed individual goals.[1] RA makes employees doubt how their objectives can be achieved and how their performance will be assessed, causing a negative relationship between RA and job performance.[2–5] Hence, we consider RA as a key job stressor that forces employees to invest effort in clarifying the ambiguity of their role and correspondingly increases their psychological ill-being. Indeed, many studies have revealed that RA is related to depression,[6] emotional exhaustion,[7] lower job satisfaction,[2,8] and other poor mental health outcomes.

However, it might be possible that RA may work not only as a job stressor but also as an amplifier of the association between job stressors and workers' psychological ill-being. In line with this view, RA has been found to amplify the association between abusive supervision and job burnout[9] as well as between job instability and psychological distress.[10] RA is considered to have a negative effect on the motivational process in the Job Demands-Control (JD-C) model[11] via a perception of increased job demands due to their uncertainty. Further, RA is considered to lower perceived control over work tasks if those tasks are ambiguous. Similarly, additional effort needed to clarify RA and ambiguity about the expected evaluation of job performance may lead to a deterioration in the balance between effort and reward within the framework of the Effort-Reward Imbalance (ERI) model.[12]

In this study, we attempted to provide new insights into the relevance of RA in occupational health in two ways. First, we examined how RA modified the associations between key job stressors (i.e., high job demands, low job control, high effort, and low reward), which are derived from the JD-C and ERI models, and workers' psychological ill-being (i.e., psychological distress [PD] and job dissatisfaction [JD]). Based on the observations in previous studies,[9,10] we predicted that RA would amplify the adverse impact of job stressors. Unlike previous studies, however, we compared the modifying effects on key job stressors within the same analytic framework.

Second, we conducted an analysis using data from the same participants collected at different points to address this issue, in contrast to a majority of previous studies, which relied on cross-sectional data. Specifically, we estimated fixed-effects (FE) models, which control for a participant's attributes, both observed and unobserved.[13,14] The associations observed from the cross-sectional data cannot be free from biases due to these factors, as suggested by previous FE model studies,[15,16] especially because RA, job stressors, and psychological ill-being are all subjectively evaluated, presumably leading to overestimation of their correlations.

2 | METHODS

2.1 | Study sample

We used panel data from eight survey waves of an occupational cohort study on social class and health in Japan (Japanese Study of Health, Occupation, and Psychosocial Factors Related Equity [J-HOPE]). The first wave was conducted from April 2010 to March 2011; the following waves were conducted approximately one year after the first wave. The eighth wave was conducted between April 2017 and March 2018. The study population consisted of employees working for 13 firms. The surveyed firms covered 12 industries and participated in three to eight waves. The original sample consisted of 47 960 observations from 14 388 individuals. The response rates were 77.0%, 81.6%, 78.6%, 67.5%, 63.9%, 64.6%, 64.2%, and 64.8% in the first to eighth waves, respectively. After removing 4007 observations in one industry (code 11, transportation industry) over the fourth and eighth waves (because they were asked only about their experiences in sick leave) and respondents missing key variables of RA, PD, JD, and/or job stressors, we ended up utilizing 41 962 observations from 13 811 individuals (10 269 men and 3542 women). The structures of the firms, waves, and participants in the study sample are summarized in Table S1.

The Research Ethics Committee of the Graduate School of Medicine and Faculty of Medicine, The University of Tokyo (No. 2772), Kitasato University Medical Ethics Organization (No. B12-103), and the Ethics Committee of Medical Research, University of Occupational and Environmental Health, Japan (No. 10-004 and H26-115) reviewed and approved the aims and procedures of the present study. This study was conducted with the J-HOPE dataset as of June 1, 2021.

2.2 | Measures

Table 1 summarizes the key measures obtained from the survey and the definitions of the binary variables that were used in the statistical analysis. For the binary variables of high RA, high job demands, low job control, high effort, and low reward, we used the sample means of their corresponding measures as the cut-off points. More detailed explanations are provided below.

TABLE 1 Summary of key measures in the survey and the definition of the binary variables

Measures in the survey	Cronbach's alpha	Score			Definition of the binary variable	
		Range	*M*	SD		
Role clarity	0.88	6–42	29.7	6.0	High role ambiguity	Score[a] < *M*
K6 score	0.90	0–24	5.5	5.0	Psychological distress	Score ≧ 13
Job satisfaction	N.A.	1–4	2.6	0.8	Job dissatisfaction	Score = 1 (*dissatisfied*)
Job demands	0.69	12–48	32.8	5.4	High job demands	Score > *M*
Job control	0.78	24–96	65.7	10.1	Low job control	Score < *M*
Effort	0.78	3–12	7.9	1.9	High effort	Score > *M*
Reward	0.76	7–28	18.1	3.0	Low reward	Score < *M*

[a]A higher score in the survey indicated lower role ambiguity (i.e., higher role clarity).

2.2.1 | Role ambiguity (RA)

We measured RA based on the Japanese version of the National Institute for Occupational Safety and Health Generic Job Stress Questionnaire (NIOSH-GJSQ).[17,18] The internal consistency reliability and validity of the Japanese version of the NIOSH-GJSQ has been reported to be acceptable.[18] Respondents were asked to assess the accuracy of each of the six statements about their role clarity, such as "I feel certain about how much authority I have" on a seven-point scale (1 = *very inaccurate* to 7 = *very accurate*; see Table S2 for the full questionnaire). Cronbach's alpha for this sample was 0.88. We summed up the scores (range: 6–42; lower scores indicating higher levels of RA) and constructed a binary variable for high RA by allocating "1" to the score below the sample mean (29.7) and "0" to others.

2.2.2 | Psychological distress (PD) and job dissatisfaction (JD)

We considered PD and JD as workers' psychological ill-being measures. To measure PD, we used Kessler 6 (K6) scores[19,20] as the reliability and validity have been demonstrated previously in a Japanese population.[21,22] From the survey, we first obtained the respondents' assessments of psychological distress using a six-item psychological distress questionnaire: "During the past 30 days, how often did you feel (a) nervous, (b) hopeless, (c) restless or fidgety, (d) so depressed that nothing could cheer you up, (e) that everything was an effort, and (f) worthless." This questionnaire was rated on a five-point scale (0 = *none of the time* to 4 = *all of the time*). The sum of the reported scores was then calculated (range: 0–24; higher K6 scores indicating higher levels of psychological distress). Cronbach's alpha for this sample was 0.90. A binary variable of psychological distress was constructed and defined as K6 ≥ 13, as this cutoff indicator has been found to indicate serious psychological distress in the Japanese population.[21,22] Regarding job satisfaction, the survey asked questions using a four-point scale (1 = *dissatisfied*, 2 = *somewhat dissatisfied*, 3 = *somewhat satisfied*, and 4 = *satisfied*). A binary variable of JD was constructed by allocating "1" to answers equaling 1, and "0" to others.

2.2.3 | Job demands and control

We utilized the items investigating job demands and control from the Japanese version of the Job Content Questionnaire (JCQ).[23] It is based on the JD-C model,[11] and includes scales related to 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 have been shown to be acceptable.[24] In the present sample, Cronbach's alpha coefficients were 0.69 and 0.78 for job demands and control scales, respectively. Following the JCQ User's Guide,[23] we summarized the responses to these items into single indices of job demands (range: 12–48) and control (range: 24–96). Finally, we used their sample means (32.8 and 65.7, respectively) as the cut-off points for the binary variables that classified each worker as having either high or low job demands and control.

2.2.4 | Effort and reward

To assess effort and reward, we utilized data collected from a simplified Japanese version of the Effort-Reward Imbalance Questionnaire (ERIQ). The ERIQ was developed based on the ERI model,[13] and its Japanese version and that of the simplified ERIQ[25] used in the present study have been shown to have acceptable internal consistency,

reliability, and validity scores.[26,27] The simplified version includes sub-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 0.76 for the effort and reward scales, respectively. We summed the responses into single indices for effort (range: 3–12) and reward (range: 7–28). Subsequently, we used their sample means (7.9 and 18.1, respectively) as the cut-off points for the binary variables classifying each worker as exhibiting either high or low effort and rewards.

2.2.5 | Potential confounders

As potential confounders, we considered gender, age (i.e., 20s, 30s, 40s, 50s, and 60s), educational attainment (i.e., high school or below, junior college, college, and graduate school), household income, job category (i.e., managerial, manual, non-manual, and others), health behavior (i.e., smoking, daily alcohol consumption, and physical inactivity), and firm codes (i.e., 1–13). Regarding household income, we divided reported household income by the square root of the number of household members to adjust for household size,[28] and constructed binary variables for each quartile. We also constructed binary variables of "unanswered" for age, educational attainment, and household income. Among these variables, gender, educational attainment, and firm codes were time-invariant and were automatically removed from the FE regression.

2.3 | Statistical analysis

Following the descriptive analysis, which examined pairwise correlations across key variables, we estimated three linear probability models[28,29] (LPM, models 1–3), all of which linearly regressed the binary variable of PD or JD on RA, four job stressors, and potential confounders. Model 1 was a pooled cross-sectional regression model. Model 2 was a FE regression model using data from the same participants collected at different points in three to eight waves depending on the firms, as summarized in Table S1. Model 3 included the interaction terms between RA and each of the four job stressors. The estimated coefficient of the interaction term with each stressor indicates the magnitude of the modifying effect of RA on the association between each stressor and PD or JD. After regression, we calculated the sum of the estimated coefficient of each job stressor and that of its interaction term with RA to measure the RA-modified association between each job stressor and PD or JD.

In the FE models, all variables were mean-centered for each participant over the estimation period, which varied from three to eight waves depending on the participant. Unlike the pooled cross-sectional regression models, which used simply pooled data for individuals over the estimation period, FE models controlled for a participant's time-invariant attributes, both observed and unobserved, which allowed us to focus exclusively on within-participant variations.[29] We further chose LPMs, which are known to provide good estimates of the partial effects of the independent variables on the response probability,[29,30] rather than probit or logistic models for two practical reasons. First, the estimated coefficient of the interaction term can be directly interpreted in LPMs.[31] Second, FE models concentrate on within-participant variations in outcome and hence would remove participants who reported no change in PD (or JD), which was measured by its binary variable, over the estimation period.[32]

We checked the robustness of the estimation results by replacing binary variables for PD and JD with continuous variables for K6 scores (range: 0–24) and job dissatisfaction scores (range: 1–4; reversing the original order to make higher scores indicate higher dissatisfaction). We used the Stata Software Package (release 17) to perform all statistical analyses.

3 | RESULTS

3.1 | Descriptive analysis

Table 2 summarizes the key features of the study sample, dividing the respondents into those with high PA and those with low RA. As seen in this table, higher RA was associated with lower educational attainment, non-managerial jobs, higher levels of job stressors, PD, JD, and lower household income. Table 3 also confirms a high correlation between RA and job stressors, PD, and JD.

3.2 | Regression results

Table 4 presents the key estimation results obtained from models 1 to 3 to explain the probability of PD, with more detailed results provided in Table S3 in the Supplementary file. Model 1, which used pooled, cross-sectional data, confirmed that PD was positively associated with high RA and all job stressors; notably, high RA corresponded to a 4.8% (95% confidence interval [CI]: 4.3%–5.4%) higher probability of PD, compared to low RA. The magnitude of the association between RA and PD was similar to that for the four job stressors.

We observed the associations of PD with RA and job stressors in model 2, even after controlling for a participant's time-invariant attributes. However, the magnitude

TABLE 2 Key features of the respondents in the survey by role ambiguity[a]

Role ambiguity	All	High	Low
Gender			
Males	31 256 (74.5)	13 876 (69.3)	17 380 (79.2)
Females	10 706 (25.5)	6133 (30.7)	4573 (20.8)
Educational attainment			
High school or below	16 349 (39.0)	8594 (43.0)	7755 (35.3)
Junior college	7122 (17.0)	3774 (18.9)	3348 (15.3)
College	14 098 (33.6)	5738 (28.7)	8360 (38.1)
Graduate school	4341 (10.3)	1880 (9.4)	2461 (11.2)
Job category			
Managerial	7403 (17.6)	1889 (9.4)	5514 (25.1)
Manual	19 015 (45.3)	9621 (48.1)	9394 (42.8)
Non-manual	9856 (23.5)	5476 (27.4)	4380 (20.0)
Other	5688 (13.6)	3023 (15.1)	2665 (12.1)
Health behavior			
Smoking	11 656 (27.8)	5327 (26.6)	6329 (28.8)
Daily alcoholic consumption	11 750 (28.0)	4988 (24.9)	6762 (30.8)
Physical inactivity	25 214 (60.1)	12 750 (63.7)	12 464 (56.8)
Job stressor			
Job insecurity (high)	15 756 (37.5)	8964 (44.8)	6792 (30.9)
Effort (high)	23 574 (56.2)	11 795 (58.9)	11 779 (53.7)
Reward (low)	21 156 (50.4)	13 403 (67.0)	7753 (35.3)
Job demand (high)	21 054 (50.2)	10 666 (53.3)	10 388 (47.3)
Job control (low)	17 293 (41.2)	10 886 (54.4)	6407 (29.2)
Psychological distress	3977 (9.5)	2867 (14.3)	1110 (5.1)
Job dissatisfaction	3911 (9.3)	3165 (15.8)	746 (3.4)
Age (years)	*M* 41.5 (SD 10.6)	*M* 41.5 (SD 10.5)	*M* 42.3 (SD 10.5)
Household income (annual, thousand JPY)	*M* 4320 (SD 2144)	*M* 4027 (SD 2003)	*M* 4585 (SD 2231)
N	41 962	20 009	21 953

[a]Figures in parentheses indicate the proportion (%) of the total sample.

of the observed associations was somewhat attenuated compared to those in model 1, suggesting that the associations observed from cross-sectional data were overestimated. Although we did not report the results, the *F* test showed that the null hypothesis that individual-specific effects were equal to zero could be rejected ($P < .001$), and the Hausman test showed that the null hypothesis that individual-specific effects were not correlated with independent variables could be rejected ($P < .001$). The results of these tests confirmed that the FE model was preferred to pooled cross-sectional and random-effects models.

Model 3 showed that the coefficient of the interaction term with high RA was significantly positive for high job demands, high effort, and low reward. For example, the coefficient of the interaction between high job demands and high RA was 2.1% (95% CI: 0.8%–3.4%; denoted by "a" in the table). As seen in the bottom part of the table, post-regression calculations showed that a combination of high job demands and high RA added to the risk of PD by 3.5% (95% CI: 2.5%–4.5%; denoted by "A + a"), compared with 1.4% (95% CI: 0.4–2.3; denoted by "A") for a combination of high job demands and low RA (denoted by "A"), both using low job demands as a reference. These results indicated that high RA amplified the association between high job demands and PD by approximately 2.5 times (=3.5%/1.4%). Such an amplifying effect of PD was observed for high effort and low reward, while it was non-significant for low job control. Meanwhile, the estimated coefficient of high RA became slightly negative and non-significant, suggesting that the association between high RA and PD was mainly through RA's amplifying effects on the association between job stressors and PD.

TABLE 3 Pairwise correlation coefficients across key variables*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) High role ambiguity	1						
(2) High job demands	0.053	1					
(3) Low job control	0.316	0.067	1				
(4) High effort	0.060	0.452	0.079	1			
(5) Low reward	0.256	−0.135	0.222	−0.132	1		
(6) Psychological distress	0.158	0.118	0.182	0.124	0.077	1	
(7) Job dissatisfaction	0.213	0.081	0.252	0.088	0.157	0.311	1

*$P < .001$ for all pairwise correlations.

TABLE 4 Estimated associations with psychological distress[a] ($N = 41\,962$ observations from 13 811 individuals)

		Pooled cross-sectional	Fixed effects	
		Model 1	Model 2	Model 3
		Coef. (95% CI)	Coef. (95% CI)	Coef. (95% CI)
Main effects				
High role ambiguity		0.048 (0.043, 0.054)	0.032 (0.025, 0.039)	−0.008 (−0.022, 0.006)
High job demands	A	0.038 (0.032, 0.045)	0.024 (0.017, 0.031)	0.014 (0.004, 0.023)
Low job control	B	0.030 (0.024, 0.036)	0.019 (0.011, 0.027)	0.014 (0.003, 0.025)
High effort	C	0.040 (0.034, 0.046)	0.029 (0.022, 0.037)	0.019 (0.009, 0.029)
Low reward	D	0.078 (0.072, 0.084)	0.049 (0.041, 0.056)	0.037 (0.027, 0.047)
Interaction terms				
High role ambiguity				
×High job demands	a			0.021 (0.008, 0.034)
×Low job control	b			0.009 (−0.004, 0.022)
×High effort	c			0.021 (0.008, 0.035)
×Low reward	d			0.024 (0.011, 0.037)
Post-regression calculations				
High job demands with high role ambiguity	A + a			0.035 (0.025, 0.045)
Low job control with high role ambiguity	B + b			0.023 (0.013, 0.033)
High effort with high role ambiguity	C + c			0.040 (0.030, 0.051)
Low reward with high role ambiguity	D + d			0.061 (0.051, 0.071)

Abbreviation: CI, confidence interval.

[a]Controlled for confounders (gender, age, health activity, educational attainment, and firms). See Table S3 for the full estimation results.

Figure 1 graphically illustrates the amplifying effect of RA for each job stressor to help understand the estimation results in Table 4. For each stressor, except for job control, the line for high RA has a greater slope than that for low RA, reflecting the RA's amplifying effect on the association between that stressor and PD. The line for high RA is also located above that for low RA for each job stressor, reflecting RA's amplifying effect on the associations between the other three stressors and PD.

Table 5 presents the estimation results obtained by replacing PD with JD as a dependent variable, with more detailed results provided in Table S4. We obtained results

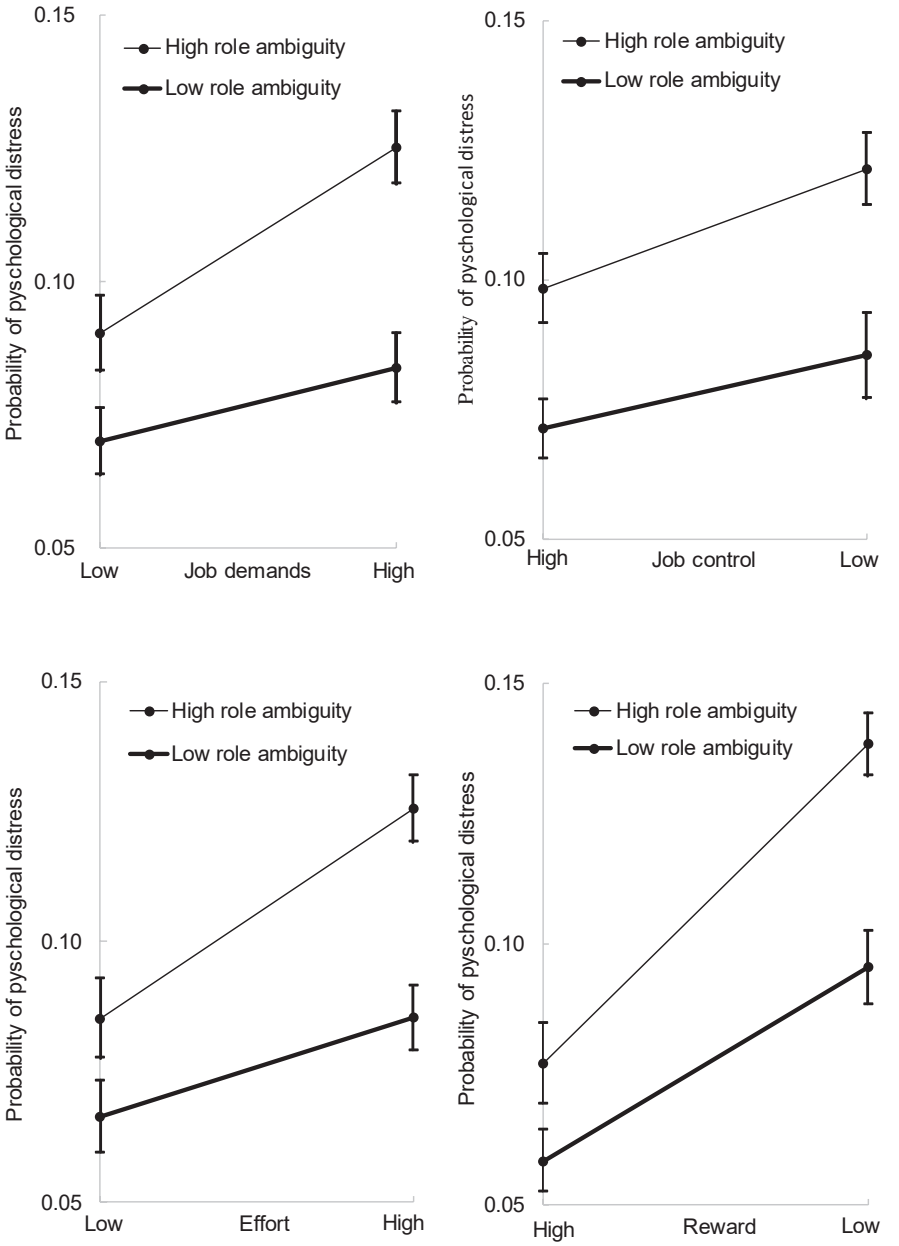

FIGURE 1 The probability of psychological distress corresponding to a combination of different levels of each job stressor and role ambiguity[†]

similar to those in Table 4 and confirmed RA's amplifying effect, except for job control. Tables S5 and S6 present the detailed estimation results for the continuous variables of the K6 and JD scores, respectively. The results in these tables were similar to those in Tables 4 and 5, except for the observation that RA's amplifying effect was nonsignificant for the association between high effort and JD score.

4 | DISCUSSION

In this study, we examined the extent to which RA modifies the association between job stressors and workers' psychological ill-being. Unlike most preceding studies, we estimated the FE models to control for a participant's time-invariant attributes using occupational survey data from the same participants collected at different points. The key findings and their practical implications are summarized as follows.

First, we confirmed that higher RA was related to a higher risk of PD and JD, as other job stressors were, generally in line with previous studies that have indicated the adverse impact of RA on workers' job performance and mental health outcomes.[2,6–8] Although the FE model results showed that the association between RA and workers' psychological ill-being observed from the cross-sectional data was somewhat overestimated, we confirmed the relevance of RA for occupational health.

Second, and more importantly, the results underscored that RA worked as a key amplifier for the association between job stressors and workers' psychological ill-being.

TABLE 5 Estimated associations with job dissatisfaction ($N = 41\,962$ observations from 13 811 individuals)[a]

		Pooled cross-sectional	Fixed effects	
		Model 1	Model 2	Model 3
		Coef. (95% CI)	Coef. (95% CI)	Coef. (95% CI)
Main effects				
High role ambiguity		0.069 (0.064, 0.075)	0.050 (0.043, 0.057)	−0.006 (−0.020, 0.008)
High job demands	A	0.030 (0.024, 0.037)	0.020 (0.013, 0.027)	0.010 (0.000, 0.019)
Low job control	B	0.063 (0.057, 0.069)	0.044 (0.036, 0.052)	0.028 (0.018, 0.039)
High effort	C	0.023 (0.017, 0.029)	0.021 (0.014, 0.028)	0.013 (0.004, 0.023)
Low reward	D	0.107 (0.101, 0.113)	0.065 (0.057, 0.072)	0.042 (0.033, 0.052)
Interaction terms				
High role ambiguity				
×High job demands	a			0.021 (0.008, 0.034)
×Low job control	b			0.028 (−0.015, 0.041)
×High effort	c			0.016 (0.003, 0.030)
×Low reward	d			0.046 (0.033, 0.058)
Post-regression calculations				
High job demands with high role ambiguity	A + a			0.031 (0.021, 0.041)
Low job control with high role ambiguity	B + b			0.057 (0.047, 0.066)
High effort with high role ambiguity	C + c			0.029 (0.019, 0.040)
Low reward with high role ambiguity	D + d			0.088 (0.078, 0.098)

Abbreviation: CI, Confidence interval.

[a]Controlled for confounders (gender, age, health activity, educational attainment, and firms). See Table S4 for the full estimation results.

The correlations between job stressors and PD or JD were substantially strengthened by interaction with high RA, a result consistent with previous studies that indicated the amplifying effect of RA on the negative impact of adverse job conditions on workers' health.[9,10] We also observed that the association between RA and PD or JD became non-significant after controlling for the effects of job stressors and their interactions. This result highlights the importance of the role of RA in amplifying the effects of job stressors on psychological ill-being, while the direct effect of RA is generally limited.

Third, it should be noted that the modifying effect of RA was not uniform across types of job stressors. As seen in Tables 4 and 5 and Figure 1, the association between job control and psychological ill-being was less sensitive to RA compared to other job stressors. This is probably because low job control may be closely related to, or even caused by, high RA, implying that the concepts of low job control and high RA may overlap with each other to some extent.

This study had several limitations. First, caution should be exercised when generalizing the obtained observations. The study sample, which consisted of full-time workers in 13 firms in Japan, was dominated by men (74.5% of the total sample) and lacks representativeness of the entire working population. Second, we did not identify causation across job stressors, RA, and psychological ill-being, even though we controlled for participants' time-invariant attributes. Specifically, we cannot exclude the feedback loop from psychological ill-being to job stressors or RA. Higher levels of PD or JD are expected to enhance job stressors or RA, which were treated as exogenous variables and would likely, in turn, raise the levels of psychological ill-being further. Third, and related to the second limitation, we must extend the analysis to address the dynamics of RA and its relationships with job stressors and psychological ill-being. Longer and more successful job experiences may reduce RA over time, and in turn, its negative impact on psychological ill-being will decline. We cannot exclude the possibility that performance recognition changes the effect of RA on engagement from negative to positive, as suggested by a recent study.[33] Lastly, we did not control for potential attrition biases; participants with higher levels of psychological ill-being may have more likely dropped from the survey.

Despite these limitations and issues bring addressed in future research, the results of this study underscore the

importance of RA for occupational health. Managers, supervisors, and colleagues should help workers clarify their roles in mitigating the adverse impact of job stressors on their psychological ill-being.

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DISCLOSURE

Ethical approval: The Research Ethics Committee of the Graduate School of Medicine and Faculty of Medicine, The University of Tokyo (No. 2772), Kitasato University Medical Ethics Organization (No. B12-103), and the Ethics Committee of Medical Research, University of Occupational and Environmental Health, Japan (Nos. 10-004 and H26-115) reviewed and approved the aims and procedures of the present study. This study was conducted with the J-HOPE dataset as of June 1, 2021. *Informed Consent*: We obtained written consent from the survey participants. *Registry and the Registration No. of the study/trial*: N/A. *Animal studies*: N/A. *Conflict of interest*: The authors declare that there is no conflict of interest.

AUTHOR CONTRIBUTIONS

Takashi Oshio conceived the ideas; Akizumi Tsutsumi and Akiomi Inoue conducted data collection; Takashi Oshio performed the analysis; Takashi Oshio prepared the initial manuscript; and Akiomi Inoue and Akizumi Tsutsumi contributed to revising it.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the Japanese study of Health, Occupation and Psychosocial factors related Equity (J-HOPE). Restrictions apply to the availability of these data, which were used under license for this study. Data are available at https://www.med.kitasato-u.ac.jp/lab/publichealth/jhope.html with the permission of J-HOPE.

ORCID

Takashi Oshio https://orcid.org/0000-0001-8142-5585
Akiomi Inoue https://orcid.org/0000-0002-4079-0719
Akizumi Tsutsumi https://orcid.org/0000-0003-0966-4869

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SUPPORTING INFORMATION

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