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Original Article

Development of a Short Questionnaire to Measure an Extended Set of Job Demands, Job Resources, and Positive Health Outcomes: The New Brief Job Stress Questionnaire

Akiomi INOUE[1†], Norito KAWAKAMI[2†*], Teruichi SHIMOMITSU[3, 4], Akizumi TSUTSUMI[5], Takashi HARATANI[6], Toru YOSHIKAWA[7], Akihito SHIMAZU[2] and Yuko ODAGIRI[4]

[1] Department of Mental Health, Institute of Industrial Ecological Sciences, University of Occupational and Environmental Health, Japan
[2] Department of Mental Health, Graduate School of Medicine, The University of Tokyo, Japan
[3] Japan Health Promotion Fitness Foundation, Japan
[4] Department of Preventive Medicine and Public Health, Tokyo Medical University, Japan
[5] Department of Public Health, Kitasato University School of Medicine, Japan
[6] Health Administration and Psychosocial Factor Research Group, National Institute of Occupational Safety and Health, Japan
[7] Department of Research, The Institute for Science of Labour, Japan

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Abstract: This study aimed to investigate the reliability and construct validity of a new version of the Brief Job Stress Questionnaire (New BJSQ), which measures an extended set of psychosocial factors at work by adding new scales/items to the current version of the BJSQ. Additional scales/items were extensively collected from theoretical job stress models and similar questionnaires in several countries. Scales/items were field-tested and refined through a pilot internet survey. Finally, an 84-item questionnaire (141 items in total when combined with the current BJSQ) was developed. A nationally representative survey was administered to employees in Japan (*n*=1,633) to examine the reliability and construct validity. Most scales showed acceptable levels of internal consistency and test-retest reliability. Principal component analyses showed that the first factor explained 50% or greater proportion of the variance in most scales. A scale factor analysis and a correlation analysis showed that these scales fit the theoretical expectations. These findings provided a piece of evidence that the New BJSQ scales are reliable and valid. Although more detailed content and construct validity should be examined in future study, the New BJSQ is a useful instrument to evaluate psychosocial work environment and positive mental health outcomes in the current workplace.

Key words: Job stress, Primary prevention, Psychosocial risk management, Reliability, Stress assessment, Validity

Introduction

In Japan, the number of workers with mental health problems is increasing[1)] and thus primary prevention of

*To whom correspondence should be addressed.
E-mail: kawakami@m.u-tokyo.ac.jp
† These authors contributed equally to this work.

mental health problems is a high priority for both employers and employees. Previous studies have shown that "assessing and improving work environment" effectively reduces mental health problems[2, 3]; thus, the Brief Job Stress Questionnaire (BJSQ)[4] and Job Stress Assessment Diagram (JSAD)[5] have been developed with an aim to assess and improve work environment in Japan. The BJSQ and JSAD have been widely used in research and practice in the field of mental health in the workplace in Japan[6, 7].

However, more than 10 years have passed since the development of these tools and since then, the field of prevention of job stress and workplace mental health has developed rapidly. First, in addition to the traditional job demands-control model[8], the effort-reward imbalance (ERI) model has been proposed[9] and found to be associated with various health problems, such as poor mental health and cardiovascular diseases (CVD)[10–13]. Second, recent research in this field has focused on higher-level organizational factors, such as organizational justice (i.e., the extent to which employees perceive workplace decision-making procedures and interactions to be fair)[14] and workplace social capital (i.e., shared values, attitudes, and norms of trust and reciprocity as well as practices of collective action in their work unit)[15]. These organizational factors were also found to be associated with poor mental health and CVD[12, 16–18]. Third, advancing research on work-family interference has indicated that both negative and positive spillovers from work life to non-work life are important factors in worker mental health[19–21]. Fourth, with the introduction of the positive psychology to this field, positive attitude at work, such as work engagement[22], has received an increased attention as an alternative mental health and well-being outcome among workers. Finally, workplace bullying or harassment at work has become a prominent problem in occupational health[23, 24]. However, these newly-proposed factors and outcomes cannot be measured by the current BJSQ; thus, they should be measured with a short questionnaire that would easily assess psychosocial workplace environments as well as their employees (i.e., health-related) and organizational (i.e., business-related) outcomes in the practice.

Such multidimensional and comprehensive assessment of these traditional and newly-proposed psychosocial factors and outcomes complies with psychosocial risk management framework in European countries, such as Psychosocial Risk Management-European Framework (PRIMA-EF)[25] and the UK Health and Safety Executive's (HSE) Management Standards for work related stress[26]. PRIMA-EF is a part of the World Health Organization's Healthy Workplaces Framework[27] which proposes the healthy workplace model: a comprehensive way of thinking and acting that addresses work-related physical and psychosocial risks; promotion and support of healthy behaviors; and broader social and environmental determinants. On the other hand, the UK HSE Management Standards cover six primary sources of stress at work, such as demands, control, support (managerial support and peer support), relationship (conflict and unacceptable behavior), role (role ambiguity and role conflict), and change (preparedness to organizational changes),which are associated with poor health and well-being, lower productivity, and increased sickness absence.

Therefore, the purpose of the present study was to develop a new version of the Brief Job Stress Questionnaire (New BJSQ), which can assess job demands and job resources as well as employee and organizational outcomes multidimensionally and comprehensively by adding its scales/items to the current version of the BJSQ.

Methods

Development of an item pool

1) Review of the current BJSQ scales

First, we reviewed the current BJSQ scales to assess what scales should be newly added. The BJSQ is a 57-item questionnaire developed in Japan[4]. The items of the scales are measured on a four-point Likert-type response option and assess a wide range of psychosocial work environments, stress reactions, and buffering factors based on the job stress model proposed by the group of researchers from the US National Institute for Occupational Safety and Health (NIOSH)[28]. Regarding job stressors, the instrument measures quantitative job overload (three items), qualitative job overload (three items), physical demands (one item), job control (three items), skill (under) utilization (one item), interpersonal conflict (three items), poor physical environment (one item), suitable jobs (one item), and intrinsic rewards (one item). For buffering factors, supervisor support (three items) and coworker support (three items) as well as support from family and friends (three items) are measured. An 18-item scale measures five aspects of psychological distress or mood: vigor (three items), anger-irritability (three items), fatigue (three items), anxiety (three items), and depression (six items). Another 11-item scale is prepared to measure physical complaints or physical stress reactions. The BJSQ also measures job satisfaction and life satisfaction (one item for each). All of these scales have been proven to show

acceptable or high levels of internal consistency reliability and factor-based validity[4]. We concluded that the current BJSQ measured basic elements of task-level psychosocial work environment based on the job demands-control and demand-control-support models[8, 29] as well as psychological and physical health outcomes while it did not measure workgroup- or organizational-level factors or positive mental health outcomes.

2) Collection of scales and items based on recent theories on job stress

We collected scales and items related to "job demands (i.e., physical, social, or organizational job aspects that require sustained physical and/or psychological effort and are associated with certain physiological and/or psychological costs)", "job resources (i.e., physical, psychological, social, or organizational job aspects that may be functional in achieving work-related goals; reduce job demands and the associated physiological and psychological costs; and stimulate personal growth and development)", or "outcomes" and evaluated suitability of these for the New BJSQ based on three sources: recent theories of job stress, already-established questionnaires of job stress, and a series of meetings with stakeholders. We first reviewed the relevant literature to find recent theories on job stress and their measures that were developed in the last 10 years but not used in the current BJSQ. This work indentified several theories, including ERI model[9], emotional demands[30], bullying and mobbing[23, 24], organizational justice (procedural justice and interactional justice)[31–33], and workplace social capital[15] as job demands and resources; and work engagement[22] as a potential outcome. Although a large part of these scales and items have been reported their reliability and validity, our original items were partly included in the item pool. The established scales for these constructs were also reviewed and their items were included in the item pool of the New BJSQ. Each "job resources" scale was classified into three levels, i.e., "task-level", "workgroup-level", and "organizational-level" in order to indicate targets of a relevant intervention. Some proposed scales were combined because of their conceptual overlap (e.g., role ambiguity and role clarity).

3) Collection of scales and items from previous questionnaires

We also reviewed questionnaires and/or published guidance of job stress and related variables, which were used in practice. These included PRIMA-EF[25], which provided a list of wide range of psychosocial work environments that could be related to worker mental health. The UK HSE Management Standards for work related stress[26] developed a questionnaire to measure six aspects of work environment mentioned earlier: demands, control, support, relationship, role, and change. The second version of the Copenhagen Psychosocial Questionnaire (COPSOQ II)[34] was designed to measure a wide range of psychosocial factors, but the instrument was particularly unique in that it measures emotional demands, predictability, possibilities for development, quality of leadership, social community at work and trust (as a part of workplace social capital), justice and respect, and family-work (im) balance. The Korean Occupational Stress Scale (KOSS)[35], developed in an Asian country, was also used as a reference. It measures eight dimensions of psychosocial work environment: physical environment, job demand, insufficient job control, interpersonal conflict, job insecurity, organizational system, lack of reward, and occupational climate. We compared the scales included in these questionnaires to cover all these concepts in the New BJSQ.

4) Proposal of additional scales from stakeholder meetings

We held a series of stakeholder meetings, which were held twice a year attended by researchers from five institutes/departments of occupational safety and health, occupational health staffs (physicians, nurses, and hygienists), and representatives of two employer associations and one employee association. Based on group discussions in the meetings, several new concepts of job resources were proposed. (1) "Workplace where people compliment each other" measures a workplace in which workers are appropriately appreciated and comprises items that may overlap with items of reward at work to some extent even though the reward scale did not specifically intend to measure this aspect of work. (2) "Workplace where mistakes are acceptable" assesses a workplace in which workers have a chance to recover even if they failed or made a mistake at work. (3) "Diversity" concerns worker diversity, particularly in terms of psychological differences by gender, age, and employment status. These aspects of organizational characteristics were added to the scale/item pool to create the New BJSQ.

Candidate scales/items for the pilot study

Through the process described above, we developed the trial version of the New BJSQ comprising 34 scales (129 items). These were "quantitative job overload", "emotional demands", "role conflict", "work-self balance (negative)", and "workplace harassment" classified as "job demands"

(five scales, 14 items); "meaningfulness of work", "job control", "role clarity", "career opportunity", "novelty", and "predictability" classified as "task-level job resources" (six scales, 19 items); "monetary/status reward", "esteem reward", "job security", "leadership", "interactional justice", "workplace where people compliment each other", "workplace where mistakes are acceptable", "collective efficacy (i.e., team members' believe that they can successfully organize and execute the courses of action required to accomplish given goals)[36]", and "workplace social capital" classified as "workgroup-level job resources" (nine scales, 38 items); "trust with management", "preparedness for change", "procedural justice", "respect for individuals", "fair personnel evaluation", "diversity", "career development", and "work-self balance (positive)" classified as "organizational-level job resources" (eight scales, 33 items); and "work engagement", "performance of a duty", "realization of creativity", "active learning", "work performance", and "others" classified as "outcomes" (six scales, 25 items).

A pilot internet survey

On March 17, 2010, Japanese employees aged 15 yr or older who registered with Yahoo! Research monitors were invited to complete an anonymous web-based self-administered questionnaire including the current BJSQ and a trial version of the New BJSQ. On the same day, the number of respondents reached 1,000 (687 men and 313 women) and the survey was terminated. Based on the data from these 1,000 respondents, we further reduced the number of items and developed a final "standard" version of the New BJSQ. We calculated Cronbach's alpha coefficient and item-total correlation coefficients (ITCs) for each candidate scale, and if possible, limited the number of items to two or three, five at maximum, in reference to opinion of occupational health staffs (e.g., occupational physicians, occupational health nurses, and clinical psychologists). Finally, the final "standard" version of the New BJSQ comprised 30 scales and 84 items (49 scales and 141 items in total when combined with the current 57-item BJSQ) (Table 1). All New BJSQ scales are available at http://www.jstress.net (only in Japanese language).

Reliability, validity, and normative scores of the New BJSQ

1) Participants

To test reliability and validity and obtain normative scores of the New BJSQ, we conducted cross-sectional and one-year prospective studies of a nationally representative sample of workers in Japan. In November 2010, a self-administered questionnaire was mailed to 5,000 Japanese people aged 20–60 years selected by a two-stage random sampling. More specifically, we firstly selected 100 municipalities randomly by considering the population size and then selected 50 residents randomly from each municipality using the population registry. If the selected municipality did not allow us to access population registry, we randomly selected another municipality. By February 2011, we received 2,400 completed questionnaires, of which 2,384 were valid (response rate, 47.7%). Among the respondents, 1,633 respondents (847 men and 786 women) were classified as being employed. Out of these 1,633 employed respondents, 479 agreed to participate in a follow-up survey. In November 2011, the same questionnaires were sent to these participants and 417 questionnaires (202 men and 215 women) were returned by December 2011 (response rate, 87.1%). Detailed characteristics of participants are shown in Table 2. The Ethics Committee of the Graduate School of Medicine/Faculty of Medicine, The University of Tokyo reviewed and approved aims, designs, and procedures of the internet-based pilot study, the cross-sectional and prospective studies, as well as the aforementioned pilot internet survey (No. 2953).

2) Measures

The self-administered questionnaires at baseline and follow-up included all scales of the current BJSQ and New BJSQ.

3) Statistical analysis

Based on the baseline cross-sectional data (1,633 employees), a national average and standard deviation of each scale of the current BJSQ and New BJSQ were calculated for the total sample. Unlike calculating a scale score as a sum of the item scores, in this analysis, a scale score was calculated as an average item score (i.e., a sum of the item scores divided by the number of items) ranging from 1 to 4 for all the scales of current BJSQ and New BJSQ after converting all item scores so that higher scores indicated better status (e.g., a higher score of job demands means lower job demands and a higher score of psychological stress reaction means low level of psychological distress; on the other hand, a higher score of job resources means higher job resources; for novelty, the score was transformed that the higher score means greater frequency of encountering new things at work). This procedure allowed us to standardize averages and ranges of scores across scales and to interpret scale scores easier, making

Table 1. Scales and the number of items on the Brief Job Stress Questionnaire (BJSQ) and New BJSQ

Scales †	BJSQ (B) or New BJSQ (N)	Number of items (BJSQ + New BJSQ)
Job demands		
1. Quantitative job overload	B	3
2. Qualitative job overload	B	3
3. Physical demands	B	1
4. Interpersonal conflict	B	3
5. Poor physical environment	B	1
6. Emotional demands	N	3
7. Role conflict	N	3
8. Work-self balance (negative)	N	2
Job resources: task-level		
9. Job control	B	3
10. Suitable jobs	B	1
11. Skill utilization	B	1
12. Meaningfulness of work	B/N ‡	3
13. Role clarity	N	3
14. Career opportunity	N	3
15. Novelty	N	3
16. Predictability	N	3
Job resources: workgroup-level		
17. Supervisor support	B	3
18. Coworker support	B	3
19. [Support from family and friends]	B	3
20. Monetary/status reward	N	2
21. Esteem reward	N	2
22. Job security	N	3
23. Leadership	N	3
24. Interactional justice	N	3
25. Workplace where people compliment each other	N	3
26. Workplace where mistakes are acceptable	N	2
27. Collective efficacy	N	3
Job resources: organizational-level		
28. Trust with management	N	3
29. Preparedness for change	N	3
30. Procedural justice	N	3
31. Respect for individuals	N	3
32. Fair personnel evaluation	N	3
33. Diversity	N	3
34. Career development	N	5
35. Work-self balance (positive)	N	2
Outcomes		
36. Vigor	B	3
37. Anger-irritability	B	3
38. Fatigue	B	3
39. Anxiety	B	3
40. Depression	B	6
41. Physical stress reaction	B	11
42. Job satisfaction	B	1
43. [Satisfaction with family life]	B	1
44. Workplace harassment	N	2
45. Workplace social capital	N	3
46. Work engagement	N	2
47. Performance of a duty	N	3
48. Realization of creativity	N	3
49. Active learning	N	3
Total number of items		141

† [ ] indicates non-work environment or outcome. ‡ A three-item scale was constructed for the New BJSQ by adding two items to its one-item BJSQ scale on intrinsic reward.

Table 2. Demographic characteristics among employees who participated in the baseline survey (*N* = 1,633) and one-year follow-up survey (*N* = 417)

Demographic characteristics	Baseline		One-year follow-up	
	n (%)	Average (SD)	*n* (%)	Average (SD)
Gender				
Men	847 (51.9)		202 (48.4)	
Women	786 (48.1)		215 (51.6)	
Age				
29 yr old or less	254 (15.6)		41 (9.8)	
30–39 yr old	450 (27.6)		107 (25.7)	
40–49 yr old	464 (28.4)		129 (30.9)	
50–59 yr old	426 (26.1)		129 (30.9)	
60 yr old or more	39 (2.4)		11 (2.6)	
Occupation				
Managers	152 (9.3)		42 (10.1)	
Professionals and Technicians	363 (22.2)		95 (22.8)	
Clerks	301 (18.4)		75 (18.0)	
Sales workers	171 (10.5)		40 (9.6)	
Service workers	165 (10.1)		50 (12.0)	
Transportation and telecommunications	70 (4.3)		14 (3.4)	
Production workers and laborers	252 (15.4)		55 (13.2)	
Others	147 (9.0)		45 (10.8)	
Unknown	12 (0.7)		1 (0.2)	
Employment contract				
Company president and executives	37 (2.3)		7 (1.7)	
Permanent employees	1,051 (64.4)		256 (61.4)	
Temporary employees	39 (2.4)		7 (1.7)	
Contract employees	99 (6.1)		29 (7.0)	
Part-time workers	383 (23.5)		113 (27.1)	
Others	20 (1.2)		5 (1.2)	
Unknown	4 (0.2)		– (0.0)	
Working hours in the past month		172.3 (55.9)		168.0 (53.7)
Company size (number of employees)				
1–20	282 (17.3)		64 (15.3)	
21–49	156 (9.6)		39 (9.4)	
50–99	134 (8.2)		46 (11.0)	
100–299	243 (14.9)		50 (12.0)	
300–499	106 (6.5)		33 (7.9)	
500–999	126 (7.7)		39 (9.4)	
1,000 or more	441 (27.0)		100 (24.0)	
Civil service	113 (6.9)		39 (9.4)	
Unknown	32 (2.0)		7 (1.7)	

the comparison of the scale scores more convenient.

Cronbach's alpha coefficient for each scale was calculated to evaluate internal consistency reliability. A proportion of variance explained by the first factor was calculated for scales with more than one item to examine their factor-based validity. Furthermore, based on the data from 417 respondents who completed the one-year follow-up, Pearson's correlation coefficients were calculated to evaluate one-year test-retest reliability. For these analyses, a pair-wise deletion of cases rather than list-wise deletion was used when items had a missing response.

Using 1,442 respondents who completed all the 34 psychosocial work environment scales (excluding "support from family and friends" scale because of non-work environment), exploratory and confirmatory factor analyses were conducted for 34 scales to see whether the factor

structure fit the job demands-resources (JD-R) model[37], in which psychosocial work environment can be classified into job demands and task-, workgroup-, and organizational-level job resources. For exploratory factor analysis, the principal factor method with Oblimin rotation was used to extract the number of factors based on the scree test criterion. The scree test involves plotting the eigenvalues in descending order of their magnitude against their factor numbers and determining where they level off. The break between steep slope and leveling off indicates the number of meaningful factors. For confirmatory factor analysis, model fit was assessed using fit indices including the goodness of fit index (GFI), adjusted goodness of fit index (AGFI), comparative fit index (CFI), and root mean square error of approximation (RMSEA) estimated by the maximum likelihood method. To examine whether the data fit the JD-R model[37], in which job demands predict negative emotional reactions (such as burnout) while job resources, including task-level, workgroup-level, and organizational-level, predict both negative and positive emotional reactions (such as work engagement), polychoric correlation coefficients were calculated between 35 scales (including "support from family and friends" scale) of psychosocial work environment and selected outcomes (psychological and physical stress reactions, work engagement, workplace social capital, and workplace harassment) using 1,398 respondents who completed all scales.

All the analyses were conducted using the IBM SPSS Statistics and Amos version 19.

Results

National average of the New BJSQ scores

For a nationally representative sample of 1,633 employees, average scores for most scales of the current BJSQ and New BJSQ fell between 2.0 and 3.0, with an average of 2.6 (Table 3). The average score was higher for workplace harassment (3.58), depression (3.27), and physical stress reactions (3.22) and lower for work-self balance (positive), respect for individuals, quantitative job overload, and fair personnel evaluation (2.10–2.15). More detailed information about the national average scores by gender, occupation, employment type, and industry is available at http://www.jstress.net (only in Japanese language).

Reliability of the New BJSQ

Almost all scales showed high internal consistency reliability (Cronbach's alpha>0.70) (Table 4). The Cronbach's alpha coefficients were moderate for interpersonal conflict, role clarity, predictability, job security, and diversity (0.60–0.69). Furthermore, among 417 workers who completed one-year follow-up, one-year test-retest reliability as measured by Pearson's correlation coefficient was high (0.50 or greater) for most scales while it was slightly lower for skill utilization, role clarity, predictability, workplace harassment, and performance of a duty.

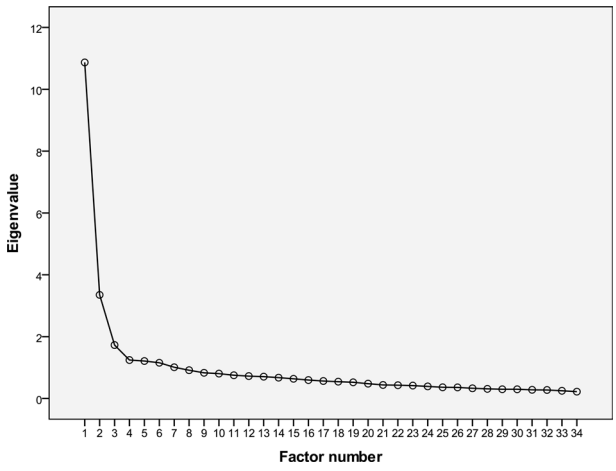

Fig. 1. Scree plot for exploratory factor analysis.

Factor-based validity of the New BJSQ

For most scales, the variance explained by the first factor in the principal component analysis exceeded 50% (Table 4). The variance explained was lower (30–50%) for psychological stress reaction and physical stress reaction scales of the current BJSQ.

Scale factor analysis

Figure 1 shows the scree plot for the exploratory factor analysis of 34 scales of the current BJSQ and New BJSQ, which measure psychosocial work environment. According to the scree test criterion, three-factor structure was thought to be meaningful because the break between the steep slope and leveling off was between factor number three and four.

When we assumed the three-factor structure, most organizational-level job resources scales showed high loadings on Factor 1 (>0.70) (Table 5). Most scales from workgroup-level job resources also showed moderate factor loadings (>0.50) on this factor. Factor 1 could be interpreted as workgroup- and organizational-level job resources. Most job demands scales showed higher factor loading on Factor 2, possibly representing a job demands dimension. Three out of eight scales of task-level job re-

Table 3. Averages (and standard deviations, SDs) of the BJSQ and New BJSQ scores obtained from a nationally representative survey of employees of Japan in 2010/2011 †

Scales ‡	Number of items	Average	(SD)
1. Quantitative job overload	3	2.14	0.76
2. Qualitative job overload	3	2.16	0.71
3. Physical demands	1	2.49	1.08
4. Interpersonal conflict	3	2.88	0.66
5. Poor physical environment	1	2.78	0.99
6. Emotional demands	3	2.65	0.82
7. Role conflict	3	2.78	0.77
8. Work-self balance (negative)	2	2.78	0.86
Job demands summary		2.58	0.51
9. Job control	3	2.53	0.74
10. Suitable jobs	1	2.92	0.80
11. Skill utilization	1	3.00	0.85
12. Meaningfulness of work	3	3.09	0.67
13. Role clarity	3	3.16	0.59
14. Career opportunity	3	2.68	0.81
15. Novelty	3	2.78	0.80
16. Predictability	3	2.46	0.73
Task-level job resources summary		2.90	0.49
17. Supervisor support	3	2.37	0.75
18. Coworker support	3	2.68	0.70
19. [Support from family and friends]	3	3.31	0.68
20. Monetary/status reward	2	2.41	0.79
21. Esteem reward	2	2.72	0.67
22. Job security	3	2.46	0.75
23. Leadership	3	2.18	0.77
24. Interactional justice	3	2.55	0.80
25. Workplace where people compliment each other	3	2.42	0.82
26. Workplace where mistakes are acceptable	2	2.26	0.78
27. Collective efficacy	3	2.49	0.74
Workgroup-level job resources summary		2.45	0.54
28. Trust with management	3	2.53	0.71
29. Preparedness for change	3	2.48	0.72
30. Procedural justice	3	2.27	0.73
31. Respect for individuals	3	2.12	0.72
32. Fair personnel evaluation	3	2.15	0.77
33. Diversity	3	2.52	0.70
34. Career development	5	2.19	0.74
35. Work-self balance (positive)	2	2.10	0.78
Organizational-level job resources summary		2.29	0.56
36. Vigor	3	2.26	0.79
37. Anger-irritability	3	2.70	0.85
38. Fatigue	3	2.70	0.88
39. Anxiety	3	2.87	0.80
40. Depression	6	3.27	0.67
Psychological stress reaction (total)	18	2.85	0.61
41. Physical stress reaction	11	3.22	0.54
42. Job satisfaction	1	2.60	0.85
43. [Satisfaction with family life]	1	3.06	0.81
44. Workplace harassment	2	3.58	0.67
45. Workplace social capital	3	2.74	0.69
46. Work engagement	2	2.52	0.77
47. Performance of a duty	3	2.98	0.57
48. Realization of creativity	3	2.67	0.72
49. Active learning	3	2.55	0.72

† The number of respondents varied from 1,590 to 1,627 because of missing values. ‡ [ ] indicates non-work environment or outcome. Each scale score was converted so that the higher score indicates better state and ranges from 1 to 4. See text for more details on scoring.

Table 4. Internal consistency, one-year test-retest reliability, and factor based validity of the BJSQ and New BJSQ scales

Scales †	*n*	Cronbach's alpha coefficient	Proportion explained by the first factor (%)	One-year test-retest (Pearson's correlation coefficient) *n* = 373–389
Job demands				
1. Quantitative job overload	1,621	0.770	69.0	0.655***
2. Qualitative job overload	1,617	0.741	66.3	0.716***
3. Physical demands	–	NC	–	0.699***
4. Interpersonal conflict	1,610	0.690	61.8	0.563***
5. Poor physical environment	–	NC	–	0.637***
6. Emotional demands	1,624	0.860	78.2	0.628***
7. Role conflict	1,623	0.791	70.6	0.633***
8. Work-self balance (negative)	1,624	0.885	89.7	0.616***
Job resources: task-level				
9. Job control	1,618	0.717	63.9	0.653***
10. Suitable jobs	–	NC	–	0.659***
11. Skill utilization	–	NC	–	0.428***
12. Meaningfulness of work	1,624	0.813	74.0	0.720***
13. Role clarity	1,626	0.646	59.4	0.426***
14. Career opportunity	1,618	0.848	76.8	0.691***
15. Novelty	1,621	0.781	69.5	0.575***
16. Predictability	1,625	0.691	62.0	0.424***
Job resources: workgroup-level				
17. Supervisor support	1,612	0.808	72.3	0.611***
18. Coworker support	1,615	0.781	69.6	0.541***
19. [Support from family and friends]	1,619	0.832	74.9	0.599***
20. Monetary/status reward	1,622	0.728	78.8	0.633***
21. Esteem reward	1,618	0.706	77.4	0.613***
22. Job security	1,620	0.639	58.1	0.620***
23. Leadership	1,607	0.787	70.6	0.654***
24. Interactional justice	1,616	0.905	84.3	0.566***
25. Workplace where people compliment each other	1,624	0.905	84.2	0.595***
26. Workplace where mistakes are acceptable	1,619	0.774	81.6	0.588***
27. Collective efficacy	1,616	0.913	85.2	0.524***
Job resources: organizational-level				
28. Trust with management	1,618	0.851	77.2	0.693***
29. Preparedness for change	1,615	0.771	68.7	0.555***
30. Procedural justice	1,611	0.792	70.7	0.584***
31. Respect for individuals	1,609	0.845	76.4	0.616***
32. Fair personnel evaluation	1,606	0.859	78.2	0.626***
33. Diversity	1,611	0.685	61.5	0.654***
34. Career development	1,609	0.889	69.6	0.733***
35. Work-self balance (positive)	1,623	0.796	83.1	0.625***
Outcomes				
36. Vigor	1,616	0.899	83.3	0.614***
37. Anger-irritability	1,618	0.910	84.7	0.547***
38. Fatigue	1,624	0.891	82.2	0.541***
39. Anxiety	1,623	0.773	69.1	0.603***
40. Depression	1,618	0.885	63.9	0.630***
Psychological stress reaction (total)	1,590	0.929	46.4	0.692***
41. Physical stress reaction	1,610	0.839	39.4	0.689***
42. Job satisfaction	–	NC	–	0.642***
43. [Satisfaction with family life]	–	NC	–	0.580***
44. Workplace harassment	1,624	0.707	78.7	0.478***
45. Workplace social capital	1,626	0.852	77.2	0.620***
46. Work engagement	1,622	0.752	80.2	0.664***
47. Performance of a duty	1,617	0.781	70.2	0.480***
48. Realization of creativity	1,620	0.869	79.3	0.603***
49. Active learning	1,620	0.839	75.7	0.547***

*** $p<0.001$. NC: Not calculated because of one-item scale. † [ ] indicates non-work environment or outcome.

Table 5. Exploratory factor analysis of 34 BJSQ and New BJSQ psychosocial work environment scales †

Scales	Factor 1 (Workgroup- and organizational-level job resources)	Factor 2 (Job demands)	Factor 3 (Task-level job resources)
Job demands			
1. Quantitative job overload	0.067	0.712	–0.080
2. Qualitative job overload	–0.064	0.686	–0.274
3. Physical demands	0.089	0.318	–0.032
4. Interpersonal conflict	0.494	0.501	0.452
5. Poor physical environment	0.363	0.250	0.291
6. Emotional demands	0.255	0.673	0.247
7. Role conflict	0.414	0.654	0.330
8. Work-self balance (negative)	0.222	0.589	0.208
Job resources: task-level			
9. Job control	0.383	0.296	0.371
10. Suitable jobs	0.348	0.184	0.634
11. Skill utilization	0.232	–0.078	0.451
12. Meaningfulness of work	0.483	–0.102	0.808
13. Role clarity	0.407	0.156	0.422
14. Career opportunity	0.579	–0.093	0.674
15. Novelty	–0.172	0.431	–0.121
16. Predictability	0.292	0.111	0.288
Job resources: workgroup-level			
17. Supervisor support	0.608	0.183	0.492
18. Coworker support	0.410	0.156	0.432
20. Monetary/status reward	0.588	0.252	0.379
21. Esteem reward	0.654	0.244	0.506
22. Job security	0.482	0.199	0.343
23. Leadership	0.754	0.005	0.426
24. Interactional justice	0.747	0.210	0.424
25. Workplace where people compliment each other	0.727	0.166	0.420
26. Workplace where mistakes are acceptable	0.692	0.056	0.490
27. Collective efficacy	0.546	0.117	0.455
Job resources: organizational-level			
28. Trust with management	0.712	0.221	0.382
29. Preparedness for change	0.763	0.154	0.367
30. Procedural justice	0.714	0.140	0.304
31. Respect for individuals	0.760	0.141	0.476
32. Fair personnel evaluation	0.765	0.116	0.320
33. Diversity	0.603	0.174	0.372
34. Career development	0.792	0.027	0.435
35. Work-self balance (positive)	0.528	0.141	0.521

† Data from 1,442 respondents who completed 34 scales from a national representative survey of employees of Japan in 2010/2011. "19. Support from family and friends" scale was excluded from the analysis because of non-work environment. Principal factor method was used to extract factors with scree test criterion, and a rotated factor structure with Oblimin method is shown. Factor loadings over 0.50 are underlined.

sources showed high loadings on Factor 3. Skill utilization and role clarity did not load on any factor (<0.50) while highest factor loadings were shown in Factor 3. Therefore, Factor 3 could be interpreted as task-level job resources. The inter-factor correlation between Factor 1 and 2 was 0.20; between Factor 1 and 3 was 0.56; and between Factor 2 and 3 was 0.09, respectively.

In the confirmatory factor analysis, assuming that there were four factors (i.e., job demands and task-, workgroup-, and organizational-level job resources), fit indices

Table 6. Confirmatory factor analysis of 34 BJSQ and New BJSQ psychosocial work environment scales: factor loading for each scale in the four-factor structure (i.e., job demands and task-, workgroup-, and organizational-level job resources) †

Scales	Job demands	Task-level job resources	Workgroup-level job resources	Organizational-level job resources
1. Quantitative job overload	0.600***			
2. Qualitative job overload	0.481***			
3. Physical demands	0.318***			
4. Interpersonal conflict	0.627***			
5. Poor physical environment	0.364***			
6. Emotional demands	0.706***			
7. Role conflict	0.750***			
8. Work-self balance (negative)	0.599***			
9. Job control		0.411***		
10. Suitable jobs		0.580***		
11. Skill utilization		0.438***		
12. Meaningfulness of work		0.758***		
13. Role clarity		0.463***		
14. Career opportunity		0.772***		
15. Novelty		–0.238***		
16. Predictability		0.340***		
17. Supervisor support			0.689***	
18. Coworker support			0.459***	
20. Monetary/status reward			0.582***	
21. Esteem reward			0.693***	
22. Job security			0.477***	
23. Leadership			0.778***	
24. Interactional justice			0.804***	
25. Workplace where people compliment each other			0.787***	
26. Workplace where mistakes are acceptable			0.707***	
27. Collective efficacy			0.564***	
28. Trust with management				0.733***
29. Preparedness for change				0.773***
30. Procedural justice				0.751***
31. Respect for individuals				0.794***
32. Fair personnel evaluation				0.792***
33. Diversity				0.613***
34. Career development				0.812***
35. Work-self balance (positive)				0.543***

***p<0.001. † Data from 1,442 respondents who completed 34 scales from a national representative survey of employees of Japan in 2010/2011. "19. Support from family and friends" scale was excluded from the analysis because of non-work environment. Maximum likelihood method was used to estimate factor loadings. A blank indicates that there was no path from a factor to a job demands/resources scale (i.e., zero factor loading) as hypothetically defined in the model[38].

were 0.79, 0.76, 0.78, and 0.08 for GFI, AGFI, CFI, and RMSEA, respectively. Factor loading for each scale was all significant (p<0.001) (Table 6). When we conducted the same analysis assuming that there were three factors, based on the result of the exploratory factor analysis, these indices were 0.77, 0.74, 0.75, and 0.09, respectively. An additional analysis to compare the four-factor structure and the three-factor structure based on the result of the exploratory factor analysis indicated that the expected cross-validation index (ECVI) was 3.94 for the former model and 4.41 for the latter model, showing the former model had better fit.

Correlation with outcomes

Polychoric correlation coefficients between psychosocial work environment and outcomes were calculated

Table 7. Polychoric correlation coefficients between psychosocial work environment (job demands and job resources) and outcomes measured by using the BJSQ/New BJSQ scales: a national representative sample of employees of Japan in 2010/2011 †

Scales ‡	Psychological stress reactions	Physical stress reactions	Work engagement	Workplace social capital	Workplace harassment
Job demands					
1. Quantitative job overload	0.361**	0.251**	–0.050	0.072**	0.207**
2. Qualitative job overload	0.240**	0.174**	–0.241**	–0.056*	0.147**
3. Physical demands	0.142**	0.103**	–0.110**	0.022	0.126**
4. Interpersonal conflict	0.494**	0.282**	0.305**	0.570**	0.531**
5. Poor physical environment	0.268**	0.179**	0.259**	0.337**	0.240**
6. Emotional demands	0.583**	0.384**	0.172**	0.251**	0.419**
7. Role conflict	0.505**	0.319**	0.236**	0.410**	0.431**
8. Work-self balance (negative)	0.499**	0.317**	0.160**	0.220**	0.275**
Job resources: task-level					
9. Job control	0.329**	0.190**	0.290**	0.241**	0.219**
10. Suitable jobs	0.411**	0.171**	0.610**	0.361**	0.254**
11. Skill utilization	0.142**	0.092**	0.326**	0.193**	0.157**
12. Meaningfulness of work	0.331**	0.142**	0.738**	0.455**	0.183**
13. Role clarity	0.245**	0.103**	0.328**	0.394**	0.153**
14. Career opportunity	0.300**	0.150**	0.578**	0.425**	0.162**
15. Novelty	–0.141**	–0.096**	0.151**	0.017	–0.098**
16. Predictability	0.208**	0.124**	0.229**	0.220**	0.091**
Job resources: workgroup-level					
17. Supervisor support	0.360**	0.209**	0.395**	0.409**	0.314**
18. Coworker support	0.305**	0.180**	0.321**	0.459**	0.264**
19. [Support from family and friends]	0.196**	0.105**	0.175**	0.210**	0.164**
20. Monetary/status reward	0.337**	0.241**	0.331**	0.427**	0.223**
21. Esteem reward	0.390**	0.237**	0.438**	0.511**	0.341**
22. Job security	0.361**	0.248**	0.306**	0.332**	0.326**
23. Leadership	0.299**	0.170**	0.429**	0.461**	0.184**
24. Interactional justice	0.376**	0.211**	0.420**	0.503**	0.362**
25. Workplace where people compliment each other	0.342**	0.189**	0.434**	0.454**	0.302**
26. Workplace where mistakes are acceptable	0.322**	0.177**	0.480**	0.458**	0.240**
27. Collective efficacy	0.320**	0.165**	0.482**	0.518**	0.188**
Job resources: organizational-level					
28. Trust with management	0.366**	0.200**	0.421**	0.547**	0.329**
29. Preparedness for change	0.341**	0.159**	0.393**	0.501**	0.247**
30. Procedural justice	0.303**	0.209**	0.354**	0.477**	0.245**
31. Respect for individuals	0.373**	0.246**	0.514**	0.510**	0.235**
32. Fair personnel evaluation	0.307**	0.193**	0.396**	0.505**	0.205**
33. Diversity	0.285**	0.156**	0.342**	0.447**	0.222**
34. Career development	0.302**	0.181**	0.477**	0.545**	0.211**
35. Work-self balance (positive)	0.435**	0.244**	0.662**	0.417**	0.190**

* $p<0.05$, ** $p<0.01$. No asterisk means $p>0.05$. † Based on data from 1,398 respondents who completed all the scales. Note that all scale scores were converted so that higher scores indicate a better status. See text for more detail. ‡ [ ] indicates non-work environment.

using the data from 1,398 respondents who completed all scales (Table 7). In general, job demands scales correlated strongly with psychological and physical stress reactions but modestly with work engagement and workplace social capital. Job resources scales correlated with psychological and physical stress reactions to a similar extent. However, these scales, particularly workgroup- and organizational-level job resources, correlated with work engagement and workplace social capital more strongly than did job demands. These findings are consistent with the theoretical framework of the JD-R model[37] in which job demands predict negative emotional reactions (such as burnout)

while job resources predict both negative and positive emotional reactions (such as work engagement).

Discussion

In the present study, we developed the New BJSQ, which can assess an extensive set of job demands, job resources, and outcomes, by adding items/scales to the current version of the BJSQ. Most scales of the New BJSQ as well as the current BJSQ showed acceptable levels of internal consistency and test-retest reliability over one year. Principal component analyses of scale items showed that the first factor explained 50% or more of variance for most scales, suggesting factor-based validity of these scales. Exploratory factor analysis of the current BJSQ/New BJSQ scales of psychosocial work environment indicated that the three-factor structure (i.e., job demands, task-level job resources, and combined factor for workgroup- and organizational-level job resources) is meaningful while confirmatory factor analysis showed better mode fit for the firstly assumed four-factor structure rather than the three-factor structure based on the result of the exploratory factor analysis. A correlation analysis showed that job demands and job resources were associated with mental and physical health while job resources were also associated with positive outcomes, such as work engagement and workplace social capital, as predicted by the JD-R model[37]. These findings provided evidence that the New BJSQ scales are reliable and valid and fit expectations from the JD-R model.

As introduced earlier, the principal aim of the New BJSQ is to assess psychosocial workplace environments and their employee (i.e., health-related) and organizational (i.e., business-related) outcomes in an extensive way. By using the national average scores as well as information about their distributions by gender, occupation, employment type, and industry, as norms, the New BJSQ scales can be used to assess psychosocial work environment and related outcomes to prevent stress at work and promote positive mental health at work. Newly added scales can be used to assess psychological work environment with a broader range of theoretical models of job stress, such as ERI and organizational justice, and a boarder range of outcomes, such as work engagement, perceived workplace social capital, and workplace harassment. The New BJSQ followed the tradition of the current BJSQ, assessing psychosocial work environment and outcomes simultaneously, which is also used in the PRIMA-EF approach[25]. An additional unique feature of the New BJSQ is that it includes a scale of perceived workplace social capital as an organizational outcome summarizing influence of psychosocial job resources. This approach may have some merits. While outcomes are a primary indicator of the need for an intervention, measuring psychosocial work environment could provide information on components of work environment, which should be a target of the intervention. The information provided by this approach on the association between psychosocial work environment and outcomes, which may vary depending on workplace, occupation, and industry, could be also useful for planning an intervention. Furthermore, outcomes assessed by the New BJSQ are supposed to predict further distal employee outcomes, such as satisfaction and well-being, and organizational outcomes, such as productivity and innovation, which need to be addressed in the future research.

The present study has some limitations that should be considered. First, the response rate in the present study was only 47.7% and employees engaged in large-sized enterprises (number of employees≥1,000) seemed over-represented (Table 2). In addition, out of these respondents (n=1,633), only 479 participated in the follow-up survey. Although we calculated national average of each scale of the current BJSQ and New BJSQ using these 1,633 respondents, it should be noted that the national average scores of the present study (Table 3) is only preliminary and may be affected by a selection bias to some extent. Further research using larger sample with higher response rate should be conducted to calculate more precise national average scores. Second, we exhaustively reviewed the relevant literature to find recent theories on job stress and their measures. Accordingly, we selected new scales/items according to the questionnaires and/or published job stress and related variables used in foreign studies, which may provide a piece of content validity of the New BJSQ. However, a more detailed content validity could not be examined. Similarly, the present study provided a partial support for construct validity of the New BJSQ by calculating a proportion of variance explained by the first factor and conducting factor analyses and correlation analyses between psychosocial work environment and outcomes. However, convergent and discriminant validities using other reliable and valid measurements (e.g., Job Content Questionnaire [JCQ][39], General Health Questionnaire [GHQ][40], Center for Epidemiologic Studies Depression [CES-D] Scale[41], World Health Organization Health and Work Performance Questionnaire [WHO-HPQ][42], etc.) could not be examined. Thus, more detailed content and construct validities should be examined in a future study.

Third, a few scales of the New BJSQ showed only modest internal consistency and test-retest reliability, particularly for role clarity scale. Further review of these items is needed to achieve higher measurement accuracy. Fourth, since the confirmatory factor analysis did not reach the recommended acceptable level for model fit (i.e., GFI, AGFI, and CFI>0.90 and RMSEA<0.05)[43], further study on factor structure of the New BJSQ is needed. Finally, as mentioned earlier, the standard version of the New BJSQ has 141 items in total when combined with the current 57-item BJSQ, which may be acceptable in practice due to large number of items. However, a recommended set of scales and a short version were also developed. A future study should examine the reliability and validity of these versions. Although the New BJSQ remains a matter of further revisions, it can assess a broader set of psychosocial factors at work compared to the current BJSQ.

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