

Reliability and validity of the Chinese version of the New Brief Job Stress Questionnaire (New BJSQ) among workers in China

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Abstract: This study aimed to develop the Chinese version of the New Brief Job Stress Questionnaire (New BJSQ) and investigate its reliability and validity. The survey was administered at two time-points separated by a two-week interval among Chinese workers. The Chinese version of the New BJSQ was developed according to the international guidelines. Cronbach's alpha, intra-class correlation coefficients (ICCs), and Pearson correlation coefficient were calculated to assess the reliability. A variance explained by the first factor was calculated to examine factor-based validity, and confirmatory factor analysis was performed (CFA) to determine the construct validity. Baseline and follow-up analyses included 516 and 52 workers, respectively. In most scales, sufficient internal consistency and test-retest reliability were observed, and principal component analyses demonstrated that the first factor explained more than 50% proportion of the variance. CFA showed that the four-factor model (Job demands, Task-level job resources, Workgroup-level job resources, and Organizational-level job resources) demonstrated a moderate fit, similar to the original version. The Chinese version of New BJSQ showed good reliability and moderate validity. Future studies should explore content and construct validities and the factor structure of the Chinese version of the New BJSQ in more detail.

Key words: New brief job stress questionnaire, Reliability, Validity, Stress assessment, Psychosocial factors at work, Scale development

Introduction

Since the early 1990s, China has been experiencing rapid economic and social changes. The continuous growth led to

dramatic changes in China's working environment, with workers experiencing increased workload or working hours¹⁾ that negatively affect workers' mental health²⁻⁵⁾. Therefore, to prevent them from developing mental illness and promote their healthy mental state, it is essential to measure and subsequently improve psychosocial factors at work.

Occupational stress has been considered a risk factor for

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various health outcomes^{6–8}). The two most prominent theoretical approaches that have been developed to understand the effect of job stressors on the health outcomes of workers are the job-demand-control (JDC) model⁹ and the effort-reward imbalance (ERI) model¹⁰. These models have shown elevated disease risks in the exposed population. The Job Content Questionnaire (JCQ) and Effort reward Imbalance (ERI) scale have been translated into Chinese, and their reliability and validity have been proven^{11, 12}. Those two models have also been applied to China's working population and have shown adverse health effects, such as depression¹³.

Additionally, attention to organizational justice, workplace social capital, or workplace bullying has been increasing worldwide^{14–18}. Their effects on health have also been studied in China^{19–22}. Although all these factors are essential, no comprehensive questionnaire has been developed in Chinese; thus, each factor has to be measured using a separate measure. The combined scales contain too many items; thus, their administration is time-consuming and tiresome for the participants. Accordingly, it is necessary to develop a questionnaire with fewer items and the same level of validity that would comprehensively measure psychosocial factors at work and health-related outcomes.

The New Brief Job Stress Questionnaire (New BJSQ) measures psychosocial factors at work, organizational outcomes, and employees' health-related states²³. The New BJSQ was developed based on the original Brief Job Stress Questionnaire (BJSQ) that has been widely used in Japan^{24, 25}. By adding new questions to the BJSQ, the New BJSQ extensively covers a psychological work environment with a broader range of theoretical models of job stress, such as job-demand-control-support (JDCS), ERI, organizational justice, and a wide range of outcomes, such as work engagement, perceived workplace social capital, and workplace harassment²³. New BJSQ has been used in several studies that have demonstrated the association of high job strain with depressive symptoms and burnout and a buffering effect of coworkers' support on depressive symptoms and burnout among physicians²⁶. The risk ratio for the onset of depression was 2.96 in the group scoring in the top 25% of the stress response on the BJSQ (same in New BJSQ) compared to the other 75%²⁷. Workers scoring high on the stress dimension of the BJSQ (57 items out of 141 items of New BJSQ) were more likely to take a sick leave²⁵. Accordingly, the New BJSQ can measure psychosocial factors and health-related outcomes simultaneously. The New BJSQ has two strengths. First, measures the abovementioned factors comprehensively with a small number of

items (141 items) instead of measuring each element separately. Second, the New BJSQ can assess both individual-level job stressors (i.e., job demands or job control) and workgroup-level or organizational-level job stressors (i.e., supervisor support or procedural justice) simultaneously. Thus, the results calculated at the workgroup-level or the organizational level can clarify the advantages and disadvantages of the workplace, encouraging employees to think about how to improve the work environment. However, in the Chinese language, no questionnaire can measure job-related factors and outcomes as comprehensively as the New BJSQ.

The purpose of this study was to examine the internal consistency reliability, test-retest reliability, and construct validity of the Chinese version of the New BJSQ among workers in China. The validation study would permit extending the use of the New BJSQ, which is currently limited only to the Japanese version. Based on the original scale development study²³, we hypothesized that the Chinese version of the New BJSQ would have high internal consistency, high intraclass correlation coefficient, and moderate structural validity.

Methods

Study design and participants

This current study aimed to validate the Chinese version of the New BJSQ. This manuscript was written according to the Consensus-based Standards for selecting health Measurement Instruments (COSMIN) study design checklist²⁸. We administered two Internet surveys among Chinese workers two weeks apart to test its reliability and validity. A Chinese Internet survey company managed the surveys, and all the participants had registered with the company. The first survey was conducted in May 2019, and the second one in June 2019. The invitation e-mail to participate in the study was sent to the registered members, and those who agreed to participate could access the online survey website. In the beginning, they were asked some questions related to demographic information (age, work contract, and occupation) to identify the participants who were eligible for the inclusion criteria mentioned below. The participants' inclusion criteria were Chinese full-time workers (except military) who lived in China and were 20–59 years old. A total of 516 individuals who passed the inclusion criteria participated in the baseline survey on a first-come, first-served basis. The participants were stratified by gender (males, females) and age (20–29, 30–39, 40–49, and 50–59). The response rate for the baseline sur-

vey could not be calculated because we surveyed the company. Those who have answered the baseline survey were asked to complete the follow-up survey. Fifty-two participants who completed baseline filled out the second survey on a first-come, first-served basis. All data were collected with a self-reported questionnaire. This research protocol has approved by the research ethics committee of the Graduate School of Medicine and the Faculty of Medicine, The University of Tokyo, Japan (No. 10003-(5)). Under the approved protocol, we obtained informed consent from every participant through the questionnaire on the website.

The development procedure of the Chinese version of the New BJSQ

The development process of the Chinese version of the New BJSQ complied with the International Society of Pharmacoeconomics and Outcomes Research (ISPOR) task force guidelines²⁹. First, we obtained permission from the original authors to translate the New BJSQ from Japanese into Chinese, which was done by a native Chinese speaker who is an expert in translation. The translated questionnaire was sent to three Chinese researchers (university researchers, two with a Ph.D. and one with a master's degree) in mental health fields for validation. After some corrections, a draft of the measurement was developed based on a consensus among the three Chinese researchers and two researchers working on this project (YH and NK). This version was back-translated into Japanese by a professional native Japanese translator who was not familiar with the questionnaire. The back-translated questionnaire was sent to the original authors and two other researchers specializing in occupational mental health. They reviewed its literal and conceptual equivalence, and the original author confirmed the back translation. Finally, one bilingual worker of Chinese and Japanese reviewed the Chinese version of the New BJSQ to verify if the items were appropriated, and the authors confirmed its cognitive equivalence.

Measures

The study's self-reported questionnaire included the newly developed Chinese version of the New BJSQ and demographic measures (gender, age, education, occupation, and worksite size (number of employees)). The Chinese version of the New BJSQ consists of 49 scales and 141 items, like the original version of the New BJSQ²³ (see Table 2). Each scale consists of one to 11 items rated on a four-point Likert scale ranging from 1 (Almost never) to 4 (Almost always) for the scales assessing health status (scale No. 36–41), from 1 (Extremely) to 4 (Not at all) for the

scales assessing social support (scale No. 17–19), from 1 (Satisfied) to 4 (Dissatisfied) for the scales assessing satisfaction (scale No. 42 and 43), and from 1 (Very much) to 4 (Not at all) for the other scales. We utilized the same method as the original study²³ to calculate each scale's score. Each scale (ranging from 1 to 4) was calculated by dividing the sum of the items' score by the number of items included. Before calculating the scale scores, all items were re-coded so that higher scores indicated better psychosocial environment status (i.e., lower job stressors and higher resources) and outcomes.

Statistical Analysis

To evaluate the internal consistency, Cronbach's alpha coefficient was calculated for each subscale. A proportion of variance explained by the first factor in principal component analyses was calculated for scales with more than one item to examine their factor-based validity. Moreover, among those who answered the follow-up survey, the intraclass correlation coefficient (ICC) and Pearson's correlation coefficients were calculated to evaluate test-retest reliability. Confirmatory factor analyses were employed among the 34 scales of psychosocial work environment scales to verify whether the Chinese version of the New BJSQ would have the same four factor structure as the original version of the New BJSQ²³. The fit of the four-factor model was assessed using fit indices, specifically goodness of fit index (GFI), adjusted goodness of fit index (AGFI), comparative fit index (CFI), and root mean square error of approximation (RMSEA) predicted by the maximum likelihood method were examined. The standard scores for fit indices are GFI, AGFI, and CFI > 0.90 and RMSEA < 0.05³⁰. All analyses were conducted using SPSS Statistics version 22 and Amos version 26.

Sample size calculation

According to the COSMIN checklist²⁸, to test the construct validity, it is recommended to collect more than 100 participants in the study. The estimated sample size based on the calculation by Bonett³¹ was 18 participants to achieve Cronbach's alpha of 0.70 or greater for the scales included in the Chinese version of the New BJSQ, considering an alpha error rate of 0.05 and a beta error rate of 0.80. The estimated sample size was 11 participants to achieve ICC or Pearson's correlation coefficients of 0.7 or greater for the scales at an alpha error rate of 0.05 and a beta error rate of 0.80. G*Power 3 program was used for the sample size calculation^{32, 33}. In other words, more than 100 participants are required for the baseline survey, and

more than 11 participants are needed for the follow-up survey. According to the COSMIN checklist²⁸⁾, the required sufficient sample size for confirmatory factor analyses was 238 (34 factors*7). Thus, this study needed more than 238 participants.

Results

Participants' characteristics

A total of 516 and 52 Chinese workers responded to the baseline and follow-up surveys, respectively. The response rate of the follow-up survey was 10.1%. Table 1 lists the participants' characteristics, showing that 30.4% were professionals or technicians, 27.5% were managers, and 23.3% were clerks. More than 70% of them had a university with more education. The dataset did not contain any missing data because the respondents answered the questionnaires through the survey company's website, and the survey system could not process questionnaires with unanswered items.

Mean scores of the Chinese version of the New BJSQ scales

The average scores, standard deviations (SDs), kurtosis, and skewness of scales of the Chinese version of the New BJSQ are shown in Table 2. Average scores of almost all the scales ranged from 2.0 to 3.0. The scale of workplace harassment had the highest kurtosis (−1.12), and the scale of depression had the highest skewness (−0.85).

Internal consistency and test-retest reliability

The Cronbach's alpha coefficients of the Chinese version of the New BJSQ ranged from 0.51 to 0.91. Cronbach's alphas were greater than 0.70 for most subscales (see Table 3), although the internal consistency values ranged from 0.60 to 0.69 for role conflict, coworker support, and qualitative job overload and from 0.50 to 0.59 for interpersonal conflict, esteem reward, and job security. Among the 52 participants who completed the baseline and two-week follow-up survey, test-retest reliability was calculated using the intraclass correlation coefficient (ICC) and Pearson's correlation coefficients. ICCs were greater than 0.70 for several scales. Pearson's correlation coefficients were 0.50 or greater for most scales except for job control, predictability, leadership, preparedness for change, vigor, fatigue, anxiety, and depression with values smaller than 0.50. For anger-irritability, the correlation between baseline and follow-up survey was non-significant.

Factor-based validity of the Chinese version of the New

BJSQ

For most scales, the variance explained by the first factor in the principal component analysis exceeded 50% (Table 3). The variance explained was less than 50% for psychological stress reaction and physical stress reaction scales.

Construct validity (Structural validity)

The results of the confirmatory factor analysis are shown in Table 4. GFI, AGFI, CFI, and RMSEA fit indices for the four factors that were the same as in the original questionnaire were 0.67, 0.63, 0.70, and 0.10, respectively.

Discussion

In the present study, we developed the Chinese version of the New BJSQ (Appendix file 1). This questionnaire assesses a comprehensive set of job demands, job resources, and outcomes (psychological and physical stress reactions). The newly developed questionnaire showed good internal consistency reliability Cronbach's alpha coefficients > 0.7) for 39 (88.6%) out of the 44 calculatable subscales, with low internal consistency reliability (<0.6) for some scales (Role clarity, Qualitative job overload, Interpersonal conflict, Esteem reward, and Job security). The two-week test-retest reliability was acceptable for 41 (83.7%) out of the 49 subscales (Pearson's correlation coefficients ≥ 0.5) except for the following subscales: job control, predictability, leadership, preparedness for change, vigor, fatigue, anxiety, and depression. For the factor-based validity, the variance explained by the first factor exceeded 50% for most scales except for psychological stress reaction and physical stress reaction scales. However, the scale factor structure only moderately to poorly fit to the hypothesized factor structure. The study suggests that most subscales of the Chinese version of the New BJSQ are reliable. However, because the study tested only limited aspects of its validity and the scale structure may vary across cultures even if each scale is valid, further research is needed to investigate the validity of the questionnaire based on the present findings.

Most subscales of the Chinese version of the New BJSQ showed acceptable internal consistency levels (Cronbach's alpha > 0.70). The scales of Role clarity and Qualitative job overload had moderate (0.60–0.69) while Interpersonal conflict, Esteem reward, and Job security had low (0.50–0.59) scores. Test-retest reliability (ICC and Pearson's correlation coefficients) over two weeks was moderate. Although coefficients for most scales were greater than 0.50 and statistically significant, some scales had low cor-

Table 1. Demographic characteristics of employees who participated in baseline survey (N=516) and follow-up survey (N=52)

Demographic characteristics	Baseline	Follow-up
	N (%)	N (%)
Gender		
Male	258 (50.0%)	25 (48.1%)
Female	258 (50.0%)	27 (51.9%)
Age		
20–29	128 (24.8%)	4 (7.7%)
30–39	130 (25.2%)	16 (30.8%)
40–49	130 (25.2%)	21 (40.4%)
50–59	128 (24.8%)	11 (21.2%)
Occupation		
Managers	142 (27.5%)	14 (26.9%)
Professionals and Technicians	157 (30.4%)	16 (30.8%)
Clerks	120 (23.3%)	16 (30.8%)
Service workers	15 (2.9%)	1 (1.9%)
Transportation and telecommunications	30 (5.8%)	1 (1.9%)
Production workers and laborers	21 (4.1%)	2 (3.8%)
Others	31 (6.0%)	2 (3.8%)
Education		
Junior high school	1 (0.2%)	0 (0.0%)
High school	22 (4.3%)	2 (3.8%)
College	116 (22.5%)	14 (26.9%)
University	342 (66.3%)	31 (59.6%)
Graduate school	35 (6.8%)	5 (9.6%)
Worksite size (number of employees)		
–49	61 (11.8%)	12 (23.1%)
50–99	59 (11.4%)	6 (11.5%)
100–499	185 (35.9%)	19 (36.5%)
500–999	117 (22.7%)	3 (5.8%)
1,000–4,999	62 (12.0%)	10 (19.2%)
5,000–	32 (6.2%)	2 (3.8%)

relations, less than 0.40. The correlation between baseline and follow-up scores on the anger-irritability scale did not show a significant correlation. The internal consistency reliability for the anger-irritability scale was high (Cron-

bach's alpha of 0.85), while the test-retest reliability was extremely low. The discrepancy between the two measures of the scale reliability is puzzling, but may indicate that changing anger-irritability may be responsible for the low

Table 2. Averages, standard deviations (SDs), kurtosis, and skewness of the Chinese version of the New BJSQ scores collected at baseline (N=516)

Scales†	Number of items	Mean	SD	Kurtosis	Skewness
1. Quantitative job overload	3	2.29	0.64	-0.22	-0.08
2. Qualitative job overload	3	2.15	0.63	-0.19	0.27
3. Physical demands	1	2.78	0.85	-0.30	-0.44
4. Interpersonal conflict	3	2.80	0.59	-0.62	-0.11
5. Poor physical environment	1	2.75	0.86	-0.46	-0.34
6. Emotional demands	3	2.78	0.79	-0.93	-0.42
7. Role conflict	3	2.77	0.72	-0.62	-0.25
8. Work-self balance (negative)	2	2.39	0.73	-0.41	0.12
Job demands summary	19	2.59	0.44	-0.28	-0.18
9. Job control	3	2.75	0.65	-0.26	-0.19
10. Suitable jobs	1	2.92	0.70	0.05	-0.31
11. Skill utilization	1	2.79	0.87	-0.33	-0.48
12. Meaningfulness of work	3	2.93	0.70	0.07	-0.56
13. Role clarity	3	2.97	0.60	0.26	-0.52
14. Career opportunity	3	2.86	0.70	-0.52	-0.28
15. Novelty	3	2.50	0.76	-0.60	-0.05
16. Predictability	3	2.65	0.65	0.44	-0.60
Task-level job resources summary	20	2.80	0.36	-0.26	-0.09
17. Supervisor support	3	2.64	0.67	-0.22	-0.26
18. Coworker support	3	2.87	0.56	-0.05	-0.14
19. [Support from family and friends]	3	3.16	0.65	-0.73	-0.30
20. Monetary/status reward	2	2.99	0.70	-0.16	-0.44
21. Esteem reward	2	2.95	0.65	-0.40	-0.13
22. Job security	3	2.67	0.66	-0.40	-0.04
23. Leadership	3	2.75	0.67	0.28	-0.63
24. Interactional justice	3	2.73	0.70	-0.44	-0.20
25. Workplace where people complement each other	3	2.78	0.73	-0.36	-0.47
26. Workplace where mistakes are acceptable	2	2.60	0.83	-0.73	-0.10
27. Collective efficacy	3	2.85	0.65	0.03	-0.46
Workgroup-level job resources summary	30	2.78	0.46	-0.02	-0.29
28. Trust with management	3	2.90	0.64	-0.11	-0.39
29. Preparedness for change	3	2.79	0.73	-0.51	-0.34
30. Procedural justice	3	2.72	0.73	-0.43	-0.41
31. Respect for individuals	3	2.76	0.70	-0.25	-0.33
32. Fair personnel evaluation	3	2.72	0.76	-0.44	-0.37
33. Diversity	3	2.61	0.78	-0.53	-0.37
34. Career development	5	2.75	0.67	-0.41	-0.41
35. Work-self balance (positive)	2	2.78	0.70	-0.25	-0.31
Organizational-level resources summary	25	2.75	0.56	0.10	-0.35

Table 2. Continued

Scales†	Number of items	Mean	SD	Kurtosis	Skewness
36. Vigor	3	2.56	0.75	-0.65	-0.13
37. Anger-irritability	3	2.94	0.74	-0.58	-0.44
38. Fatigue	3	2.75	0.76	-0.62	-0.41
39. Anxiety	3	3.08	0.65	-0.13	-0.60
40. Depression	6	3.17	0.61	0.28	-0.85
Psychological stress reaction (total)	18	2.94	0.54	-0.44	-0.38
41. Physical stress reaction	11	3.06	0.57	-0.44	-0.42
42. Job satisfaction	1	2.98	0.70	0.20	-0.39
43. [Satisfaction with family life]	1	3.18	0.71	-0.23	-0.48
44. Workplace harassment	2	3.07	1.00	-1.12	-0.61
45. Workplace social capital	3	2.93	0.66	0.12	-0.54
46. Work engagement	2	2.93	0.66	-0.60	-0.24
47. Performance of a duty	3	2.76	0.78	-0.01	-0.49
48. Realization of creativity	3	3.00	0.69	0.20	-0.76
49. Active learning	3	2.91	0.65	-0.35	-0.33

† [] indicates non-work environment or outcome. According to the original paper, each scale score was converted so that the higher score indicates better state and ranges from 1 to 4.

test-retest reliability. Anger-irritability is affected by the social environment more among Chinese than Americans³⁴. Anger-irritability of participants may have fluctuated depending on the social situation where they had at each time point. It would be useful how cultural differences in expression of anger could affect the stability of anger. Principal component analyses of scale items revealed that the first factor explained 50% or more variance in most scales, suggesting factor-based validity of these scales. GFI, AGFI, CFI, and RMSEA scores were below standard values (i.e., GFI, AGFI, and CFI > 0.90 and RMSEA < 0.05)³⁰, indicating that the Chinese version of the New BJSQ was not well fitted to the structural model of the original New BJSQ. Such a moderate fitness could have resulted from insufficient cognitive debriefing. In summary, the current study partially supported the reliability and validity of the newly developed Chinese version of the New BJSQ.

Test-retest reliability of some scales (Role clarity, Qualitative job overload, Interpersonal conflict, Esteem reward, and Job security) in this newly developed questionnaire was moderate or low. The Cronbach's alpha coefficients for the scale of Interpersonal conflict, Role clarity, and Job security were also reasonable in the original Japanese questionnaire²³. In this study, random sampling was not employed for the follow-up survey, and a Likert scale, which asks for a variation of the respondents' physical and mental

status, was not used. Thus, we could not detect and exclude the respondents whose physical or mental health states changed significantly from the baseline survey to the follow-up survey, which might have decreased the test-retest reliability of this questionnaire.

The confirmatory factor analysis of the Chinese New BJSQ did not achieve the recommended model fit. We conducted an ad-hoc exploratory factor analysis (EFA) to detect the Chinese version's data-based structure. The EFA revealed a three-factor structure (the results can be shown upon the request). The first factor included job resource items; the second comprised job demand items, including skill utilization; and the third contained only job security. In the Japanese version of the New BJSQ, skill utilization is classified as a task-level job resource based on the job demands-resources model (JD-R model)^{35, 36}. On the other hand, another model for evaluating job stress is the National Institute for Occupational Safety and Health (NIOSH) job stress model³⁷, where underutilization of skills is proposed as a job stressor that can elicit stress reaction. Earlier studies have shown that skill underutilization is associated with increased risk for depressive symptoms³⁸ and hypertension³⁹. Therefore, skill utilization may act as a resource or stressor, and in this newly developed Chinese version of the new BJSQ, it may be linked to job demand, unlike the Japanese version. The third factor from the EFA contained

Table 3. Internal consistency, two-week test-retest reliability, and factor-based validity of the Chinese version of the New BJSQ scales

Scales†	Cronbach's alpha coefficient (N=516)	Proportion explained by the first factor (%) (N=516)	Two-week test-retest (ICC) § (N=52)	Two-week test-retest (Pearson's r) § (N=52)
Job demands				
1. Quantitative job overload	0.75	66.6	0.72**	0.73**
2. Qualitative job overload	0.68	61.3	0.77**	0.77**
3. Physical demands	NC	NC	0.50**	0.51**
4. Interpersonal conflict	0.51	57.2	0.71**	0.71**
5. Poor physical environment	NC	NC	0.46**	0.50**
6. Emotional demands	0.82	73.2	0.68**	0.67**
7. Role conflict	0.79	70.5	0.64**	0.64**
8. Work-self balance (negative)	0.78	82.3	0.52**	0.53**
Job resources: task-level				
9. Job control	0.79	70.3	0.41**	0.40**
10. Suitable jobs	NC	NC	0.52**	0.54**
11. Skill utilization	NC	NC	0.62**	0.71**
12. Meaningfulness of work	0.84	76.1	0.77**	0.78**
13. Role clarity	0.61	57.4	0.63**	0.64**
14. Career opportunity	0.83	74.4	0.77**	0.76**
15. Novelty	0.83	74.7	0.56**	0.56**
16. Predictability	0.77	68.5	0.45**	0.45**
Job resources: workgroup-level				
17. Supervisor support	0.76	67.7	0.64**	0.64**
18. Coworker support	0.63	57.2	0.63**	0.63**
19. [Support from family and friends]	0.76	68.0	0.66**	0.66**
20. Monetary/status reward	0.78	82.1	0.73**	0.74**
21. Esteem reward	0.58	70.6	0.61**	0.60**
22. Job security	0.58	55.1	0.63**	0.63**
23. Leadership	0.80	72.4	0.48**	0.48**
24. Interactional justice	0.82	73.8	0.71**	0.70**
25. Workplace where people complement each other	0.84	76.3	0.59**	0.59**
26. Workplace where mistakes are acceptable	0.81	84.2	0.52**	0.51**
27. Collective efficacy	0.82	74.1	0.51**	0.51**
Job resources: organizational-level				
28. Trust with management	0.79	70.6	0.83**	0.83**
29. Preparedness for change	0.82	73.3	0.49**	0.49**
30. Procedural justice	0.81	72.9	0.61**	0.61**
31. Respect for individuals	0.81	73.1	0.73**	0.75**

Table 3. Continued

Scales†	Cronbach's alpha coefficient (N=516)	Proportion explained by the first factor (%) (N=516)	Two-week test-retest (ICC) § (N=52)	Two-week test-retest (Pearson's r) § (N=52)
32. Fair personnel evaluation	0.85	77.1	0.74**	0.74**
33. Diversity	0.82	74.0	0.62**	0.62**
34. Career development	0.85	63.0	0.76**	0.77**
35. Work-self balance (positive)	0.83	85.4	0.52**	0.51**
Outcomes				
36. Vigor	0.88	80.2	0.29*	0.28**
37. Anger-irritability	0.85	77.7	0.20	0.20
38. Fatigue	0.87	79.1	0.44**	0.44**
39. Anxiety	0.79	70.3	0.37**	0.37**
40. Depression	0.87	61.0	0.48**	0.49**
Psychological stress reaction (total)	0.93	45.0	0.62**	0.63**
41. Physical stress reaction	0.89	47.4	0.52**	0.53**
42. Job satisfaction	NC	NC	0.70**	0.70**
43. [Satisfaction with family life]	NC	NC	0.76**	0.76**
44. Workplace harassment	0.91	91.5	0.88**	0.88**
45. Workplace social capital	0.81	73.4	0.66**	0.67**
46. Work engagement	0.83	85.4	0.67**	0.67**
47. Performance of a duty	0.79	70.5	0.55**	0.56**
48. Realization of creativity	0.85	76.8	0.63**	0.63**
49. Active learning	0.81	72.6	0.52**	0.54**

** $p < 0.01$ * $p < 0.05$

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

§: Calculated among respondents of the follow-up.

only job security item. In the Japanese version of New BJSQ, job security is recognized as a job resource, which may not be the case for the Chinese version. Employees in collectivistic countries, such as China and Japan, are believed to react more sensitively to the threat of job insecurity compared to employees in individualistic countries (e.g., United States of America)⁴⁰. For this reason, job security may have a positive effect on the mind of workers. However, recent human resources in China have become more fluid, like the United States these days. Thus, job security might not be as highly valued as it used to be, and it may act less as a job resource among Chinese workers.

As introduced, the New BJSQ can comprehensively assess psychosocial workplace environments and their em-

ployee and organizational outcomes. It can be used to compare the national average score and evaluate the workplace environment, or the workplace and employee states, to prevent the diverse effect of the workplace stressors and promote positive health at work²³. Thus, to validate the evidence of the Chinese version of the New BJSQ, a longitudinal observational study or an intervention study should incorporate the new scale to assess the work environment.

Limitation

This study has several limitations that should be considered. First, all the recruited participants were Chinese peo-

Table 4. Confirmatory factor analysis of 34 psychosocial work environment subscales of the Chinese version of the New BJSQ

Scales	Job demands	Task-level job resources	Workgroup-level job resources	Organizational-level job resources
1. Quantitative job overload	0.49			
2. Qualitative job overload	0.07			
3. Physical demands	0.38			
4. Interpersonal conflict	0.60			
5. Poor physical environment	0.50			
6. Emotional demands	0.82			
7. Role conflict	0.75			
8. Work-self balance (negative)	0.41			
9. Job control		0.54		
10. Suitable jobs		0.54		
11. Skill utilization		0.67		
12. Meaningfulness of work		0.51		
13. Role clarity		0.75		
14. Career opportunity		-0.36		
15. Novelty		0.48		
16. Predictability		0.17		
17. Supervisor support			0.62	
18. Coworker support			0.65	
19. Monetary/status reward			0.66	
20. Esteem reward			0.66	
21. Job security			0.18	
22. Leadership			0.73	
23. Interactional justice			0.79	
24. Workplace where people complement each other			0.74	
25. Workplace where mistakes are acceptable			0.53	
26. Collective efficacy			0.73	
27. Trust with management				0.82
28. Preparedness for change				0.65
29. Procedural justice				0.69
30. Respect for individuals				0.83
31. Fair personnel evaluation				0.80
32. Diversity				0.73
33. Career development				0.86
34. Work-self balance (positive)				0.67

Goodness-of-fit indicator: GFI=0.67, AGFI=0.63, CFI=0.70, and RMSEA=0.10.

ple living in China who registered with the Internet survey company; therefore, the findings' generalizability is limited. Another validation study should be conducted with Chinese workers in Japan to use this questionnaire among them. Second, the participants in this research had higher educational background compared to the national representative survey⁴¹⁾, and those who had lower educational background might not enter the survey. This may cause a selection bias. There is a possibility that high educated population may pay attention to their psychological stress more than lower educated population; therefore, they answered the surveys more precisely, which might make the reliability of the newly developed questionnaire higher. Third, random sampling was not employed at baseline and follow-up, and since we used the company, we were not able to calculate the response rate for the baseline survey. Moreover, we stopped recruiting for the follow-up survey when the number of participants reached over fifty. For these reasons, the results may have been affected by the selection bias to some extent. Fourth, for cognitive debriefing, we could approach only one Chinese worker who was working in Japan. The ISPOR guideline²⁹⁾ recommends engaging 5–8 individuals who would be practical users of this questionnaire. Because of this flawed process, the cross-cultural validity of this questionnaire could not be established. Moreover, the present study provided partial support for the construct validity of the Chinese version of the New BJSQ by calculating a proportion of variance explained by the first factor and conducting factor analyses. However, convergent and discriminant validities of this newly developed questionnaire were not examined; thus, future research should include other highly reliable and valid measurements (i.e., Job Content Questionnaire [JCQ]¹²⁾, Kessler 6 [K6]⁴²⁾, among others) to validate this scale. Fifth, a few scales of the Chinese version of the New BJSQ showed only modest internal consistency, and several scales showed medium to low test-retest reliability. Further review of these items and cognitive debriefing with a corporate from Chinese workers living in China is needed to achieve higher measurement accuracy. Finally, since the confirmatory factor analysis did not reach acceptable model fit³⁰⁾, further study on the factor structure of the Chinese version of the New BJSQ is needed.

Conclusion

This study examined the structure of the Chinese version of the New BJSQ and its internal consistency, test-retest reliability, and construct validity among workers in China.

The questionnaire had good reliability and moderate to low validity. While further study is needed to improve its validity, this newly developed questionnaire could be used to measure individual job demands or resources and evaluate China's workplace situation.

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