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Article

The Survey Measure of Psychological Safety and Its Association with Mental Health and Job Performance: a Validation Study and Cross-Sectional Analysis

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Abstract:

Objectives: This study validated the Japanese version of O'Donovan et al.'s (2020) composite measure of psychological safety scale and examined the associations of psychological safety with mental health and job-related outcomes.

Methods: Online surveys were administered twice to Japanese employees with teams of more than three members. Internal consistency and test-retest reliability was tested using Cronbach's α and intra-class correlation coefficient (ICC). Structural validity was examined using confirmatory factor analysis (CFA) and exploratory factor analysis (EFA). Convergent validity was tested. Multiple linear regression analyses were conducted to examine the relationship between psychological safety and psychological distress, work engagement, job performance, and job satisfaction.

Results: Two hundred healthcare workers and 200 non-healthcare workers were analyzed. The Cronbach's alpha of the total score was 0.92 - 0.96 and ICC was 0.88 - 0.92. CFA demonstrated poor fit, and EFA yielded a two-factor structure, suggesting one factor combined with peers and team. The scale showed good convergent validity. The total score of the scale showed significant associations with all outcomes in adjusted model in all workers.

Conclusions: The Japanese version of the measure of the psychological safety scale presented good reliability and validity. Psychological safety is important for employees' mental health and performance.

Keywords: occupational health; leadership; mental health; workplace climate; worksite

INTRODUCTION

Psychosocial factors at work are well-known determinants of workers' health and well-being. Psychological safety (PS) at work has received much attention as an important psychosocial factor in workers' positive mental health and the other work-related outcomes, such as work engagement, satisfaction, communication, and performance[1,2]. PS describes workers' perceptions of the consequences of taking interpersonal risks in a particular context such as a workplace[3,4]. PS was defined as a shared belief that the team is safe for interpersonal risk-taking (i.e., doing learning behavior that may place workers at risk, including seeking feedback, sharing information, asking for help, talking about errors, and

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experimenting), announced worldwide by Edmondson in 1999[3]. Previous review articles reported three streams of research on PS (i.e., individual-, team-, and organizational-level), with team-level analysis the largest and most active[1,4]. A meta-analysis has reported that individual- and team-level PS is significantly related to work engagement, task performance, information sharing, creativity, learning behavior, and job satisfaction[2]. Therefore, it is important to measure and improve both individual- and team-level PS for workers' health and well-being.

For quantitatively assessing PS at work, many studies used self-reported questionnaires, mainly referring to and adapting the items from Edmondson's team-level measure [1]. O'Donovan et al. (2020) have presented the composite measure of PS (i.e., observation and survey component) for use by healthcare teams, which they co-developed with healthcare professionals and based on six measures and the PS literature[5]. This three-section measure (i.e., team leader, peers, team) can assess the individual and team levels of PS. This measure offers a detailed understanding of PS on a team[5] and contributes to investigating the association of these three components with employees' mental health and performance and in developing an effective intervention plan. Although the measures developed by O'Donovan et al. (2020) was tailored to healthcare settings, the survey measure of PS could also be useful for measuring PS in non-healthcare workers (HCWs). Several scales with fewer than 10 items can measure PS in non-HCWs [3,6-8], including the Japanese version of the PS scale[6] developed by Liang et al.[9]. However, a systematic review has suggested that scales with few items could not fully capture the state of PS at work and needed holistic, objective measuring instruments[10]. The 19 items of the survey measure of PS developed by O'Donovan et al. (2020) were identified as the corresponding comprehensive behaviors relevant to PS[5]. This scale could therefore be available to non-HCWs and to HCWs, although the scalability has not yet been tested in non-HCWs.

The associations of PS with mental health and work-related outcomes should be examined in each HCW and non-HCW group. A previous systematic review presented possible pathways from job resources (e.g., supportive leadership behavior) through PS to positive and negative work outcomes (e.g., stress, conflict, and performance) in the integrative theoretical framework of PS[1]. Some previous studies suggested that PS reduced the risk of poor mental health outcomes such as burnout, stress, and diminished well-being, by increasing social support in HCW and non-HCW[11,12]. However, the effect of PS on mental health has not been empirically examined. In addition, the effect may be different in HCWs and non-HCWs because the clinical settings have different working conditions. Further study is needed to investigate the association of PS at work with mental health among both groups of workers, using well developed measures of PS.

The objectives of this study were (i) to develop the Japanese version of the survey measure of PS developed by O'Donovan et al. (2020)[5] and validate the scale in HCWs and non-HCWs; and (ii) to examine the associations of PS with the mental health and work-related outcomes.

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METHOD

Study design

Online surveys were administered twice to Japanese employees who had not been appointed a leader in their team at baseline (January 2022) and at a two-week follow-up (February 2022). This study was approved by the Research Ethics Committee of the Graduate School of Medicine/Faculty of Medicine, The University of Tokyo, No. 2019361NI-(3). The study was reported according to the Consensus-based Standards for the Selection of Health Measurement Instruments (COSMIN) guideline, which is used to improve the quality of efforts to develop health-related self-report measurement instruments[13].

Participants

Participants were invited from the registered panel of an Internet research company (Rakuten Insight Inc.) from Japan, and living in Japan. Equal numbers of HCW and non-HCW were recruited. Participants' inclusion criteria were below.

(i) Full-time employees 20–65 years old

(ii) Working for a company with more than five employees

(iii) Joined a team with more than three members

(iv) Not a president or manager

(v) Not a team leader

All participants at baseline were invited to a two-week follow-up. The follow-up survey was closed after 100 answers were collected.

Measurements

The survey measure of psychological safety developed by O'Donovan et al.

The Japanese version of the survey measure of PS was developed per the procedure specified in the International Society of Pharmacoeconomics and Outcomes Research (ISPOR) task force guidelines[14]. Permission from O'Donovan, the developer of the original scale, to translate the measures into Japanese was obtained. Forward-translation was independently conducted by two external translators who were proficient in Japanese and English. We then performed reconciliation, back-translation, back-translational review, harmonization, and cognitive debriefing. Reconciliation was conducted by NS, YS, and KI to choose the appropriate expression of the items. The back-translation was conducted by an English native translator unaware of the original scale. The original developer confirmed and accepted the back-translated measures. Cognitive debriefing sessions were conducted with three Japanese nurses, including HA. Their feedback about difficult wording was used for further modifications. Results from these stages were combined to develop the final measure. The full Japanese version of the survey measure of PS is presented in **Appendix 1**. The original measure was developed specifically for HCWs, but we optimized the descriptions of instructions and items for using both HCWs and non-HCWs with permission from the developer. This scale has 19 items on a seven-point Likert scale. Subscales were nine items for team leader, seven items for peers, and three items for team as a whole. The scale score was calculated by averaging the items. Higher scores indicated greater PS.

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Measurements for convergent validity

Psychological safety scale for workers developed by Liang et al.

The PS scale developed by Liang et al. (2012) reflects Kahn's concept[15], focusing on the workers' speaking out[9]. The Japanese version of the scale was translated by Ochiai et al.[6]. It had five items on a five-point Likert scale. The items asked workers the extent to which they feel free to express their thoughts and feelings. The scale score was calculated by averaging the items. Higher scores indicated greater PS. Cronbach's alpha was 0.71 in this sample.

Social support at work

Social support at work was measured by the Brief Job Stress Questionnaire (BJSQ)[16] on a four-point Likert scale. Social support at work consists of two subscales: supervisor support (three items) and co-workers' support (three items). A higher score indicated higher social support at work. Cronbach's alpha for supervisor support was 0.89 and that for co-workers' support was 0.88 in this sample.

Servant Leadership

Servant leadership was measured by the Japanese short version of the Servant Leadership Survey (SLS-J) [17], evaluating the employees' supervisor. This scale has six items for empowerment (leader side), three items for humility (servant side), three items for standing back (servant side), three items for stewardship (leader side), and authenticity (servant side), on a six-point Likert scale. The score for each dimension of the SLS-J-short was calculated by averaging the item scores. A higher score indicated stronger servant leadership. Cronbach's alpha was 0.95 for empowerment, 0.91 for humility, 0.84 for standing back, 0.83 for stewardship, and 0.81 for authenticity.

Organization-based self-esteem

Organization-based self-esteem was measured by the Japanese version of the Organization-based Self-Esteem Scale[18]. This scale has eight items on a five-point Likert scale. The scale score was calculated by averaging the items. A higher score indicated higher organization-based self-esteem. Cronbach's alpha was 0.94.

Organizational justice

Organizational justice was measured by the Japanese version of the Organizational Justice Questionnaire (OJQ)[19]. The OJQ consists of two subscales: procedural justice and interactional justice. The OJQ has seven items for procedural justice and six items for interactional justice on a five-point Likert scale. Each factor score was calculated by averaging the items. A higher score indicated a greater degree of organizational justice. Cronbach's alpha was 0.93 for procedural justice and 0.95 for interactional justice.

Measurements as outcome variables

Psychological distress

Psychological distress was measured by the Japanese version of the K6 scale [20,21]. This scale has six items (felt nervous, hopeless, restless or fidgety, worthless, depressed, and that everything was an effort in the past four weeks) on a five-

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point Likert scale. The total score was calculated by summing all items. The higher score indicated greater distress. Cronbach's alpha was 0.93.

Work engagement

Work engagement was measured by the Japanese version of the Utrecht Work Engagement Scale (UWES-9)[22]. This scale has nine items on a seven-point Likert scale. The scale score was calculated by averaging the items. The higher score indicated greater work engagement. Cronbach's alpha was 0.96.

Job performance

Work performance was evaluated using one item of the Japanese version of the WHO Health and Work Performance Questionnaire (HPQ)[23]. Participants were asked to rate their overall work performance over the past four weeks. Items are scored on an 11-point scale ranging from 0 (worst) to 10 (best). A high score indicates good work performance.

Job satisfaction

Job satisfaction was measured by one item from the Brief Job Stress Questionnaire (BJSQ)[16] on a four-point Likert scale. A higher score indicated more job satisfaction.

Demographic variables

Demographic variables were gender, age, education attainment, working from home, marital status, company size, occupation (e.g., professions, service workers), and job category (e.g., doctor, nurse) at baseline.

Statistical analysis

Scale validation

Internal consistency and test-retest reliability of the Japanese PS scale were tested by calculating Cronbach's α and intra-class correlation coefficient (ICC) for each of the three subscales. To assess structural validity, confirmatory factor analysis (CFA) assuming three factors was conducted to test the goodness of fit for the existing structure of PS, and an exploratory factor analysis (EFA) was conducted if the CFA showed a poor fit. As a hypothesis test for convergent validity, Pearson's correlation coefficients (r) were calculated between each score of the PS scale and PS scale for workers developed by Liang et al., social support at work, servant leadership, organization-based self-esteem, and organizational justice, which was considered to have moderate to high positive correlations with PS scale ($r > 0.40$) [6].

The cross-sectional associations with outcomes

We conducted multiple linear regression analyses to examine the relationship between PS scale and psychological distress, work engagement, job performance, and job satisfaction, adjusting for gender, age, educational attainment, working from home, marital status, company size, occupation, and job category. In addition to the full scale, we examined the relation of three subscales, putting each scale individually (Model 1) and simultaneously (Model 2).

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Statistical significance was defined as $p < 0.05$. IBM SPSS Statistics® version 28 and IBM SPSS Amos® version 28 were used for the analyses.

RESULTS

Characteristics of participants

The demographic characteristics of 400 participants (200 HCW and 200 non-HCW) are presented in **Table 1**. Among HCWs, 60% of participants were women, 58% were married, and 90% were employed in the medical industry. The average age was 40.1 (standard deviation [SD] = 9.6). The type of HCWs were physicians (14%), nurses/midwives/public health nurses (48%), and others (39%). The number of team members was 20 or more (45%), 11–19 (23%), and 6–10 (21%). Among non-HCWs, 69% of the participants were men, 57% were married and 25% were employed in the manufacturing industry. The average age was 43.4 (SD = 10.7). The number of team members was 6–10 (44%), 3–5 (29%), and 11–19 (15%).

Table 1. Characteristics of Japanese non-manager employees with more than three team members

	Healthcare workers (HCW)		Non-HCW	
	Baseline (n=200)	Follow-up (n=100)	Baseline (n=200)	Follow-up (n=100)
	n (%)/Mean (SD)	n (%)/Mean (SD)	n (%)/Mean (SD)	n (%)/Mean (SD)
Gender				
Men	80 (40.0)	41 (41.0)	138 (69.0)	67 (67.0)
Women	120 (60.0)	59 (59.0)	62 (31.0)	33 (33.0)
Age (year)	40.1 (9.6)	40.8 (9.5)	43.4 (10.7)	43.9 (10.3)
Marital status				
Single	66 (33.0)	27 (27.0)	70 (35.0)	37 (37.0)
Married	116 (58.0)	65 (65.0)	114 (57.0)	54 (54.0)
Divorced/widowed	18 (9.0)	8 (8.0)	16 (8.0)	9 (9.0)
Educational attainment				
High school or less	5 (2.5)	5 (5.0)	50 (25.0)	23 (23.0)
Junior college/vocational school	78 (39.0)	42 (42.0)	26 (13.0)	15 (15.0)
University or higher	117 (58.5)	53 (53.0)	124 (62.0)	62 (62.0)
Occupation				
Professional/technician	180 (90.0)	94 (94.0)	54 (27.0)	32 (32.0)
Clerical	8 (4.0)	4 (4.0)	74 (37.0)	37 (37.0)
Manual workers	4 (2.0)	1 (1.0)	25 (12.5)	10 (10.0)
Service workers	1 (0.5)	0 (0.0)	42 (21.0)	19 (19.0)
Others	7 (3.5)	1 (1.0)	5 (2.5)	2 (2.0)
Type of healthcare worker				
Physicians	28 (14.0)	12 (12.0)	n/a	n/a
Nurses	95 (47.5)	47 (47.0)	n/a	n/a
Others	77 (38.5)	41 (41.0)	n/a	n/a
Company size				
1,000 or more	73 (36.5)	31 (31.0)	82 (41.0)	39 (39.0)
500-999	25 (12.5)	13 (13.0)	16 (8.0)	10 (10.0)
300-499	35 (17.5)	21 (21.0)	18 (9.0)	10 (10.0)
100-299	38 (19.0)	19 (19.0)	31 (15.5)	14 (14.0)
50-99	8 (4.0)	1 (1.0)	23 (11.5)	13 (13.0)
20-49	4 (2.0)	2 (2.0)	15 (7.5)	7 (7.0)
5-19	17 (8.5)	13 (13.0)	15 (7.5)	7 (7.0)
Number of team members				
20 or more	89 (44.5)	40 (40.0)	26 (13.0)	12 (12.0)
11-19	46 (23.0)	24 (24.0)	30 (15.0)	12 (12.0)
6-10	41 (20.5)	21 (21.0)	87 (43.5)	46 (46.0)
3-5	24 (12.0)	15 (15.0)	57 (28.5)	30 (30.0)
Status of team leader				
Manager	79 (39.5)	36 (36.0)	89 (44.5)	46 (46.0)
Not a manager	121 (60.5)	64 (64.0)	111 (55.5)	54 (54.0)
Working style				
Commuting	198 (99.0)	98 (98.0)	134 (67.0)	64 (64.0)

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Working from home (WFH)	0 (0.0)	0 (0.0)	15 (7.5)	9 (9.0)
Hybrid	1 (0.5)	1 (1.0)	50 (25.0)	27 (27.0)
Other	1 (0.5)	1 (1.0)	1 (0.5)	0 (0.0)

SD: standard deviation.

Internal consistency and test-retest reliability

The scores for internal consistency and test-retest reliability of the PS scale are presented in **Table 2**. Among HCWs, the Cronbach's alpha of each section ranged from 0.91 to 0.95, and ICC ranged from 0.75 to 0.89. Among non-HCWs, the Cronbach's alpha ranged from 0.93 to 0.96, and ICC ranged from 0.84 to 0.92. Among HCWs, the mean of total score was 4.96 and the Cronbach's alpha was 0.96. Among non-HCWs, the mean of total score was 4.63 and the Cronbach's alpha was 0.92.

Table 2. The mean scores of the survey measures of psychological safety and internal and test-retest reliability

	HCW				Non-HCW			
	Baseline (n=200)		Follow-up (n=100)		Baseline (n=200)		Follow-up (n=100)	
Subscales [possible range]	Mean (SD)	Cronbach's α	Mean (SD)	ICC	Mean (SD)	Cronbach's α	Mean (SD)	ICC
Section 1 (team leader) [1 - 7]	4.89 (1.32)	0.95	4.76 (1.24)	0.89	4.76 (1.39)	0.96	4.58 (1.50)	0.92
Section 2 (peers) [1 - 7]	5.04 (1.26)	0.94	4.90 (1.20)	0.83	4.71 (1.41)	0.96	4.73 (1.51)	0.84
Section 3 (team as a whole) [1 - 7]	4.98 (1.36)	0.91	4.80 (1.24)	0.75	4.59 (1.50)	0.93	4.58 (1.59)	0.90
Full scale [1 - 7]	4.96 (1.17)	0.96	4.82 (1.11)	0.88	4.71 (1.28)	0.97	4.63 (1.40)	0.92

HCW: healthcare workers.
ICC: intra-class correlation coefficient.
SD: standard deviation.

Construct validity

Structural validity

The results of confirmatory factor analyses were as follows: χ^2 (149) = 540.001, comparative fit index (CFI) = 0.899, Tucker-Lewis index (TLI) = 0.884, root mean square error of approximation (RMSEA) = 0.115, standardized root mean square residual (SRMR) = 0.0444, goodness of fit index (GFI) = 0.764, Akaike Information Criterion (AIC) = 622.001, and adjusted goodness of fit index (AGFI) = 0.699, in HCWs. In non-HCWs, the comparable figures were χ^2 (149) = 584.778, CFI = 0.903, TLI = 0.888, RMSEA = 0.121, SRMR = 0.0472, GFI = 0.733, AIC = 666.778, and AGFI = 0.659. The factor loading scores for each item of PS are presented in **Table 3**. The model fit was poor, so we tried conducting EFA that hypothesized no factor structure with the Promax rotation method, using a robust maximum likelihood estimation. **Table 4** shows the results of EFA and yielded a two-factor structure. Among both HCWs and non-HCWs, Section 2 (peers) and Section 3 (team as a whole) were combined into a single factor.

Table 3. Factor loading scores from the confirmatory factor analysis based on three-factor model

	Factor loading scores	
	HCW (baseline n=200)	Non-HCW (baseline n=200)
Section 1 (team leader)		
1 If I had a question or was unsure of something in relation to my role at work, I could ask my team leader.	0.81	0.80
2 I can communicate my opinions about work issues with my team leader.	0.88	0.85
3 I can speak up about personal problems or disagreements to my team leader.	0.78	0.85
4 I can speak up with recommendations/ideas for new projects or changes in procedures to my team leader.	0.84	0.86
5 If I made a mistake on this team, I would feel safe speaking up to my team leader.	0.83	0.87
6 If I saw a colleague making a mistake, I would feel safe speaking up to my team leader	0.81	0.82

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7 If I speak up/voice my opinion, I know that my input is valued by my team leader.	0.87	0.92
8 My team leader encourages and supports me to take on new tasks or to learn how to do things I have never done before.	0.86	0.85
9 If I had a problem in this company, I could depend on my team leader to be my advocate.	0.89	0.84
Section 2 (peers)		
1 If I had a question or was unsure of something in relation to my role at work, I could ask my peers.	0.82	0.79
2 I can communicate my opinions about work issues with my peers.	0.86	0.88
3 I can speak up about personal issues to my peers.	0.73	0.76
4 I can speak up with recommendations/ideas for new projects or changes in procedures to my peers.	0.89	0.90
5 If I made a mistake on this team, I would feel safe speaking up to my peers.	0.88	0.94
6 If I saw a colleague making a mistake, I would feel safe speaking up to this colleague.	0.85	0.90
7 If I speak up/voice my opinion, I know that my input is valued by my peers.	0.86	0.92
Section 3 (team as a whole)		
1 It is easy to ask other members of this team for help.	0.87	0.95
2 People keep each other informed about work-related issues in the team.	0.95	0.90
3 There are real attempts to share information throughout the team.	0.83	0.86

HCW: healthcare workers.

Table 4. Exploratory factor analysis without assuming the number of factors by using maximum likelihood method with Promax rotation.

	Factor loading score	
	1	2
HCW (baseline n=200)		
(peers) 5 If I made a mistake on this team, I would feel safe speaking up to my peers.	**.927**	-.061
(peers) 2 I can communicate my opinions about work issues with my peers.	**.921**	-.096
(peers) 4 I can speak up with recommendations/ideas for new projects or changes in procedures to my peers.	**.846**	.043
(peers) 1 If I had a question or was unsure of something in relation to my role at work, I could ask my peers.	**.813**	.012
(peers) 3 I can speak up about personal issues to my peers.	**.812**	-.105
(peers) 6 If I saw a colleague making a mistake, I would feel safe speaking up to this colleague.	**.794**	.069
(peers) 7 If I speak up/voice my opinion, I know that my input is valued by my peers	**.779**	.106
(team as a whole) 2 People keep each other informed about work-related issues in the team.	**.725**	.167
(team as a whole) 1 It is easy to ask other members of this team for help.	**.645**	.180
(team as a whole) 3 There are real attempts to share information throughout the team.	**.519**	.295
(team leader) 9 If I had a problem in this company, I could depend on my team leader to be my advocate.	-.064	**.948**
(team leader) 7 If I speak up/voice my opinion, I know that my input is valued by my team leader.	-.092	**.946**
(team leader) 8 My team leader encourages and supports me to take on new tasks or to learn how to do things I have never done before.	.030	**.848**
(team leader) 6 If I saw a colleague making a mistake, I would feel safe speaking up to my team leader.	-.029	**.832**

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(team leader) 4 I can speak up with recommendations/ideas for new projects or changes in procedures to my team leader.	.065	**.778**
(team leader) 1 If I had a question or was unsure of something in relation to my role at work, I could ask my team leader.	.036	**.778**
(team leader) 2 I can communicate my opinions about work issues with my team leader.	.071	**.747**
(team leader) 5 If I made a mistake on this team, I would feel safe speaking up to my team leader.	.141	**.728**
(team leader) 3 I can speak up about personal problems or disagreements to my team leader	.093	**.703**
Non-HCW (baseline n=200)		
(peers) 6 If I saw a colleague making a mistake, I would feel safe speaking up to this colleague.	**.975**	-.109
(peers) 5 If I made a mistake on this team, I would feel safe speaking up to my peers.	**.960**	-.037
(peers) 4 I can speak up with recommendations/ideas for new projects or changes in procedures to my peers.	**.886**	.018
(peers) 7 If I speak up/voice my opinion, I know that my input is valued by my peers.	**.880**	.048
(peers) 3 I can speak up about personal issues to my peers.	**.863**	-.144
(peers) 2 I can communicate my opinions about work issues with my peers.	**.844**	.033
(peers) 1 If I had a question or was unsure of something in relation to my role at work, I could ask my peers.	**.777**	.013
(team as a whole) 1 It is easy to ask other members of this team for help.	**.679**	.271
(team as a whole) 2 People keep each other informed about work-related issues in the team.	**.661**	.239
(team as a whole) 3 There are real attempts to share information throughout the team.	**.611**	.221
(team leader) 3 I can speak up about personal problems or disagreements to my team leader.	-.131	**.952**
(team leader) 7 If I speak up/voice my opinion, I know that my input is valued by my team leader.	-.008	**.929**
(team leader) 2 I can communicate my opinions about work issues with my team leader.	-.022	**.881**
(team leader) 1 If I had a question or was unsure of something in relation to my role at work, I could ask my team leader.	-.098	**.875**
(team leader) 4 I can bring recommendations/ideas for new projects or changes in procedures to my team leader.	.013	**.856**
(team leader) 5 If I made a mistake on this team, I would feel safe speaking up to my team leader.	.061	**.829**
(team leader) 8 My team leader encourages and supports me to take on new tasks or to learn how to do things I have never done before.	.128	**.750**
(team leader) 6 If I saw a colleague making a mistake, I would feel safe speaking up to my team leader.	.145	**.708**
(team leader) 9 If I had a problem in this company, I could depend on my team leader to be my advocate.	.184	**.696**

Hypothesis testing for convergent validity

Table 5 shows correlations between the scores of the PS scales and the scores of PS scale for workers developed by Liang et al., social support at work, servant leadership, organization-based self-esteem, and organizational justice. The PS score of full scale and all the three subscales was significantly and positively correlated with the scores of all the

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scales. In non-HCWs, the relation of full scale was high with PS scale for workers developed by Liang et al (r = 0.735), with supervisor support (r = 0.729), with empowerment (r = 0.757), and with interactional justice (r = 0.723). The relation of section 1 (team leader) was high with PS scale for workers developed by Liang et al. (r = 0.711), supervisor support (r = 0.761), empowerment (r = 0.753), standing back (r = 0.709), and interactional justice (r = 0.748). Section 3 (team as a whole) showed high relation with empowerment (r = 0.701). HCW did not achieve high correlation (r > 0.70), but showed a similar trend to non-HCW.

Table 5. Pearson's correlation coefficients between each subscale on the psychological safety scale and other psychometric scales (convergent validity).

scales [possible range]	HCW (n=200)				non-HCW (n=200)			
	Full scale	Section 1 (team leader)	Section 2 (peers)	Section 3 (team as a whole)	Full scale	Section 1 (team leader)	Section 2 (peers)	Section 3 (team as a whole)
Psychological Safety Scale for Workers [1 - 5]	0.657*	0.628*	0.536*	0.603*	0.735*	0.711*	0.589*	0.700*
Social support at work (BJSQ)								
Supervisor support [1 – 4]	0.640*	0.696*	0.425*	0.553*	0.729*	0.761*	0.537*	0.647*
Coworkers support [1 – 4]	0.557*	0.389*	0.612*	0.593*	0.672*	0.501*	0.694*	0.715*
Servant leadership survey								
Empowerment [1 – 6]	0.655*	0.680*	0.481*	0.560*	0.757*	0.753*	0.589*	0.701*
Humility [1 – 6]	0.494*	0.547*	0.315*	0.428*	0.644*	0.654*	0.500*	0.567*
Standing back [1 – 6]	0.564*	0.609*	0.384*	0.486*	0.694*	0.709*	0.538*	0.597*
Stewardship [1 – 6]	0.574*	0.580*	0.440*	0.496*	0.625*	0.595*	0.525*	0.573*
Authenticity [1 – 6]	0.572*	0.616*	0.398*	0.471*	0.660*	0.649*	0.538*	0.581*
Organization-based self-esteem [1 - 5]	0.421*	0.387*	0.403*	0.306*	0.529*	0.477*	0.466*	0.512*
Organizational justice								
Procedural justice [1 - 5]	0.570*	0.586*	0.419*	0.505*	0.594*	0.586*	0.471*	0.548*
Interactional justice [1 - 5]	0.596*	0.654*	0.397*	0.501*	0.723*	0.748*	0.547*	0.629*

HCW: healthcare workers
BJSQ: Brief Job Stress Questionnaire
*p<0.01

The relationship with psychological distress, work engagement, job performance, and job satisfaction

The results of the multiple linear regression analyses are shown in **Table 6**. In HCWs, the full scale showed significant associations with low psychological distress (adjusted β = -0.508, p < 0.001), high work engagement (adjusted β = 0.462, p < 0.001), high job performance (adjusted β = 0.476, p < 0.001), and high job satisfaction (adjusted β = 0.592, p < 0.001). In Model 2 (simultaneously entered), section 1 (team leader) was significantly associated with high work engagement, high job performance, and high job satisfaction in the adjusted model. The section 2 (peers) was significantly associated with low psychological distress. Section 3 (team as a whole) was significantly associated with high job satisfaction.

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Table 6. Associations of psychological safety scale with psychological distress, work engagement, job performance, and job satisfaction.

	Psychological distress (K6)				Work engagement (UWES-9)				Job performance (HPQ)				Job satisfaction (BJSQ)			
	Crude		Adjusted [c]		Crude		Adjusted [c]		Crude		Adjusted [c]		Crude		Adjusted [c]	
variables	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p
HCWs																
Full scale	-0.507	<0.001*	-0.508	<0.001*	0.465	<0.001*	0.462	<0.001*	0.476	<0.001*	0.476	<0.001*	0.597	<0.001*	0.592	<0.001*
Model 1 [a]																
Section 1 (team leader)	-0.422	<0.001*	-0.431	<0.001*	0.428	<0.001*	0.422	<0.001*	0.479	<0.001*	0.477	<0.001*	0.542	<0.001*	0.543	<0.001*
Section 2 (peers)	-0.508	<0.001*	-0.497	<0.001*	0.409	<0.001*	0.413	<0.001*	0.390	<0.001*	0.390	<0.001*	0.500	<0.001*	0.495	<0.001*
Section 3 (team as a whole)	-0.448	<0.001*	-0.445	<0.001*	0.411	<0.001*	0.409	<0.001*	0.366	<0.001*	0.381	<0.001*	0.605	<0.001*	0.590	<0.001*
Model 2 [b]																
Section 1 (team leader)	-0.128	0.141	-0.138	0.131	0.243	0.008*	0.210	0.026*	0.396	<0.001*	0.365	<0.001*	0.251	0.002*	0.245	0.003*
Section 2 (peers)	-0.363	0.001*	-0.332	0.002*	0.140	0.193	0.162	0.140	0.131	0.219	0.106	0.309	-0.030	0.754	-0.013	0.889
Section 3 (team as a whole)	-0.075	0.473	-0.093	0.384	0.135	0.215	0.143	0.195	-0.006	0.955	0.056	0.590	0.459	<0.001*	0.439	<0.001
Non-HCWs																
Full scale	-0.458	<0.001*	-0.424	<0.001*	0.524	<0.001*	0.510	<0.001*	0.516	<0.001*	0.494	<0.001*	0.598	<0.001*	0.587	<0.001*
Model 1 [a]																
Section 1 (team leader)	-0.405	<0.001*	-0.372	<0.001*	0.504	<0.001*	0.496	<0.001*	0.498	<0.001*	0.484	<0.001*	0.580	<0.001*	0.574	<0.001*
Section 2 (peers)	-0.422	<0.001*	-0.391	<0.001*	0.413	<0.001*	0.395	<0.001*	0.425	<0.001*	0.397	<0.001*	0.479	<0.001*	0.467	<0.001*
Section 3 (team as a whole)	-0.422	<0.001*	-0.396	<0.001*	0.522	<0.001*	0.509	<0.001*	0.474	<0.001*	0.454	<0.001*	0.567	<0.001*	0.552	<0.001*
Model 2 [b]																
Section 1 (team leader)	-0.185	0.049*	-0.152	0.103	0.280	0.002*	0.278	0.002*	0.318	<0.001*	0.318	<0.001*	0.361	<0.001*	0.362	<0.001*
Section 2 (peers)	-0.195	0.086	-0.172	0.133	-0.104	0.327	-0.137	0.209	0.045	0.677	0.006	0.959	-0.032	0.750	-0.035	0.731
Section 3 (team as a whole)	-0.127	0.304	-0.146	0.241	0.405	<0.001*	0.423	<0.001*	0.207	0.082	0.222	0.064	0.332	0.003*	0.322	0.004*

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a) Three subscales of psychological safety scale (team leader, peer, and team as a whole) were individually entered.
b) Three subscales of psychological safety scale (team leader, peer, and team as a whole) were simultaneously entered.
c) The adjusted model additionally adjusted for sex, age, industry, type of healthcare worker, working style (e.g., work from home), educational attainment, company size, and occupation among HCWs, and adjusted for the same variables excluding type of healthcare workers among non-HCWs.
K6: Kessler's Psychological Distress Scale
UWES: Utrecht Work Engagement Scale
HCW: healthcare worker
HPQ: Health and Work Performance Questionnaire
BJSQ: Brief Job Stress Questionnaire
*p<0.05.

In non-HCWs, the full scale showed significant associations with low psychological distress (adjusted $\beta = -0.424$, $p < 0.001$), high work engagement (adjusted $\beta = 0.510$, $p < 0.001$), high job performance (adjusted $\beta = 0.494$, $p < 0.001$), and high job satisfaction (adjusted $\beta = 0.587$, $p < 0.001$). In Model 2 (simultaneously entered), section 1 was significantly associated with high work engagement, high job performance, and high job satisfaction in the adjusted model. Section 3 (team as a whole) was associated with high work engagement and high job satisfaction. No section showed a significant associations with low psychological distress in the adjusted model, but section 1 in the crude model did show significance.

DISCUSSION

The Japanese version of the survey measure of PS developed by O'Donovan et al. demonstrated acceptable high internal consistency, test-retest reliability, and convergent validity. Structural validity remained an issue. The full scale of the survey measure of PS showed significant associations with low psychological distress, high work engagement, high job performance, and high job satisfaction. These results were found both in HCWs and non-HCWs. Overall, the Japanese version of the survey measure of PS proved to be a reliable and valid scale for use in all working populations.

In terms of internal consistency, Cronbach's alpha of full scale was 0.96 in HCWs and 0.97 in non-HCWs, which exceeded the stringent criterion of 0.80[24]. The ICC in test-retest (two weeks) reliability was acceptable, except for 0.75 in section 3 (team as a whole) in HCWs. Because section 3 has a small number of items, discrepancies in the evaluation of one item may easily be reflected in a lower ICC.

In CFA, the three-factor model was not theoretically fitted. The indicators of fit model in CFA (CFI, TLI, RMSEA, SRMR, GFI, AIC, and AGFI) showed low to moderately acceptable fit for the three-factor model. Rather, EFA suggested a two-factor structure. Peers and team as a whole were combined into one factor, suggesting that Japanese population may be likely to imagine colleagues (peers) when they see the word "team". Future study is needed to examine the structure in another sample.

Factor loading pattern was almost the same in factor 1 (peers and team) both in HCWs and non-HCWs. But the pattern was slightly different in factor 2 (leader), while "speaking up is valued by team leader" (no. 7) was highly loaded in both. HCWs showed that "sense of trust in team leader" (no. 9) and "support for new task and learning (no.8) were highly loaded, and non-HCWs showed that "feeling safe discussing personal problems and disagreements" (no. 3) and "communicating about work issues" (no. 2) were highly loaded. In clinical settings, patient safety is likely to be

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prioritized and speaking up is necessary regardless of leaders' attitudes. While leaders' behavioral integrity affected the reported treatment errors[25], trust in leaders may influence the atmosphere for PS in Japanese HCWs. Support for learning new tasks may be frequently seen in leaders who create psychologically safe workplaces in Japanese clinical settings. In non-HCWs, a previous study suggested that being allowed to express opinions and actually doing so were different experiences among Japanese workers[6]. Leaders' willingness to allow and encourage employees to speak up and employees' perceptions of doing so may both be required PS in non-HCWs.

Convergent validities were also well supported, as we expected. The findings were in line with previous research showing the positive association of PS with supervisor support, co-workers' support, and organizational factors[6]. A supportive work environment may make workers feel safe in taking interpersonal risks. In relation to servant leadership, subscales of empowerment showed the greatest associations in both HCWs and non-HCWs. The empowerment in leadership was defined as a motivational concept aimed at fostering a pro-active, self-confident attitude among followers and giving them a sense of personal power by encouraging self-directed decision making, information sharing, and coaching for innovative performance[17]. In Japan, leaders who can empower their team members may be likely to be leader with PS. In non-HCWs, PS was highly correlated ($r > 0.70$) with supervisor factors, such as supervisor support, leadership (especially empowerment), and interactional justice. In HCWs, no measure achieved high correlations. The leader's supportive attitude, examined in previous research, may have an affinity with PS in non-HCW, and other workplace factors may influence clinical settings. Another reason may be that measurement scales used to test convergent validity were developed for workers (not specifically for HCWs). Overall, theoretical associations were found, suggesting good convergent validity both in HCWs and non-HCWs.

The full scale of the survey measure of PS was significantly associated with low psychological distress, high work engagement, high job performance, and high job satisfaction, as we expected. This finding empirically demonstrated the theoretical framework which was stated in the previous literature[1]. The results of Model 2 (simultaneous entry) showed significant associations between section1 (team leader) and work engagement, job performance, and job satisfaction both in HCWs and non-HCWs. Given the Japanese corporate culture that emphasizes hierarchical relationships[26], it is possible that these job-related positive outcomes were more likely to be enhanced by the team leader's listening to and respecting others. At the same time, low psychological distress was significantly associated with section 2 (peers) only in HCWs. As mentioned earlier, speaking up is especially important in clinical settings to prioritize patient safety[25]; therefore, for HCWs, an environment in which they cannot admit their mistakes or point out those of their peers may be more likely to cause frustration and psychological distress. A previous study reported that the ability to forgive themselves and others was significantly associated with PS among nurses[27]. Lack of PS from peers may lead to a risk of mental health deterioration among HCWs. Peers' role may be more essential for mental health in clinical settings than in other workplaces.

Limitation

This study has several limitations. It was conducted online and participants were recruited from the research company panel, leading the limited generalizability. In addition, self-reporting style lead the bias, for example, people with high distress may be likely to score the items in different manners. Finally, the cross-sectional nature of the analysis precluded

identification of a causal relationship. Future studies are expected to examine the associations of PS with outcomes in longitudinal design for workers from more diverse backgrounds.

Conclusion

The Japanese version of the survey measure of PS developed by O'Donovan et al. had acceptable reliability and validity both in HCWs and non-HCWs. This measure can be useful to evaluate PS of leaders, peers, and teams, in the workplace. PS was also associated with mental health and positive job-related outcomes. PS can be important psychosocial factors in a healthy workplace.

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Approval of the research protocol: This study was approved by the Research Ethics Committee of the Graduate School of Medicine/Faculty of Medicine, The University of Tokyo, No. 2019361NI-(3).

Informed consent: Online informed consent was obtained from all participants with full disclosure and explanation of the purpose and procedures of this study. We explained that their participation was voluntary, and they can withdraw consent for any reason, simply by not completing the questionnaire.

Registry and registration number of the study/trial: N/A.

Animal studies: N/A.

Conflict of interest: DN reports personal fees from Startia, Inc., en-power, Inc., MD.net, AIG General Insurance Company, Ltd, outside the submitted work.

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Author contribution: KI was in charge of this study, supervising the process and of providing his expert opinion. NS, AI, HA, and KI organized the study design and analyzed the data. Collaborators YS, DN, and AT ensured that questions related to the accuracy or integrity of any part of the work were appropriately investigated and resolved. All authors participated in conducting the survey. NS wrote the first draft of the manuscript, and all other authors critically revised it. All authors approved the final version of the manuscript.

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