Initial Validation of the Self Experiences Questionnaire-2 in People with Chronic Pain

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Abstract

Purpose The struggle with sense of self has a fundamental impact on health and wellbeing in people with chronic pain. Acceptance and Commitment Therapy (ACT) particularly includes a process related to sense of self, called self-as-context (SAC). A measure of SAC, called the Self Experiences Questionnaire-8 (SEQ-8) has been developed in people with chronic pain. A brief version of the SEQ can facilitate more efficient assessment in clinical settings, and further research using intensive assessment to produce situation and time-sensitive information on SAC. The aim of the study was to establish a two-item version of the SEQ.

Methods This study used secondary analyses of data from 453 people with chronic pain.

Results The newly validated SEQ-2 demonstrated acceptable reliability, Cronbach's $\alpha = 0.77$, and performed well in assessing SAC, with 88.6% of the variance in the SEQ-8 explained by the SEQ-2. The construct validity of the SEQ-2 was supported by its associations with other theoretically-specified processes, $r = .25\text{-}0.51$, $p < .001$. and measures of functioning, $|r| = 0.18\text{-}0.40$, $p < .001$. The incremental validity of the SEQ-2 was relatively limited, $|\beta| = 0.08\text{-}0.34$. Conclusions: The SEQ-2 appears to be an acceptable measure of SAC. The brief version of the SEQ can facilitate the application of individualised research methods and personalised pain treatments, informed by intensive assessment.

Keywords Self experiences questionnaire · Self-as-context · Chronic pain · Acceptance and commitment therapy · Psychological flexibility

Introduction

People with chronic pain often experience a serious challenge to their identity and sense of self. In a recent BBC survey (BBC, 2022), one participant says chronic pain left her grieving for "the person she was", and she says "I feel I've lost every part of my life- I've lost me." Indeed, individuals' experience of chronic pain and its burdens can lead to considerable changes in their activities and roles. Along with these changes, people with chronic pain struggle to hold onto the "real me" and suffer a "loss of identity" (Toye et al., 2013). At the same time, they experience an intrusion of a "new self" that is considerably diminished in comparison with their "old self," regarding emotional, social, and family functioning, and satisfaction with life (Morea et al., 2008; Rodham et al., 2010).

Acceptance and Commitment Therapy (ACT) specifically includes a process related to a sense of self, called "self-as-context (SAC)". ACT is based on a model called the Psychological Flexibility (PF) model, which includes six processes: acceptance, defusion, present-moment awareness, self-as-context, values, and committed action (Hayes et al., 2011). SAC entails the experience of an enduring sense of self that is bigger than and contains one's thoughts, feelings, and sensations. It is like a perspective or point of view whereby one can observe these experiences rather than identifying with them (Yu & McCracken, 2016).

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ACT has been widely applied in chronic pain and is beneficial for improving a range of outcomes (Hughes et al., 2017; McCracken et al., 2022). Accumulating evidence also supports the role of SAC in relation to functioning and wellbeing (Godbee & Kangas, 2020). In people with chronic pain, improvement in SAC has also been observed to be associated with improvement in functioning (Yu et al., 2017b, 2021).

A measure of SAC called the Self Experiences Questionnaires (SEQ) was initially developed in people with mixed chronic pain conditions (Yu et al., 2016), and further developed in people with fibromyalgia (Yu et al., 2017a, b). The SEQ comprises 15 items with two factors: one reflecting a sense of self separated/distinct from one's s thoughts and feelings, namely self-as-distinction (SAD), and one reflecting a sense of self as an observer of one's thoughts and feelings, namely self-as-observer (SAO). A shorter version of the SEQ, which maintains the two-factor structure and includes eight items, was also validated in people with mixed chronic pain conditions (Yu et al., 2021). These measures of SAC have been applied in treatment outcome studies in people with chronic pain, where significant and clinically meaningfully changes in SAC from baseline to post-treatment were observed, and these changes in SAC were associated with changes in treatment outcomes, including pain interference, daily functioning and mood (Yu et al., 2017a, b, 2021).

A briefer measure of the SAC with fewer than eight items is needed and could facilitate intensive and comprehensive assessment. First of all, individuals' responses to psychological interventions are often dynamic, non-linear, and highly individual (Hofmann et al., 2020). Intensive assessment of PF processes, including SAC, is required to gather data that is sensitive to situational and temporal variation, where such intra- and inter-individual variability can be revealed. Secondly, comprehensive assessment of all PF processes is needed to fully understand the mechanisms of associated treatments, such as ACT, and to inform the refinement of the theoretical model. However, these efforts would result in significant assessment burden on patients or participants, and one way to reduce the assessment burden would be to develop briefer version of existing reliable and valid measures.

The aim of the current study was to establish a two-item version of the SEQ, the SEQ-2. A very brief version of the SEQ would make it feasible to assess SAC repeatedly and intensively during the treatment in order to produce fine-grained information about the change trajectory of the process in relation to outcomes, which in turn can inform personalised treatment delivery, and the development of more targeted treatments. Specifically, this study includes three objectives: (1) To identify the most robust two items of the SEQ-8, one from each factor; (2) To examine the performance of the two-item version of the measure in assessing SAC; (3) To examine the construct validity and incremental validity of the SEQ-2.

Methods

Study Design

This study used secondary analyses of a cross-sectional online survey study in people with chronic pain. Ethical approval was obtained for this study from the Psychology Research Ethics Committee of the first author's affiliated institution. Informed consent was obtained from all participants.

Participants

Participants who self-report aged 18 or above and having had persistent or recurring pain for 6 months or longer were deemed eligible. Data were collected using online tool Qualtrics. Advertisement with the link for the online survey was distributed in social media. Potential participants clicked on the link for the online survey to access information about the study, and provided informed consent, and participated if they wished to. Participation is voluntary. Figure 1 shows the data collection process. The sample consisted of 453 participants, with mean age of 39.7 years (SD = 13.7 years). Their characteristics are presented in Table 1. The majority of participants were women (86.1%), and white (91.8%). Most of the participants had generalized pain, 56.1%. The mean pain duration was 10.7 years (SD = 9.1 years) and the mean pain intensity on a 0–10 scale was 6.4 (SD = 2.1).

Measures

Self Experiences Questionnaire-8 (SEQ-8)

The SEQ-8 is an eight-item measure referring to self-as-context, as mentioned in the PF model (Yu et al., 2021). Self-as-context is the ability to see a separation from one's feelings, thoughts, and bodily sensations. An example item is: "Above all my experiences, there is a sense of myself who is noticing them". The scale is numbered from 0 (never true) to 6 (always true). All items, on the scale, are positively keyed, and the higher the scores the higher self-as-context. The construct validity of the SEQ-8 is supported in demonstrating strong correlations with other processes of the PF model, such as cognitive defusion, committed action, and acceptance, and outcomes including depression and daily functioning, in people with chronic pain. In this
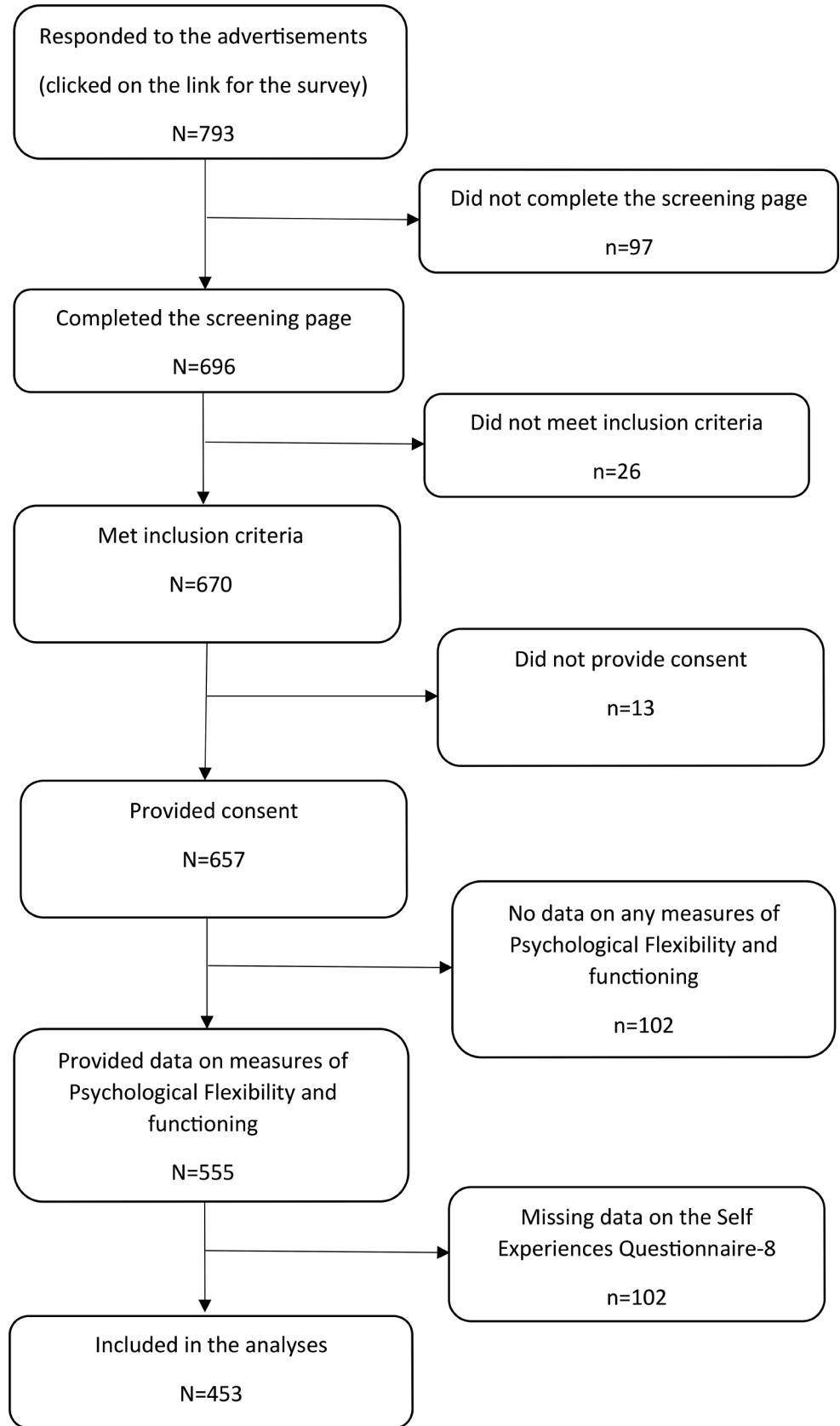
Fig. 1 Data collection flowchat

Responded to the advertisements (clicked on the link for the survey) N=793

Did not complete the screening page n=97

Completed the screening page N=696

Did not meet inclusion criteria n=26

Met inclusion criteria N=670

Did not provide consent n=13

Provided consent N=657

No data on any measures of Psychological Flexibility and functioning n=102

Provided data on measures of Psychological Flexibility and functioning N=555

Missing data on the Self Experiences Questionnaire-8 n=102

Included in the analyses N=453

Table 1 Participants characteristics

N=453		N (%)
Gender		
	Male	57 (12.6)
	Female	390 (86.1)
	Other	6 (1.3)
Age, mean (SD)		39.7 (13.7)
Ethnicity		
	White	416 (91.8)
	Mixed	20 (4.4)
	Asian	10 (2.2)
	Black	2 (0.4)
	Other	5 (1.1)
Present work status		
	Working/studying full-time.	153 (33.8)
	Working/studying part-time due to pain	45 (9.9)
	Working/studying part-time due to other reasons	34 (7.5)
	Volunteer/carer/home maker	18 (4)
	Unemployed due to pain	125 (27.6)
	Unemployed for other reasons	55 (12.1)
	Retired	23 (5.1)
Pain site		
	Head. face. or mouth	206 (45.5)
	Neck region	266 (58.7)
	Upper shoulder or upper limbs	319 (70.4)
	Chest region	143 (31.6)
	Abdominal (stomach) region	236 (52.1)
	Lower back. lumbar spine. sacrum. and coccyx (tailbone)	349 (77)
	Lower limbs	304 (67.1)
	Pelvic region	246 (54.3)
	Anal or genital region	108 (23.8)
Generalised pain		254 (56.1)
Pain duration organised in years, mean (SD)		10.7 (9.1)
Pain intensity during last week (0–10), mean (SD)		6.4 (2.1)
Functioning mean (SD)		
	Pain Disability Index	41.9 (15.5)
	Work and Social Adjustment Scale	24.3 (10.5)
	Patient Health Questionnaire-9	15.8 (6.8)
Psychological Flexibility mean (SD)		
	Chronic Pain Acceptance Questionanire-8	19 (9.2)
	Comitted Action Questionaire-8	25 (9)
	Self Experiences Questionnaire-8	25.5 (10.6)

sample, the SEQ-8 demonstrated excellent internal consistency, Cronbach's α = 0.92.

Chronic Pain Acceptance Questionnaire (CPAQ-8)

The Chronic Pain Acceptance Questionnaire (CPAQ- 8) is a self-report measure aiming to assess the acceptance of chronic pain. It includes participation in activities while being in pain and an individual's willingness to experience pain without trying to control or avoid it (McCracken et al., 2004). The scale is rated from 0 (never true) to 6 (always true), where the higher score shows higher acceptance of pain. The CPAQ-8 is the shorter version of a 20-item measure, both versions are validated (Fish et al., 2010). In this sample, the CAPQ-8 demonstrated good internal consistency, Cronbach's α = 0.82.

Committed Action Questionnaire (CAQ-8)

The Committed Action Questionnaire (CAQ-8) is an 8-item self-report measure of committed action (McCracken, 2013; McCracken et al., 2015). Committed action is the ability to develop and follow patterns of behaviour guided by values and goals, even if it involves uncomfortable experiences. The scale is numbered from 0 (never true) to 6 (always true). Four, out of the 8 items, are negatively keyed and 4 positively keyed. The construct validity of the measures is shown by correlations with measures of physical and social functioning and acceptance in individuals with chronic pain (McCracken et al., 2015). In this sample, the CAQ-8 demonstrated good internal consistency, Cronbach's α = 0.83.

Pain Disability Index (PDI)

The Pain Disability Index (PDI) is a widely used, 7-ietm, self-report measure aiming to assess disability in relation to pain (Tait et al., 1987). The PDI covers 7 areas: life-support activities, self-care, sexual behaviour, occupation, social activity, recreation and family/home responsibilities. The participants respond from a scale from 0 (no disability) to 10 (worst disability). The higher the total score the worse the pain-related disability. The PDI has strong support for its reliability and validity in people suffering from chronic pain (Tait et al., 1987). In this sample, the PDI demonstrated good internal consistency, Cronbach's α = 0.88.

Work and Social Adjustment Scale (WSAS)

The Work and Social Adjustment Scale (WSAS) is a validated and reliable, 5-item, self-report measure which aims to assess impairment in social functioning and work (Mundt et al., 2002). The WSAS involves work, home management,

private and social leisure and relationships. The participants respond to a scale from 0 (no impairment) to 8 (very severe impairment). The validity of the WSAS is clear from the correlations with measures of strong effects and psychiatric symptoms related to treatment. A total score below 10 is correlated with sub-clinical populations, a score from 10 to 20 is associated with severe functional impairment, a score from 20 and above is correlated with extremely severe functional impairment. In this sample, the WSAS demonstrated good internal consistency, Cronbach's α = 0.91.

Patient Health Questionnaire (PHQ-9)

The Patient Health Questionnaire (PHQ-9) is a 10-item, validated and reliable, self-report measure aiming to assess depression severity. The items included in the measure are based on DSM-IV. The first 9 items are rated on a scale from 0 (not at all) to 4 (nearly every day) assessing depression symptoms. While the last item (10) is rated from "not difficult at all" to "extremely difficult" to assess the impact of depression. This last item was added as an extra variable as within the PF model, the impact of symptoms of depression is considered as a significant outcome in treatment. The higher the total sum of the symptoms' items the higher the level of depression (Kroenke et al., 2001). A sum of 0–4 for the first 9 items shows none to minimal depression, while 5–9 indicates mild depression, 10–14 reports moderate depression, 15–19 presents moderately severe depression and 20–27 indicates severe depression. In this sample, the PHQ-9 demonstrated good internal consistency, Cronbach's α = 0.89.

Pain

The pain intensity of the participants was assessed via one validated question. The numerical scale which was used was from 0 (no pain) to 10 (worst possible pain). Respondents were asked to rank their pain during the past week (Jensen et al., 1999; Von Korff et al., 1992).

Statistical Analysis

(1) Item Factor Analyses (IFA; Wirth & Edwards, 2007) based on the polychoric correlation matrix was conducted to identify the most robust item for each dimension of the SEQ-8, using FACTOR version 10.3.01 (Lorenzo-Seva & Ferrando, 2006). IFA is essentially a re-parametrization of an item response model (Item Response Theory; IRT) - specifically a multi-dimensional normal ogive model (Reckase, 1985). A basic concept of IRT is that the relation between a persons' latent trait levels and their probability of endorsing a given item in a trait-consistent manner is expressed

by a response curve with certain characteristics, the item information curve (Edelen & Reeve, 2007). The item difficulty parameter can be interpreted as the point where, on the latent construct continuum, it becomes relatively more likely for a person to endorse this category than the previous category. The item discrimination parameter describes how sensitive the item is to the change of level of the latent construct. It indicates the item discrimination in each dimension when a multi-dimensional model is applied. Cronbach's a for the two items (SEQ-2) was calculated to examine the internal consistency of the two-item scale.

(2) Skewness, kurtosis, histograms, and Q-Q plots for each variable were examined for normality. The total scores of all measures were considered normally distributed, except pain duration. Pain duration data were log-transformed. (3) The variance accounted for by the SEQ-2 in the SEQ-8 was calculated using regression analysis, to evaluate the performance of the SEQ-2 in assessing SAC. (4) In order to evaluate the construct validity of the SEQ-2, Pearson's correlations coefficients (r) were calculated to explore the associations of SEQ-2 and SEQ-8 scales with measures of functioning, including PDI, WSAS, PHQ-9, and measures of other PF processes, including CPAQ-8 and CAQ-8. (5) In addition, both construct and incremental validity were evaluated by examining variance accounted for in pain disability, work and social adjustment and depression for the SEQ-2 and comparatively for the SEQ-8. In these regression analyses, only demographic factors that were significantly correlated with the dependent variables were entered, as well as pain duration, pain intensity and having generalized pain. Outliers (+/-3 SD) were identified and removed. Residual plots were examined for linearity, and no obvious non-linearity was identified. All reported p values are two-tailed. Statistical significance was set at p < .05 and analyses were conducted using SPSS statistical software (version 26.0).

Results

Identification of the Two most Robust Items of the SEQ-8

Factor loadings, discrimination parameters, and item difficulties for the eight items from SEQ-8 are presented in Table 2. IFA yielded a two-factor structure that is generally consistent with the previous studies, with one factor reflecting SAC and the other SAO. Item 3 ("I am able to separate myself from my thoughts and feelings.") appeared to be the most sensitive item for the factor reflecting SAD, with the highest discrimination parameter (2.72). Although item 2 ("I am able to step back from my emotions and observe

Table 2 Factor loading, discrimination parameter in each dimension, and item difficulty for each item from the SEQ-8.

Item	Factor loading		Discrimination in each dimension		Item difficulty					
	F1	F2	a1	a2	d 1	d 2	d 3	d 4	d 5	d 6
1	0.90		1.62	-0.15	-2.83	-1.92	-0.94	0.15	1.32	2.47
2	0.92		2.55	0.05	-3.95	-2.41	-0.96	0.53	2.14	3.83
3	0.89		2.72	0.22	-3.71	-2.32	-0.69	0.98	2.79	4.37
4	0.45	0.46	0.88	0.89	-2.36	-1.48	-0.73	0.59	1.59	3.09
5		0.77	0.17	1.44	-2.53	-1.64	-0.97	0.35	1.32	2.61
6		0.91	-0.04	2.03	-2.99	-2.00	-1.13	0.36	1.71	3.12
7		0.73	0.03	1.11	-2.59	-1.77	-0.86	0.15	1.01	1.97
8		0.72	-0.11	0.97	-2.29	-1.63	-1.02	-0.10	0.60	1.44

Note. F = factor; a = item discrimination in each factor, this indicates the ability or sensitivity of the item in differentiating people at level of the latent construct (the underlying dimension; d = item difficulty (d1 represents the point, on the continuum of the latent construct, at which the probability of (participants) endorsing "0" (on a scale of 0–6) is equal to the probability of endorsing "1")

Table 3 Pearson's correlation coefficients of SEQ-2 and SEQ-8 scores with measures of functioning, PF processes, and pain intensity and pain duration

	SEQ-2 score	SEQ-8 score
Measures of functioning		
Pain disability	− 0.18***	− 0.21***
Work and social adjustment	− 0.21***	− 0.23***
Depressive mood	− 0.40***	− 0.42***
Psychological Flexibility		
Pain acceptance	0.25***	0.26***
Comitted action	0.51***	0.55***
Pain duration	0.02	− 0.002
Pain intensity	− 0.17***	− 0.19***

Note For pain duration, logarithmic transformations were used

*p < .05; **p < .01; ***p < .001

them from a separate point of view.") has a slightly higher factor loading, the discrimination parameter is lower and the item difficulty parameters are less spread out along the continuum of the latent construct. Therefore, Item 3 is selected to reflect SAD. Item 6 ("I can observe experiences in my body and mind as events that come and go.") was the most sensitive item for the factor reflecting SAO, with the highest discrimination parameter (2.03). The item difficulty parameters for these two items were generally spread along the construct continuum. The intercepts between each two response categories varied, indicating Item 3 was relatively consistently difficult across the latent construct continuum, while item 6 was slightly more difficult on the higher end of the latent construct continuum.

Thus, item 3 and item 6 were selected to potentially constitute the 2-item version of the SEQ scale. Cronbach's a for SEQ-2 was equal to 0.77, suggesting acceptable internal consistency. The mean SEQ-2 score was 6.02 (SD = 3.05) and the mean SEQ-8 score was 25.48 (SD = 10.55).

The Performance of the SEQ-2 in Assessing SAC

Linear regression showed that the SEQ-2 scores explained 88.6% of the SEQ-8 scores' variance, and the standardized beta of the SEQ-2 score was 0.94, $p < .001$, supporting the utility of the SEQ-2 in assessing SAC.

The Construct Validity of the SEQ-2

Table 3 shows the correlations of SEQ-2 and SEQ-8, with measures of functioning, other PF processes, and pain intensity and pain duration. Albeit to a slightly reduced degree compared with scores from SEQ-8, SEQ-2 scores were significantly associated with scores from all measures of functioning, as well as measures of other PF processes, in the expected direction, demonstrating the construct validity of the SEQ-2. Higher level of SAC was significantly associated with lower level of pain disability, work and social functioning impairment and depressive mood. Higher level of SAC was significantly associated with higher level of pain acceptance and committed action. Pain duration was not significantly associated with SEQ-2 or SEQ-8 scores, while greater pain intensity during the last week was significantly associated with lower SEQ-2 and SEQ-8 scores.

The Incremental Validity of the SEQ-2

Table 4 displays variance that the SEQ-2 scores and the SEQ-8 scores accounted for in pain disability, work and social adjustment and depression, after controlling for demographic factors, and pain characteristics. Pain intensity was significantly associated with all outcomes. SEQ-2 accounted for incremental variances in all measures of functioning that were comparable to the variances accounted for by the SEQ-8. However, the variances explained by the SEQ-2 in pain disability and work and social adjustment were limited.

Table 4 Hierarchical regression results and comparisons of variances in the measures of functioning explained by the SEQ-2 and the SEQ-8.

Step	Variable	SEQ-2		SEQ-8	
		ΔR^2	B (final model)	ΔR^2	B (final model)
Pain disability					
1	Working full time or not	0.01*	− 0.23***	0.01*	− 0.23***
	Age		0.06		0.06
	Female or not		0.02		0.02
2	Pain intensity	0.21***	0.38***	0.21***	0.38***
	Pain duration		− 0.08*		− 0.08*
	Generalised pain or not		0.23***		0.23***
3	SEQ	0.006*	− 0.08*	0.01*	− 0.09*
	Total R^2	0.42		0.42	
Work and social adjustment					
1	Working full time or not	0.05***	− 0.26***	0.05***	− 0.26***
	Age		0.06		0.06
2	Pain intensity	0.23***	0.39***	0.23***	0.39***
	Pain duration		− 0.03		− 0.03
	Generalised pain or not		0.24***		0.24***
3	SEQ	0.01**	− 0.10**	0.01**	− 0.10**
	Total R^2	0.48		0.48	
Depression					
1	Working full time or not	0.06***	− 0.11*	0.06***	− 0.10*
2	Pain intensity	0.15***	0.31***	0.15***	0.31***
	Pain duration		− 0.06		− 0.06
	Generalised pain or not		0.10*		0.09
3	SEQ	0.11***	− 0.34***	0.11***	− 0.35***
	Total R^2	0.30		0.31	

Note. *$p < .05$; **$p < .01$; ***$p < .001$; SEQ: Self Experiences Questionnaire

Discussion

The aim of the study was to establish a two-item version of the SEQ. The newly validated SEQ-2 demonstrated acceptable reliability and appeared to perform well in assessing SAC, as evidenced by its association with the SEQ-8. The construct validity of the SEQ-2 was supported by its associations with other PF processes and measures of functioning, albeit to a slightly reduced degree compared with the SEQ-8. The incremental validity of the SEQ-2 was demonstrated by its associations with measures of functioning, which were comparable to those for the SEQ-8.

The results from this study are generally in line with findings from previous studies, where SAC was examined in people with chronic pain (Yu et al., 2016, 2017a, b, 2021). Intriguingly, SAC appeared to consistently demonstrate relatively strong correlations with committed action, in these studies. That is, people who demonstrate high level of SAC appeared to demonstrate more value-guided actions. SAC entails a sense of self that is not identified with self-concepts and self-evaluations. From the perspective of Contextual Behavioural Science (CBS), people with low level of SAC would overly identify with their self-concepts and self-evaluations, which are often negative and diminished as a result of their living experience of chronic pain. These in turn would lead to avoidant behaviour, as opposed to value-guided actions (McHugh, 2015). The negative association between SAC and committed action appears to support the role of SAC as theorized in the contextual behavioural approach to the self.

SAC also consistently demonstrated stronger association with depressive mood, compared with other measures of functioning such as pain-related interference and work and social functioning (Yu et al., 2017a, b; Yu et al., 2021). People who overly identify with their own thoughts and feelings, appear to report higher level of depressive mood. Similar patterns have also been observed in the relationship between rumination and patient outcomes, where rumination was found to predict depression, but not social functioning in people with chronic pain (McCracken et al., 2014). Taken together, "being enmeshed" in one's thoughts and feelings appears to have a particular effect on mood.

From the CBS point of view, the core experiences of depression, such as low mood and sadness, are in many circumstances normal and adaptive, emotional responses, that can lead to chronic and maladaptive depression through experiential avoidance (Kanter et al., 2008). Indeed, it was observed, in people with chronic pain, that rumination indirectly exerted its influence on depression through pain acceptance (McCracken et al., 2014), a process reflecting the willingness to engage with undesirable thoughts and feelings, as opposed to avoidance. Perhaps treatment methods targeting acceptance, combined with techniques designed to improve SAC, can be particularly helpful for people with high level of depressive mood.

It is noted that the unique variance in these measures of pain disability and work and social functioning explained by the SEQ were limited. In the regression models, we took a statistically conservative approach to force enter pain duration, pain intensity, and pain location in the models, before the SEQ, which statistically disadvantaged the SEQ scores. At the same time, SAC is not a process that emerges from ordinary language environment. Training is often needed to foster such a perspective. For instance, in a previous longitudinal validation study of the SEQ (Yu et al., 2017a, b), the SEQ generally performed better with post-treatment data, where participants had received training in SAC. Furthermore, the correlations between SAC and measures of

functioning at baseline were much smaller, compared with correlations between the changes in SAC and measures of functioning at post-treatment. Longitudinal studies that include SAC training are needed to further validate the measure. Nevertheless, this finding appears in line with what has been observed in previous studies (Yu et al., 2016, 2017a, b, 2021), and the unique variances explained by the SEQ-2 in the measures of functioning were comparable to those explained by the SEQ-8, indicating that the performance of the SEQ-2 in predicting functioning is comparable to that of the SEQ-8 in this sample.

The association between SAC and depressive mood appeared stronger than those observed in previous studies in people with chronic pain (Yu et al., 2017a, b, 2021). The data for this study was collected during the COVID-19 pandemic, when an elevated level of depression was observed among people with chronic pain. In addition, prolonged quarantines were widely enforced to control the spread of the virus. Such a restricted social environment could lead to reduced source of reinforcement for adaptive behaviours, such as engaging with meaningful activities while experiencing pain (pain acceptance), which could potentially mitigate the effect of SAC on mood. On a related note, the context of the pandemic may also have implications for the sample. For instance, the employment status of the participants might have been affected by the pandemic. The pain characteristics, such as pain intensity may have been affected due to restricted pain services during the pandemic. To reduce such impact, we controlled for demographics and pain characteristics in the analyses.

Nevertheless, the two-item SEQ that emerged here appears to be a reliable and valid measure of SAC. The availability of a very brief measure of SAC can facilitate efficient and intensive assessment of the process in clinical practice and research. Such assessment can generate time and situation-sensitive information about the process, such as if any improvement occurs after the treatment is implemented, when the improvement occurs, and the stability of change over time. Such information in turn can further inform treatment development and personalized treatment delivery.

The study includes limitations. First of all, the data for this study was collected during the COVID-19 pandemic. Some contextual factors specific to the pandemic may have exerted some influence on the relationships we observed in this study. For instance, we have discussed the stronger relationship between SAC and depression observed in this study in the context of the pandemic and the implication for the sample characteristics. Second, the sample in this study is dominantly white and women. Chronic pain is generally more common in women compared to men, and women are often overly-presented in chronic pain research. For

instance, in a large Canadian online survey study ($N = 2423$) in people with chronic pain during the pandemic, 83.5% of the participants were women (Pagé et al., 2021). The survey was distributed in English, thus participants were likely from English-speaking countries, where the majority of the populations are often whites. Nevertheless, the limited representativeness of the sample may have implications for the generalizability of the findings. Third, although acceptable, the reliability of the SEQ-2 appeared lower than that of the SEQ-8. Nevertheless, the inter-item correlation for SEQ-2 (0.63) is higher than the mean inter-item correlation for SEQ-8, 0.59 (0.40-0.83), and the item-total correlation is 0.63 for both items of the SEQ-2, while the item-total correlation for SEQ-8 is 0.56-0.83, supporting the internal consistency of the items. Next, the discriminant validity of the SEQ-2 was not examined due to the lack of data on theoretically unrelated construct. However, the clinically-relevant incremental validity of the SEQ-2 (beyond pain intensity, duration, and pain location), was examined in addition to convergent validity. Lastly, the cross-sectional design of the study limited our ability to infer any causal relations between our study variables, or to draw conclusions on the responsiveness of the newly developed measure. Longitudinal studies are warranted in this regard.

Conclusions

A two-item version of the SEQ emerged from this study, and appeared an acceptable measure of SAC. The availability of the measure could facilitate more efficient and intensive assessment of SAC, where high-frequency repeated administration is needed, which in turn can help testing and refining the theoretical model in research, and inform clinical practice. Further treatment studies that include a longitudinal design and training for SAC are needed to further validate the SEQ-2.

Declarations

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