



Evaluating the psychometric properties of two-item and four-item short forms of the Japanese Pain Self-Efficacy Questionnaire: a cross-sectional study

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Received: 10 July 2018 / Accepted: 12 November 2018 / Published online: 16 November 2018
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Abstract

Purpose The Pain Self-Efficacy Questionnaire is a valid measure assessing self-efficacy in individuals with chronic pain. Short-form versions of the measure have been developed to decrease the assessment burden. However, few studies have evaluated the psychometric properties of the short forms in languages other than English. The aim of this study was to evaluate two 2-item short forms and one 4-item short form of the Japanese Pain Self-Efficacy Questionnaire in terms of internal consistency, criterion validity, structural validity, and construct validity.

Methods This was a cross-sectional study. Data from 150 individuals with mixed chronic pain at a pain management center in a university hospital were extracted from clinical records and analyzed. The data included the information of the original version and short forms of the Japanese Pain Self-Efficacy Questionnaire, and other pain-related measures assessing pain intensity, pain interference, anxiety, depression and pain catastrophizing.

Results Item statistics supported the item selection for each of the three short forms. All the short forms demonstrated adequate internal consistency and criterion validity. With respect to construct validity, one of the 2-item short forms failed to meet the criterion regarding the change in the magnitude of correlation with a depression scale. The 4-item short form met all the criteria including structural validity.

Conclusion The study findings provide evidence for the reliability and validity of 2- and 4-item versions of the Japanese Pain Self-Efficacy Questionnaire for use in clinical and research settings.

Keywords Pain Self-Efficacy Questionnaire · Self-efficacy · Chronic pain · Short form

Electronic supplementary material The online version of this article (<https://doi.org/10.1007/s00540-018-2583-8>) contains supplementary material, which is available to authorized users.

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Introduction

Previous studies investigating associations between psychological factors and chronic pain have supported self-efficacy is an important factor which is associated with adjustment to chronic pain [1, 2]. Bandura defined self-efficacy as “people’s judgments of their capabilities to organize and execute courses of action required to attain designated types of performances” [3]. A meta-analysis integrating the results of 83 studies showed that self-efficacy has negative associations with pain-related outcomes such as impairment, affective distress, and pain severity in chronic pain samples [4]. Other studies have also shown that self-efficacy mediates the relationship between pain intensity and disability [5, 6]. Therefore, assessing the degree of self-efficacy is important to evaluate the current psychological status of individuals with chronic pain and identify specific treatment targets.

The Pain Self-Efficacy Questionnaire (PSEQ) [7] is a 10-item self-report questionnaire used to assess self-efficacy in individuals with chronic pain [8–10]. A systematic review has supported its clinical and research use because of its simplicity and good psychometric properties [11]. The PSEQ has been translated from its original English version to several other language versions including a Japanese one (PSEQ-J) [12–15]. To reduce the assessment burden of the measure, several short forms of the PSEQ have been developed: two versions with two-items [16–18] and a four-item version [19]. Research supports the sound psychometric properties for the PSEQ short forms in terms of internal consistency, [16–19] test–retest reliability, [17, 18] criterion validity, [16–19] construct validity, [16–19] and responsiveness [18, 19]. The Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials (IMMPACT) recommendations include the availability of translated and culturally adapted versions of measures as a criterion when selecting assessment measures [20]. However, the Italian PSEQ short form [15] is the only translated version whose psychometric properties have been evaluated. Thus, evaluating the psychometric properties of additional translated versions of the PSEQ short forms would support further use of the measure for assessing self-efficacy in pain across different cultural and language settings.

Given these considerations, we sought to evaluate the three Japanese version of the PSEQ (PSEQ-J) short forms using cross-sectional data in terms of four psychometric properties: internal consistency, criterion validity, structural validity, and construct validity. We hypothesized that all the PSEQ-J short forms would meet the criteria for these properties except for structural validity. Regarding structural validity, we hypothesized that the four-item PSEQ-J short form would have the same one-factor structure as the PSEQ-J.

Methods

Participants

Participants consisted of new patients with chronic pain attending a pain management center in a university hospital. Eligibility criteria were: (1) history of pain lasting 3 months or more, (2) at least 20 years of age, and (3) ability to read and write Japanese.

Procedure

This study was a cross-sectional study using retrospectively extracted data from records of routine assessments at the pain management center. The routine assessments had been conducted as a part of another study which uses a touch-screen e-tablet system regarding patient evaluation. The Institutional Review Board for Clinical Research at Osaka University Hospital approved the procedures of that study (No. 13,004; Date of approval: June 13th, 2013).

At their initial clinic visits, participants were informed verbally and provided a document indicating that completion of the study measures was voluntary and that their anonymized data would be used for other researches in future. Subsequently, participants were asked to complete the study measures using the e-tablet before their medical evaluation. The e-tablet notified participants of missed answers to minimize missing data.

The Institutional Review Board for Clinical Research at Osaka University Hospital approved all procedure of the present study (No. 17,440; Date of approval: March 2nd, 2018). Formal notice about this study was provided to participants via the website of the pain management center. We extracted the data of new patients who attended the pain management center from January 2014 to January 2016. Then, a researcher, who is an experienced pain clinician, classified patients based on their condition according to the proposed chronic pain classification of the International Classification of Diseases, 11th Revision [21]. We reported only a primary parent category in the present study.

Study measures

PSEQ-J and its short forms: self-efficacy

The PSEQ-J has 10 items and assesses the degree of confidence to perform certain activities in daily life despite pain [7, 12]. Participants are asked to rate how confident they are to perform the given activities despite pain on a scale from 0 (“Not at all confident”) to 6 (“Completely confident”). The total PSEQ-J score ranges from 0 to 60, with higher scores indicating higher levels of self-efficacy in functioning

despite pain. Cronbach's alpha coefficient for the PSEQ-J in the present sample was 0.94 [95% confidence interval (CI): 0.93–0.96], indicating excellent internal consistency.

We extracted specific item sets reported in previous studies [16–19] from the PSEQ-J and used their data to evaluate the psychometric properties of the PSEQ-J short forms. To evaluate the validity of item selection, item analyses were conducted for ten items of the PSEQ-J. The results from previous studies have suggested that two 2-item and one 4-item brief version of the PSEQ might be most useful. The PSEQ-2a-J is a two-item short form, consisting of items 5 (“I can do some form of work, despite the pain. (“work” includes housework, paid and unpaid work)”) and 9 (“I can live a normal lifestyle, despite the pain”), based on the short form developed by Nicholas et al. [18] Another two-item short form is the PSEQ-2b-J, consisting of items 8 (“I can still accomplish most of my goals in life, despite the pain”) and 9, based on the short-form developed by Bot et al. [16, 17] The PSEQ-2a-J and PSEQ-2b-J scores range from 0 to 12. The PSEQ-4-J is a four-item short form consisting of items 4 (“I can cope with my pain in most situations”), 6 (“I can still do many of the things I enjoy doing, such as hobbies or leisure activity, despite pain”), 8, and 9, based on the short form developed by McWilliams et al. [19] The PSEQ-4-J scores range from 0 to 24. Previous studies have shown that the original PSEQ and the PSEQ-J have a one-factor structure [7, 12]. The instructions and items of the PSEQ-J short forms in Japanese are given in Online Resources 1–3.

Numerical rating scale (NRS): pain intensity

The 0–10 NRS is commonly used to assess pain intensity [22]. With this measure, the participants were asked to indicate their worst, least and average pain intensity over the past 24 h, as well as the pain intensity that they currently experience (current pain intensity), on a scale from 0 (“No pain”) to 10 (“Pain as severe as you can imagine”). The present study used an average score of these four pain ratings as a composite pain score. The use of composite scores has been supported as a reliable and stable method to measure pain intensity for individuals with chronic pain [23]. Cronbach's alpha coefficient for the composite score of pain intensity in the current sample was 0.89 (95% CI: 0.87–0.92), indicating excellent internal consistency.

Pain Disability Assessment Scale (PDAS): pain interference

The PDAS is a 20-item self-report questionnaire measuring pain interference with various daily activities during the past week such as carrying an object, walking, and engaging in a hobby [24]. Participants are asked to rate the level of pain interference on a scale from 0 (“Pain did not interfere with this activity”) to 3 (“Pain interfered completely with this

activity”). The PDAS total score ranges from 0 to 60, with higher scores indicating higher levels of pain interference. Cronbach's alpha coefficient for the PDAS in the current sample was 0.96 (95% CI 0.95–0.97), indicating excellent internal consistency.

Hospital Anxiety and Depression Scale (HADS): anxiety and depression

The HADS is a 14-item self-report questionnaire assessing anxiety and depression among patients with physical illnesses [25–27]. Each item is rated on a 4-point scale from 0 to 3. The HADS is scored on two separate subscales measuring anxiety and depression, respectively. Both anxiety and depression scores range from 0 to 21, with higher scores indicating higher levels of anxiety and depression. Cronbach's alpha coefficients in the current sample were 0.83 (95% CI 0.79–0.87) and 0.86 (95% CI 0.82–0.89) for the Anxiety and Depression subscales, respectively, indicating good internal reliabilities.

Pain Catastrophizing Scale (PCS): pain catastrophizing

The PCS is a 13-item self-report questionnaire that measures exaggerated negative thoughts in relation to the pain experience, known as pain catastrophizing [28, 29]. Participants are asked to rate the degree to which they experience each of 13 thoughts and feelings when experiencing pain on a scale from 0 (“Not at all”) to 4 (“All the time”). The total PCS score ranges from 0 to 52, with higher scores indicating higher levels of pain catastrophizing. Cronbach's alpha coefficient for the PCS in the current sample was 0.92 (95% CI 0.91–0.94), indicating excellent internal consistency.

The routine assessments included other questionnaires which we did not use their data for the present study. Because we thought that detailed descriptions of those questionnaires are out of scope, here we refrained to report their characteristics.

Data analysis

First, we calculated descriptive statistics for the demographic variables, and computed the means, standard deviations (SDs), skewness, and kurtosis for all 10 items of the PSEQ-J. Skewness and kurtosis were considered acceptable if they were between -2 and $+2$ [30]. We then computed the item-total correlation coefficients for each PSEQ-J item. We performed a confirmatory factor analysis (CFA) to compute the factor loadings for each item. Model fit was evaluated using three fit indices: Chi square goodness of fit index (χ^2 ; a non-significant result at a 0.05

threshold indicates good model fit [31]), root mean square error of approximation (RMSEA; values below 0.08 indicate an acceptable fit [31]), and comparative fit index (CFI; values above 0.95 indicate an acceptable fit [32]).

After completion of the item analysis, we computed means, SDs, and Cronbach's alpha coefficients for all study measures. To conclude that the measure had a good internal consistency, the Cronbach's alpha coefficients for the PSEQ-J short forms had to exceed 0.80 [19].

Criterion validity refers to the association between the PSEQ-J and its short forms. The CONsensus-based STANDards for the selection of health status Measurement INSTRUMENTS (known as COSMIN) [33] suggest that an original measure can be regarded as the “gold standard” in the development of its short form. Based on the results of previous evaluations, [16–19] we adopted $r > 0.80$ as the standard to determine that a short form had adequate criterion validity.

We then evaluated the structural validity of the PSEQ-4-J using a CFA. We did not analyze the two-item short forms because it would not be possible to identify their factor structure using the t rule [31].

Next, we examined the change in the magnitude of Pearson correlations between the PSEQ-J short forms and other pain-related measures as a part of the construct validity evaluation. Previous studies illustrated that the PSEQ short forms had significant negative correlations with pain-related measures [16–19]. These correlations are expected to be somewhat lower than those found with the original PSEQ [19], given that short forms tend to be less reliable than the original full-length version of measures. This reduction in reliability is expected to result in a reduction of variance and mean score, as well as the strength of the association between the short forms and a given validity measure. We determined a priori that the magnitude of correlation between the PSEQ-J short form and a pain-related measure should not decrease more than 0.10 when compared to that found when using the PSEQ-J. This standard may be acceptable because $r = 0.10$ corresponds to a small effect size of the Cohen's criteria [34]. A previous study used same criterion [19].

To evaluate the construct validity of the different versions of the PSEQ-J, we performed a series of hierarchical multiple regression analyses to assess the predictive power of the PSEQ-J short forms in relation to pain-related variables when controlling for demographics and pain intensity. When pain intensity was treated as the dependent variable, only demographics were controlled for.

We used the criterion of $p < 0.05$ to evaluate statistical significance. Maximum likelihood estimation was employed to estimate a model in CFA. The statistical package R version 3.2.4 [35], and the Mplus version 8.0 [36] were used.

Results

Descriptive statistics

The data of 153 patients were identified from the clinical records for the study use. We were unable to retrieve information from three of these patients regarding their chronic pain classification. Thus, a total of 150 participants were included in the analyses. Their mean age \pm SD was 54.74 ± 15.73 years (range 21–84 years) and their mean pain duration was 62.21 ± 85.42 months (range: 3–540 months). Most participants were female (63%), were classified into the chronic primary pain category (51%), had at least high school education (82%), had a job or were homemakers or students (56%), were married (59%), and did not have a routine exercise habit (70%). Additional information on demographic characteristics are presented in Table 1.

Item analysis of the PSEQ-J

Table 2 presents the item statistics for the PSEQ-J. All items showed acceptable ranges of skewness and kurtosis. All selected items for the PSEQ-J short forms (item 4, 5, 6, 8, and 9) had substantial item-total correlations; all were above 0.80. Model fit statistics for the first one-factor model of the PSEQ-J did not show sufficient fit ($\chi^2(35) = 119.49$, $p < 0.001$, RMSEA (90% CI) = 0.13 (0.10–0.15), and CFI = 0.93). We allowed five error covariances between items with modification indices (MI) above 10 (item 1 and 3, item 1 and 5, item 1 and 6, item 4 and 10, and item 9 and 10). Those error covariances were selected with reference to not only MI but also overlap of phrasing and meaning between the items. The second CFA revealed acceptable fit ($\chi^2(30) = 67.99$, $p < 0.001$, RMSEA (90% CI) = 0.09 (0.06–0.12), and CFI = 0.97). Factor loadings ranged 0.57–0.85. The factor loadings on selected items for the PSEQ-J short forms exceeded 0.80.

Internal consistency of PSEQ-J short forms

Means, SDs and Cronbach's alpha coefficients of the study measures are presented in Table 3. Cronbach's alpha coefficients for the PSEQ-J short forms all exceeded 0.80.

Criterion validity of PSEQ-J short forms

The PSEQ-2a-J, PSEQ-2b-J, and PSEQ-4-J had significant positive correlations with the PSEQ-J ($r = 0.92$, 0.91 , and 0.97 , respectively, all $p < 0.001$).

Table 1 Summary of demographic variables

Demographic variables	<i>n</i> (%)
Sex	
Men	56 (37%)
Women	94 (63%)
Chronic pain classification	
Primary pain	77 (51%)
Cancer pain	0 (0%)
Postsurgical and posttraumatic pain	34 (23%)
Neuropathic pain	23 (15%)
Headache and orofacial pain	5 (3%)
Visceral pain	0 (0%)
Musculoskeletal pain	11 (7%)
Educational history	
Elementary	0 (0%)
Junior high	27 (18%)
High	51 (34%)
Junior college/vocational	25 (17%)
Undergraduate	40 (27%)
Graduate	7 (5%)
Work status	
Full time	36 (24%)
Part time	10 (7%)
Homemaker	38 (25%)
Student	1 (1%)
Not working/retirement	53 (35%)
Not working due to pain	12 (8%)
Marital status	
Married	88 (59%)
Divorced	19 (13%)
Widowed	11 (7%)
Unmarried	32 (21%)
Exercise frequency	
Everyday	9 (6%)
One–three occasions per week	22 (15%)
One–three occasions per month	13 (9%)
One–three occasions per year	1 (1%)
No exercise habit	105 (70%)

Structural validity of PSEQ-4-J

The CFA revealed a one-factor structure of the PSEQ-4-J, with items loading on the self-efficacy factor showing a good fit to the data ($\chi^2(2) = 3.65$, $p = 0.16$, RMSEA (90% CI) = 0.07 (0.00–0.19), and CFI = 1.00, see Fig. 1).

Construct validity of PSEQ-J short forms

The correlations between the various versions of the PSEQ-J and other measures are shown in Table 4. For the PSEQ-2b-J and PSEQ-4-J, the degree of correlation did not decrease

by more than 0.10 when compared to the correlations of the PSEQ-J. Only the change in the magnitude of the correlation between the PSEQ-2a-J and the HADS depression subscale did not meet this criterion.

Results of the hierarchical multiple regression analyses examining the relationship between self-efficacy and pain-related variables after controlling for demographics and pain intensity are shown in Tables 5 and 6. Self-efficacy assessed by the PSEQ-J accounted for a significant proportion of the variance in pain intensity (9%), pain interference (25%), anxiety (19%), depression (33%), and pain catastrophizing (27%). Self-efficacy measured by the PSEQ-J short forms also explained a significant proportion of the variance in the dependent variables (pain intensity: 6–9%; pain interference: 18–20%; anxiety: 14–17%; depression: 23–31%; pain catastrophizing: 22–26%).

Discussion

In the present study, we sought to evaluate the psychometric properties of the PSEQ-J short forms. The selected items had substantial item-total correlations and factor loadings on self-efficacy. All PSEQ-J short forms met the criteria of good internal consistency and satisfactory criterion validity. The CFA confirmed the structural validity of the PSEQ-4-J. We evaluated the construct validity from two perspectives. First, the PSEQ-2b-J and PSEQ-4-J met the criterion regarding the change in the magnitude of the correlations with pain-related measures. However, the PSEQ-2a-J failed to meet the criterion only with the measure of depression. Second, self-efficacy as measured by all PSEQ-J short forms explained a significant proportion of the variance in the pain-related variables when controlling for demographics and pain intensity. Consequently, the three PSEQ-J short forms showed good enough psychometric properties. Especially, the PSEQ-4-J met all criteria; therefore, this short form is the primarily recommended tool for briefly assessing self-efficacy among Japanese pain populations in clinical and research settings.

A number of strengths of the present study can be highlighted. First, our study employed rigorous criteria for evaluating several psychometric properties of the PSEQ-J short forms. In particular, the evaluation of the change in the magnitude of correlations with the other study measures adopted a strict standard based on a previous study [19]. Second, our study confirmed the availability of PSEQ short forms for Japanese cultural and language settings. The number of studies examining the cross-cultural availability of PSEQ short forms is still limited. As mentioned, the IMMPACT recommendations regard availability and of culturally adapted and equivalent versions of measure for different cultures and languages as an important feature of outcome measures for use

Table 2 Item statistics of the PSEQ-J

PSEQ-J item	Mean	SD	Skewness	Kurtosis	Item–total correlation	Factor Loading
Item 1	2.31	1.65	0.24	−0.72	0.85	0.82
Item 2	2.43	1.84	0.22	−1.05	0.79	0.75
Item 3	2.69	1.81	0.11	−0.89	0.81	0.77
Item 4	1.90	1.56	0.61	−0.34	0.83	0.83
Item 5	2.15	1.87	0.63	−0.68	0.84	0.83
Item 6	2.07	1.70	0.51	−0.61	0.86	0.82
Item 7	1.31	1.55	1.04	0.32	0.64	0.57
Item 8	1.54	1.50	0.76	−0.05	0.84	0.85
Item 9	1.77	1.58	0.66	−0.32	0.86	0.84
Item 10	1.99	1.67	0.50	−0.75	0.84	0.83

PSEQ-J Japanese version of the Pain Self-Efficacy Questionnaire, *SD* standard deviation

Table 3 Means, standard deviations, and Cronbach’s alpha of the study measures

Measures	Mean	SD	α (95% CI)
PSEQ-J	20.17	13.65	0.94 (0.93–0.96)
PSEQ-2a-J	3.93	3.18	0.81 (0.75–0.87)
PSEQ-2b-J	3.31	2.89	0.86 (0.81–0.90)
PSEQ-4-J	7.29	5.56	0.90 (0.87–0.92)
NRS: worst pain	7.33	2.29	–
NRS: least pain	3.75	2.54	–
NRS: average pain	6.10	2.26	–
NRS: now	5.85	2.69	–
NRS: composite score	5.76	2.14	0.89 (0.87–0.92)
PDAS	27.29	14.39	0.96 (0.95–0.97)
HADS: Anx	9.29	4.79	0.83 (0.79–0.87)
HADS: Dep	10.61	5.24	0.86 (0.82–0.89)
PCS	37.55	11.12	0.92 (0.91–0.94)

SD standard deviation, *PSEQ-J* Japanese version of the Pain Self-Efficacy Questionnaire, *NRS* Numerical Rating Scale, *PDAS* Pain Disability Assessment Scale, *HADS: Anx.* Hospital Anxiety and Depression Scale Anxiety subscale, *HADS: Dep* Hospital Anxiety and Depression Scale Depression subscale, *PCS* Pain Catastrophizing Scale

in clinical trials targeting pain populations [20]. Our study contributes to important information regarding this feature for the PSEQ short forms.

The present study revealed differences between the 2-item PSEQ short forms in English and Japanese. The English short-form consisted of item 5 and 9 of the PSEQ [18] and PSEQ-2b-J (item 8 and 9) showed comparable construct validity with the 10-item PSEQ, but the English short-form consisted of item 8 and 9 [19] and PSEQ-2a-J (item 5 and 9) failed. These differences may be due to cultural differences between Australia, Canada, and Japan. For example, in the Japanese sample, the perceived possibility to work despite pain (content of item 5) did not show an adequate association with depression.

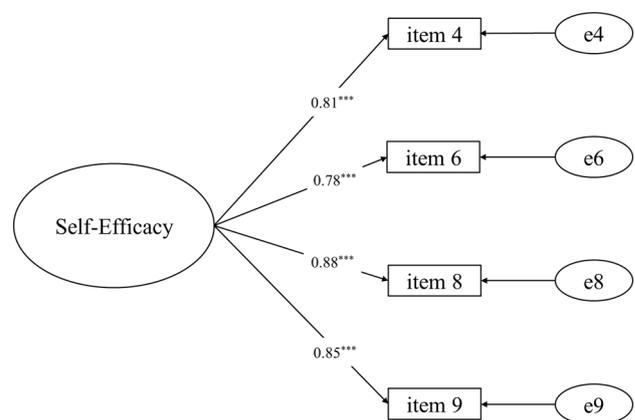


Fig. 1 Factor structure of the 4-item short form of the Japanese version of the Pain Self-Efficacy Questionnaire. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Note: Item 4, 6, 8, and 9 represent the item number of the Japanese version of the Pain Self-Efficacy Questionnaire. The “e” represents error

Table 4 Pearson correlation coefficients between various versions of the PSEQ-J and other study measures

PSEQ versions	Other measures				
	NRS-comp	PDAS	HADS-Anx	HADS-Dep	PCS
PSEQ-J	−0.36	−0.59	−0.55	−0.68	−0.68
PSEQ-2a-J	−0.29	−0.56	−0.51	−0.57	−0.59
PSEQ-2b-J	−0.31	−0.54	−0.49	−0.58	−0.61
PSEQ-4-J	−0.35	−0.56	−0.54	−0.66	−0.66

All correlations are significant at $p < 0.001$

PSEQ-J Japanese version of the Pain Self-Efficacy Questionnaire, *NRS-comp* Numerical Rating Scale composite score, *PDAS* Pain Disability Assessment Scale, *HADS-Anx.* Hospital Anxiety and Depression Scale Anxiety subscale, *HADS-Dep* Hospital Anxiety and Depression Scale Depression subscale, *PCS* Pain Catastrophizing Scale

Table 5 Hierarchical multiple regression models predicting pain intensity and pain interference

Dependent variables	Step	Predictors	Total R^2	ΔR^2	F -change	Beta to Enter	t	
Pain intensity (NRS-comp)	1	Demographics	0.12	0.12	6.52***			
		Age				0.10	1.23	
		Gender				0.08	0.97	
			Pain duration				0.31	3.92***
	2a	Self-efficacy (PSEQ-J)	0.21	0.09	16.24***	− 0.31	− 4.03***	
	2b	Self-efficacy (PSEQ-2a-J)	0.18	0.06	11.89***	− 0.26	− 3.45***	
	2c	Self-efficacy (PSEQ-2b-J)	0.19	0.07	13.73***	− 0.28	− 3.71***	
	2d	Self-efficacy (PSEQ-4-J)	0.21	0.09	16.08***	− 0.30	− 4.01***	
Pain interference (PDAS)	1	Demographics	0.03	0.03	1.39			
		Age				0.00	0.02	
		Gender				0.12	1.47	
			Pain duration				0.12	1.47
	2	Pain intensity	0.19	0.16	29.57***	0.43	5.44***	
	3a	Self-efficacy (PSEQ-J)	0.41	0.25	51.54***	− 0.50	− 7.18***	
	3b	Self-efficacy (PSEQ-2a-J)	0.39	0.20	47.02***	− 0.47	− 6.86***	
	3c	Self-efficacy (PSEQ-2b-J)	0.37	0.18	39.69***	− 0.44	− 6.30***	
		3d	Self-efficacy (PSEQ-4-J)	0.38	0.19	43.94***	− 0.47	− 6.63***

PSEQ-J Japanese version of the Pain Self-Efficacy Questionnaire, *NRS-comp* Numerical Rating Scale composite score, *PDAS* Pain Disability Assessment Scale. We reported standardized partial regression coefficients as beta to enter

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The present findings suggest how researchers and clinicians might use the three PSEQ-J short forms differently. First, we recommend the PSEQ-4-J as a first choice. This short form meets all criteria indicating good to excellent psychometric properties. A previous study also supports the superiority of the 4-item short form over other short-form versions of the PSEQ [19]. However, in settings or situations when a very brief (i.e., 2-item) version is required, the PSEQ-2b-J would appear to be adequate. In addition, if the primary goal of a study is to evaluate the role of self-efficacy on work status only, and not on the role of self-efficacy on depression, the PSEQ-2a-J could be used.

The current findings providing support for the psychometric properties of a 2- and a 4-item version of the PSEQ-J allows researchers and clinicians additional opinions measuring this important construct; especially in settings where assessment burden is a critical issue (i.e., in busy clinical settings where numerous measures are administered, or in survey studies that include a large number of measures). Studies employing an ecological momentary assessment (EMA) [37] could also make valid use of short forms of psychological questionnaires. EMA requires frequent repeated data acquisition throughout the measurement period; thus, it is practical to use a short form measure to reduce assessment burden. In EMA studies, relationships between pain and maladaptive psychological variables such as stress have been illustrated [38, 39]. Therefore, examining the role of protective psychological factor such as self-efficacy using

the EMA method will shed light on individual's momentary stress regulation ability. The two-item versions of the PSEQ-J short forms can be used more effectively in the above-mentioned settings.

The present study does have a number of limitations as well. First, we extracted specific items from the original PSEQ-J and analyzed them as the PSEQ-J short forms. Future research administering the actual PSEQ-J short forms and evaluating their psychometric properties would be useful. That said, extracting short form items from an original version of a measure to evaluate the psychometric properties of the short form is a common strategy, generally thought to provide valid information [15–17, 19, 40]. Second, our study did not compare assessment burden between the PSEQ-J short forms and the original PSEQ-J. Thus, a future study designed to examine their actual burden will help to clarify burden reduction when using the PSEQ-J short forms. Third, our study did not evaluate test–retest reliability or responsiveness over time (or with treatment) of the PSEQ-J short forms. Research to evaluate these psychometric properties of the PSEQ-J short forms would be useful. These properties are important when considering the variation of self-efficacy over time and the magnitude of change by specific interventions. Fourth, we used the data of individuals with mixed chronic pain. Different results on the psychometric properties of the PSEQ-J short forms may be obtained when targeting homogenous pain diagnostic samples such as chronic low-back pain or

Table 6 Hierarchical multiple regression models predicting anxiety, depression, and pain catastrophizing

Dependent variables	Step	Predictors	Total R^2	ΔR^2	F -change	Beta to enter	t	
Anxiety (HADS)	1	Demographics	0.02	0.02	0.93			
		Age				0.02	0.20	
		Gender				0.09	1.13	
	2	Pain duration				0.10	1.22	
		Pain intensity	0.18	0.16	28.02***	0.42	5.29***	
		3a	Self-efficacy (PSEQ-J)	0.37	0.19	42.67***	− 0.47	− 6.53***
		3b	Self-efficacy (PSEQ-2a-J)	0.34	0.16	35.9***	− 0.43	− 5.99***
		3c	Self-efficacy (PSEQ-2b-J)	0.32	0.14	29.47***	− 0.40	− 5.43***
		3d	Self-efficacy (PSEQ-4-J)	0.35	0.17	38.38***	− 0.45	− 6.20***
		Depression (HADS)	1	Demographics	0.07	0.07	3.59*	
Pain Catastrophizing (PCS)	1	Age				0.01	0.17	
		Gender				− 0.07	− 0.81	
		Pain duration				0.25	3.05**	
	2	Pain intensity	0.17	0.10	17.40***	0.34	4.17***	
		3a	Self-efficacy (PSEQ-J)	0.50	0.33	97.68***	− 0.63	− 9.88***
		3b	Self-efficacy (PSEQ-2a-J)	0.40	0.23	56.24***	− 0.51	− 7.50***
		3c	Self-efficacy (PSEQ-2b-J)	0.40	0.23	56.73***	− 0.51	− 7.53***
		3d	Self-efficacy (PSEQ-4-J)	0.48	0.31	85.48***	− 0.60	− 9.25***
		1	Demographics	0.08	0.08	4.12**		
		2	Age				0.12	1.50
Gender					0.14	1.77		
Pain duration					0.20	2.45*		
Pain intensity	0.28		0.20	41.48***	0.48	6.44***		
3a	Self-efficacy (PSEQ-J)		0.55	0.27	86.50***	− 0.56	− 9.30***	
3b	Self-efficacy (PSEQ-2a-J)		0.50	0.22	61.68***	− 0.49	− 7.85***	
3c	Self-efficacy (PSEQ-2b-J)		0.51	0.23	67.21***	− 0.51	− 8.20***	
3d	Self-efficacy (PSEQ-4-J)	0.54	0.26	78.80***	− 0.54	− 8.88***		

PSEQ-J Japanese version of the Pain Self-Efficacy Questionnaire, *HADS* Hospital Anxiety and Depression Scale, *PCS* Pain Catastrophizing Scale. We reported standardized partial regression coefficients as beta to enter

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

rheumatoid arthritis. Fifth, because we did not conduct any cognitive screening, participants might include people with cognitive dysfunction that might influence to our results.

In conclusion, all PSEQ-J short forms showed good enough psychometric properties. Especially, the PSEQ-4-J is a brief measure with the best psychometric properties among the three short forms. We recommend the use of the PSEQ short forms when clinicians and researchers consider assessing self-efficacy in individuals with pain in a concise manner.

Acknowledgements We would like to thank Professor Michael Nicholas for granting us permission to develop and evaluate the PSEQ-J short forms and also to Professor Mark P Jensen for his detailed comments on an earlier draft of this manuscript.

Compliance with ethical standards

Conflict of interest All authors declare no conflict of interest related to the present study.

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