Clinical Pain Research

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Psychometric assessment of the Swedish version of the injustice experience questionnaire among patients with chronic pain

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Abstract

Objectives: The use of the Injustice Experience Questionnaire (IEQ) in psychological assessment of individuals with chronic pain is supported by research. The psychometric properties of the Swedish version, the IEQ-S, has not yet been evaluated. Hence, the aim was to investigate structural validity, and concurrent criterion validity of the IEQ-S against the Work Ability Index (WAI), the Pain Catastrophizing Scale (PCS-SW), the Patient Health Questionnaire 9-item depression module (PHQ-9), and the Generalized anxiety disorder 7-item scale (GAD-7). Internal consistency and test-retest reliability were also studied.

Methods: Sixty-five participants, referred to a University hospital, with a pain duration over three months were consecutively sampled. They completed the IEQ-S at admission and again within six weeks. A confirmatory factor analysis was performed for the study of structural validity. Concurrent criterion validity was evaluated using Spearman's correlation coefficient. Internal consistency reliability for the full IEQ-S was calculated using the Cronbach's alpha. Test-retest reliability was calculated using an Intraclass Correlation Coefficient (ICC).

Results: The median total score (0–48, where high scores indicate high levels of injustice) at admission (test 1) was 27.0 (n=64), 25th percentile=15.3, 75th percentile=37.8, range=3–48 points. A one-factor model was supported with item-loadings between 0.67–0.92. Spearman's correlation coefficient between the IEQ-S and the WAI (n=56) was r_S=−0.46; the PCS-SW (n=63) was r_S=0.68, the PHQ-9 (n=64) was r_S=0.50 and the GAD-7 (n=64) was r_S=0.57, p<0.01. Cronbach's alpha was 0.94 (n=64). The ICC was 0.80 (n=55), with a 95% confidence interval, ranging between 0.69–0.88.

Conclusions: Our study supported structural validity and concurrent criterion validity of the IEQ-S against other measures of psychological constructs and work ability. It also supported the internal consistency reliability of the IEQ-S and the test-retest reliability with a retest interval up to six weeks, was good. These findings support the use of the IEQ-S as an adjunct tool to assess appraisals of injustice in patients with chronic pain who are referred to tertiary care in Sweden. The added value might be identification of those who are at risk for slow or no improvement in their pain condition over time, and sick-leave, but this has to be confirmed in future studies.

Ethical committee number: EPN Uppsala D-No 2016-376.

Keywords: chronic pain; cognitive aspects; psychometrics; work performance.

Introduction

Perceived injustice has been conceptualized as "an appraisal cognition or set of cognitions comprising elements of blame, magnitude of loss and irreparability of loss" [1]. The term justice is often used interchangeably with fairness, which can be described as when distributions are the same within a situation. Unfairness, or injustice, might then be experiences of when outcomes of another surpass one's own outcomes. The pursuit of justice has been stated to be a fundamental aspect of social life [2]. Although the research area of perceived injustice is relatively novel, recent research suggests that perceived injustice may have a significant negative impact on pain-related outcomes [3] Sullivan et al. [1] developed the Injustice Experience Questionnaire (IEQ) to measure

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perceived injustice associated with musculoskeletal injury. However, perceived injustice does not only arise in an injury context but is also present in chronic pain conditions that have a more insidious onset [4]. Perceived injustice among patients having work disabilities, specifically musculoskeletal conditions, has been shown to correlate with pain severity, catastrophizing, fear of movement, perceived disability and depression [1]. It has been suggested that high scores on the IEQ predict failure to return to work [1] and correlate with current unemployment [5]. Some overlap has been seen between the IEQ and other measures, such as The Pain Catastrophizing Scale. However, the IEQ has been suggested to add to other measures by its unique ability to predict work disability [1]. Further, perceived injustice seems to impede successful recovery after injury at both a physical and psychological level [4], making it important to detect. Research has supported the construct validity as well as the test-retest reliability of the IEQ and has shown that the measure might be a useful complement to psychosocial assessment of individuals with chronic pain [1].

Chronic pain is one of the most intractable problems challenging patients and health care professionals today [6]. In Sweden, musculoskeletal pain disorders, together with mental illness, are the most common diagnoses responsible for work disability and sick leave [7]. Chronic pain is usually described as pain that has lasted longer than three months [8]. The maintenance of chronic pain can often be explained by other factors than those that triggered the pain in the first place, such as changes in pain modulation and behavior. Patients with chronic pain may have alterations in their behavioral or psychological responses to pain, which can have major clinical significance. Chronic pain is not only the product of the sensory dimension but also the emotional and cognitive dimensions, with the interpretation of pain based on previous experiences playing an important role [6]. Due to the complex nature of chronic pain, both behavioral and psychological factors need to be taken into consideration when assessing chronic pain [9]. A thorough biopsychosocial assessment is recommended prior to the treatment of individuals with chronic pain [10]. Psychometrically sound measures are essential not only when conducting research on chronic pain [11], but also for targeting and evaluating treatment [12].

There are no previous published studies examining perceived injustice in a Swedish pain population, although a Swedish version of the IEQ, the IEQ-S, was developed in 2015 in a master thesis [13]. No psychometric properties of the Swedish IEQ-S had previously been evaluated, hence, a vast amount of comparable constructs should be studied. In this study we limited our focus to IEQ-S in association to measures of other psychological constructs and work ability. Thus, the aim of this study was to investigate structural validity and concurrent criterion validity of the IEQ-S against the Work Ability Index (WAI), the Pain Catastrophizing Scale (PCS-SW), the Patient Health Questionnaire 9-item depression module (PHQ-9), and the Generalized anxiety disorder 7-item scale (GAD-7), as well as the internal consistency and test-retest reliability of the IEQ-S, among patients with chronic pain referred to Swedish tertiary care.

Methods

Setting and sample

This study was part of a feasibility study for a large cohort within the U-PAIN research program [14], which is an interdisciplinary and translational pain research program exploring methods for pain diagnostics, treatment and rehabilitation. The aim of the cohort is to identify patients who benefit from long-term opioid therapy or are at risk for problematic opioid use. A multidisciplinary research group will follow over 1,000 patients over the course of five years with annual follow-ups to build a knowledge base regarding risks and benefits with long-term opioid treatment. The study was approved by the regional ethics board in Uppsala (EPN Uppsala D-No 2016-376).

The sample was consecutive and set to 65 participants for this feasibility study. The sample included patients with chronic pain, referred to tertiary care at a pain clinic in a Swedish university hospital during 2019. Inclusion criteria were: an age of 18 years or older, first visit of their current referral to the pain clinic, and a pain duration of more than three months at the time of referral. Patients who were given acute care related to active cancer treatment and patients in palliative care were excluded, as were patients who had cognitive impairment or were illiterate in the Swedish language. According to the government agency Swedish Statistics, the Swedish working population constitutes of inhabitants between the ages of 15–74 [15]. Since we wanted to explore work ability with regard to concurrent criterion validity, participants over the age of 74 were hence excluded from this analysis. Participants who had failed to answer all, or the majority of, questions in any questionnaire, were excluded from the particular analysis where this questionnaire was needed. When a participant had failed to answer a minor part of a questionnaire, and this response did not affect the total score or index, a deductive imputation [16] was made and the participant was included.

Measures

Demographics: A study specific questionnaire was used to collect information on gender, age, pain duration, highest completed education, main occupation, and perceived conjunction with onset of pain. Data on pain were collected with the Swedish Brief Pain Inventory – Short form (BPI-SF). In BPI-SF items 3–6, a person's pain level is estimated by a Numeric Rating Scale (NRS) with 0 representing *no pain* and 10 representing *pain as bad as you can imagine*. The reliability and validity of the BPI has been supported for assessing

pain intensity in patients with chronic, nonmalignant pain [17]. The validity of the BPI-SF has been supported for different pain-related musculoskeletal conditions [18]. However, psychometric properties for the Swedish version seem to be lacking.

Injustice Experience Questionnaire (IEQ-S): The IEQ-S was used to measure perceived injustice in the context of chronic pain. The IEQ was translated into Swedish by our research group in 2015 [13]. Permission to use and translate was obtained from the originator Michel J.L. Sullivan. The process to translate and adopt the questionnaire into Swedish followed a modified version of the Guidelines for the Process of Cross-Cultural Adaption of Self-Report Measures [19]. It involved the following steps: (I) Forward translation from English into Swedish by two independent, bilingual professional translators. (II) The two bilingual, professional translators, together with one bilingual expert professional with experience in the field of chronic pain, compared the English and the Swedish versions of the questionnaire. (III) Back translation from Swedish into English was performed by two independent, bilingual professional translators, blinded to the original version of the questionnaire. (IV) All the professional translators and the expert professional with experience in the field chronic of pain reviewed all the translations to reach conceptual, idiomatic, and semantic consensus on the Swedish version. (V) The back translation was sent to the originators for comments, who did not have any remarks and approved the back translation. (VI) The Swedish version was prepared for psychometrical testing.

The IEQ-S is a self-administered questionnaire, addressing the degree to which individuals perceive their life to be characterized by injustice following an injury. Respondents are asked to indicate on a five-point scale, where the endpoints are 0 – *not at all* and 4 – *all the time*, the degree to which they experience each of the 12 items, described as thoughts and feelings [1]. The total score is calculated by adding the scores of each item. It has been indicated that a total score of 30 on the IEQ represents clinically relevant levels of perceived injustice [20]. Another study proposed that a total score above 19 may represent a barrier to return to work [21]. With regard to structural validity, Sullivan et al. [1] have proposed a one-factor solution, i.e. that the measure should not be divided into subscales. The construct validity of the IEQ has been supported by significant correlations with several other measures and outcomes [1]. The internal consistency reliability has been supported for the original IEQ [1] as well as for the Danish [5], Japanese [22], and Spanish [23] versions of the measure, with Cronbach's alphas ranging between 0.89–0.92. The IEQ has shown high levels of test-retest reliability. The original IEQ was very stable across four weeks (r=0.9) [1]. The Japanese version of the IEQ, which had a retest done within 1–4 weeks of the baseline measure, had an ICC of 0.96 [22]. The ICC for the Spanish IEQ was even higher, calculated for 1- to 2-week follow-up interval, with an ICC of 0.98 [23].

Work Ability Index (WAI): The Swedish WAI was used to measure work ability for concurrent criterion validity analysis. The WAI is a self-administered questionnaire, widely used in research and occupational health services since the 1990s [24]. The full WAI consists of seven domains that have single or multiple questions, measuring physical and mental demands of work, and the individual's health status and resources. The various domain items are all scored differently. The scores are weighed and summed into an index, ranging from 7 to 49. The index results have been categorized into poor (7–27 points), moderate (28–36 points), good (37–43 points), and excellent (44–49 points) work ability [25]. The Swedish WAI has been shown to be a useful tool for the working population [26]. A Swedish study on the general population concluded that the full WAI is superior to its individual items and has acceptable predictive criterion-related validity for long term sickness absence [27]. A Dutch study concluded an acceptable stability reliability through test-retest over a four-week interval for the WAI [28]. However, no such studies seem to have been made on the Swedish version. An additional instruction was added to the WAI to measure work ability for individuals with no current employment in this study, asking them to answer the questions based on the profession and the main work tasks of a previous employment.

Pain Catastrophizing Scale (PCS-SW): The Swedish PCS is a 13 item self-administered questionnaire that was used to assess pain-related catastrophizing for concurrent criterion validity analysis. The items address the degree to which patients experience different thoughts and feelings when in pain. The items are rated from 0–4, with endpoints ranging from *never* (0) to *all the time* [4, 29]. A total score of 30 or more has been indicated to represent clinically relevant levels of catastrophizing [30]. The original PCS has shown to be a valid and reliable measure of catastrophizing [31]. A psychometric assessment of the Swedish PCS has indicated adequacy of a three-factor solution (*helplessness*, *rumination*, and *magnification*) and provided initial support for its structural validity and internal consistency in a chronic pain population [29].

Patient Health Questionnaire 9-item depression module (PHQ-9): The Swedish PHQ-9 was used to measure depression for concurrent criterion validity analysis. The self-administered questionnaire contains nine items and was originally the depression module in the Patient Health Questionnaire (PHQ). In PHQ-9, patients are asked how often, during the last two weeks, they have been bothered by different symptoms. The response options range from *not at all* (0) to *nearly every day* [3], with a total score of 27 (1–4=minimal, 5–9=mild, 10–14=moderate, and 20–27=severe levels of depression). The Swedish PHQ-9 has shown to be a reliable measure, with high internal consistency and a stable factor structure [32].

Generalized anxiety disorder 7-item scale (GAD-7): The Swedish GAD-7 is a seven-item self-administered questionnaire that was used to measure generalized anxiety for concurrent criterion validity analysis. In GAD-7, patients are asked how often, during the last two weeks, they have been bothered by different symptoms. The response options range from *not at all* (0) to *nearly every day* [3], with a total score of 21 (0–4=minimal, 5–9=mild, 10–14=moderate, and 15–21=severe levels of anxiety). The original GAD-7 has shown to be a valid and reliable tool for screening for generalized anxiety disorder (GAD), as well as assessing its severity both in research and clinical practice [33]. However, psychometric studies of the Swedish version are lacking.

Procedures

The participants received a written invitation letter to the pain clinic in which they were asked to fill in the questionnaires for admission (test 1) to prepare for their clinical visit. They were instructed to do so electronically, using the Swedish Healthcare Guide online. In the invitation letter, they received written information about the study.

Research staff called the participants before their clinical visit to offer help with the above described procedure and requested permission to give more information about the cohort and feasibility study during the clinical visit. Patients accepting to participate filled in a written consent form. The first 65 patients who met the inclusion criteria and accepted to be part of the feasibility study were included. This sampling was made between January and June 2019. The participants were then asked to complete the IEQ-S once more for a retest (test 2) at their clinical visit. These data had to be done within six weeks after test 1 to be included in the analysis. The retest (test 2) was mainly done through a web-based platform for distribution of electronic questionnaires.

Data analysis

A confirmatory analysis was conducted to investigate the strength of the 12 items loadings. Data from the first test were analyzed. The packages *psych and nFactors* in R 4.0.2 was used for the factor analysis.

The concurrent criterion coefficients between the IEQ-S and WAI, PCS-SW, PHQ-9 as well GAD-7 were all calculated using Spearman's correlation coefficient. The correlation coefficient was interpreted as zero (0.0), weak (0.1–0.3), moderate (0.4–0.6), strong (0.7–0.9), and perfect (1.0) correlation [34]. The internal consistency reliability was established by calculating Cronbach's alpha, including the Corrected Item–Total Correlation and Cronbach's Alpha if Item is deleted, for the IEQ-S total scores at admission (test 1). A Cronbach's alpha around 0.8 was desirable [35]; however, a value over 0.9 was considered as suggesting that the different items might be too similar [36]. Having the Corrected Item–Total Correlation (correlations between each item and the total score of a measure) be larger than 0.30 was desirable. The Cronbach's Alpha if Item is Deleted for each individual item should not be higher than the overall alpha, since this would have meant that the deletion of that item would result in higher reliability [35]. An Intraclass Correlation Coefficient, 2-way mixed effects model, with absolute agreement definition, was used as the test-retest reliability coefficient. The ICC value was interpreted as poor (<0.5), moderate (0.50–0.75), good (0.75–0.9), and excellent (>0.9) reliability [37]. The analyses were made using the Statistical Package for the Social Sciences (SPSS version 26).

Results

Missing data

When scrutinizing data, it was discovered that one of the included participants had a pain duration of less than three months and was thus excluded from all analyses. Eight participants were excluded from the concurrent criterion validity analysis between the IEQ-S and the WAI, whereof five participants had not answered the WAI, two participants had not answered a majority of the WAI questions and one participant was over age 74. One participant had failed to answer one question of the WAI and a deductive imputation could be made. Another participant had failed to answer the majority of the questions of the PCS-SW, hence was excluded from the concurrent criterion validity analysis between the IEQ-S and the PCS-SW. Finally, three participants had not answered the IEQ-S retest (test 2) and six participants had not answered within the predetermined interval (six weeks or less), which excluded them from the test-retest reliability analysis. Figure 1 displays a flowchart of the included and the excluded data.

Sample characteristics

Of the participants, 42.2% (n=27) were men and 56.3% (n=36) were women; one participant was unsure about gender identity. Their age ranged from 19 to 85 years old, with a mean of 50.3 (n=64) and a standard deviation (SD) of 14.5. The median total score for the IEQ-S measured at admission (test 1) was 27.0 (n=64), 25th percentile=15.3, 75th percentile=37.8, with a range between 3–48 points (IEQ total score=0–48, where higher scores indicate higher levels of injustice). The mean was 26.2 with a standard deviation of 13.3. 30 out of 64 participants (46.9%) had a total score of ≥30, representing a clinically relevant level of perceived injustice. Forty-one out of 64 participants (64%) had a total score ≥19, which may represent a barrier to return to work. 30 participants (46.9%) had a total score of ≥30, representing a clinically relevant level of perceived injustice. Forty-one participants (64%) had a total score ≥19, which may represent a barrier to return to work. Demographic variables and clinical characteristics are summarized in Table 1.

Structural validity

In a one-factor confirmatory factor analysis all items had high loadings, see Table 2, which indicates that all items load on the same factor. Testing for the number of factors it was confirmed that a one-factor model was a good fit. The scree test showed the second factor had an eigenvalue just below 1. The proportion of variance explained was 0.61.

For exploratory purpose the two-factor model was also fitted, which resulted in great overlap in item content between the two factors.

Concurrent criterion validity

The correlation coefficient between the IEQ-S and WAI (n=56) was r_S=–0.46, p<0.01, meaning that there was a negative, significant correlation between perceived injustice and work ability. The correlation coefficient between

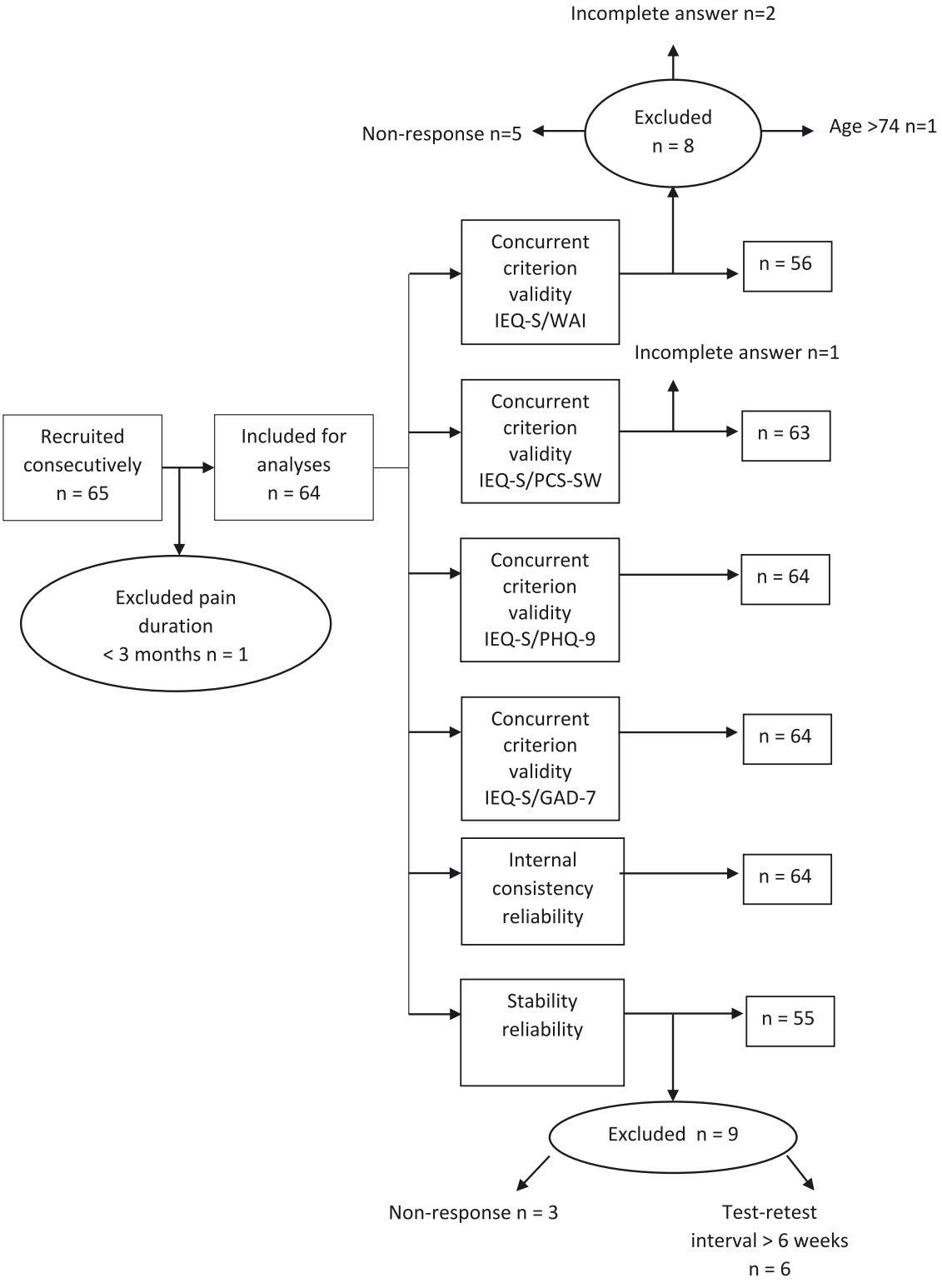

Figure 1: Flowchart of included and excluded data.

the IEQ-S and PCS-SW (n=63) was r_S=0.68, p<0.01, meaning that there was a positive significant correlation between perceived injustice and pain catastrophizing. The correlation coefficient between the IEQ-S and PHQ-9 (n=64) was r_S=0.50, p<0.01, meaning that there was a positive significant correlation between perceived injustice

Table 1: Sample characteristics: education, occupation, and clinical variables.

	Frequency n=64	%
What is you highest completed education?		
Have not completed elementary school, junior secondary school or similar	1	1.6
Elementary school, junior secondary school or similar	15	23.4
2 years of high school education or vocational school	16	25.0
3 or 4 years of high school education	12	18.8
University or college education less than 3 years	9	14.1
University or college education 3 or more years	11	17.2
What is your main occupation right now?		
Work as an employee	15	23.4
Entrepreneur	1	1.6
Student	1	1.6
Pensioner (by age, disability or early retirement)	19	29.7
On long-term sick leave (more than 3 months)	19	29.7
Job seeker or in a labor market policy measure	5	7.8
Other	4	6.3
The pains started in conjunction with		
Disease	6	9.4
Accident	2	3.1
Surgery	7	10.9
Stress/strain	4	6.3
Other	2	3.1
Do not know	18	28.1
Several of the options above	25	39.1

	Median/Mean (SD)[g]	25th percentile	75th percentile	Range
Pain duration, years n=64	8.0/13.7 (14.1)	3.0	21.75	0.4–53.0
IEQ-S at admission (test 1)[a] n=64	27.0	15.3	37.8	3–48
BPI-SF[b] n=64				
Item 3: Worst pain in last 24 h	8.0	7.0	9.0	2–10
Item 4: Least pain in 24 h	5.0	3.0	7.0	0–10
Item 5: Pain on average	7.0	5.0	8.0	2–10
Item 6: Pain right now	7.0	5.3	8.0	0–10
WAI[c] n=57	15.0	11.0	25.0	7–40
PCS[d] n=63	27.0	16.0	37.0	2–52
PHQ-9[e] n=64	11.5	7.25	15.0	0–25
GAD-7[f] n=64	7.0	2.0	12.0	0–20

[a]Injustice Experience Questionnaire – Swedish version, Total score=sum of responses to 12 items, with a total score range of 0–48: total score >30=clinically relevant level of perceived injustice. [b]Brief Pain Inventory (Short form) 0=no pain, 10=pain as bad as you can imagine. [c]Work Ability Index, Index range=7–49: 7–27=poor, 28–36=moderate, 37–43=good, and 44–49=excellent work ability. [d]Pain Catastrophising Scale, Total score=sum of responses to all 13 items, with a total score range of 0–52; total score >30=clinically relevant levels of pain catastrophizing. [e]Patient Health Questionnaire 9-item depression moduleTotal score=sum of responses to all nine items, with a total score range of 0–27: 1–4=minimal, 5–9=mild, 10–14=moderate, and 20–27=severe levels of depression. [f]Generalized Anxiety Disorder 7-item scale, Total score=sum of responses to all seven items, with a total score range of 0–21: 0–4=minimal, 5–9=mild, 10–14=moderate, and 15–21=severe levels of depression. [g]Single values describe median score.

and depression. Lastly, the correlation coefficient between the IEQ-S and GAD-7 (n=64) was r_S=0.57, p<0.01, meaning that there was a positive significant correlation between perceived injustice and generalized anxiety. In summary, high levels of perceived injustice were associated with low work ability and high levels of pain catastrophizing, depression, as well as generalized anxiety.

Internal consistency reliability

The Cronbach's alpha for the overall IEQ-S (n=64) was 0.941. The Corrected Item-Total Correlation ranged between 0.619–0.894, and the Cronbach's Alpha if Item Deleted varied between 0.929–0.940 for the 12 items, as shown in Table 3.

Table 2: One-factor confirmatory factor analysis of the Injustice Experience Questionnaire – Swedish version (IEQ-S): item loadings. (n=64).

IEQ-S item	Loading
Item 1	0.68
Item 2	0.79
Item 3	0.69
Item 4	0.75
Item 5	0.69
Item 6	0.78
Item 7	0.92
Item 8	0.67
Item 9	0.82
Item 10	0.86
Item 11	0.86
Item 12	0.80

Test-retest reliability

The ICC, single measure, 2-way mixed effects model, with absolute agreement definition, was 0.80 (n=55) with a 95% confidence interval, ranging between 0.69–0.88. Table 4 shows the central tendency and variability of the total scores for IEQ-S on the two different occasions. The number of days between the test at admission (test 1) and retest (test 2) varied between 3–42 days, with a median of 22 days.

Table 4: Total score for Injustice Experience Questionnaire – Swedish version (IEQ-S)[a] (n=55) at admission (test 1) and retest (test 2).

	Median	25th percentile	75th percentile	Range
IEQ-S at admission (test 1)	29.0	16.0	38.0	3–48
IEQ-S retest (test 2)	26.0	17.0	36.0	4–48

[a]IEQ total score=sum of responses to all 12 items, with a total score range of 0–48: total score >30=clinically relevant level of perceived injustice.

Discussion

To the best of our knowledge, this is the first study to present the Swedish version of the IEQ and psychometric properties. The confirmatory factor analysis supported the one-factor solution, previously presented by Sullivan et al. [1]. For exploratory purpose a two-factor model was fitted, showing a great overlap in item content between

Table 3: Injustice Experience Questionnaire – Swedish version (IEQ-S) at admission (test 1) (n=64): item-total statistics.

IEQ-S item	Corrected item-total correlation[a]	Cronbach's alpha if item deleted[b]
Item 1 *Most people don't understand how severe my condition is*	0.625	0.939
Item 2 *My life will never be the same*	0.746	0.935
Item 3 *I am suffering because of someone else's negligence*	0.633	0.939
Item 4 *No one should have to live this way*	0.695	0.937
Item 5 *I just want to have my life back*	0.639	0.939
Item 6 *I feel that this has affected me in a permanent way*	0.733	0.936
Item 7 *It all seems unfair*	0.894	0.929
Item 8 *I worry that my condition is not being taken seriously*	0.619	0.940
Item 9 *Nothing will ever make up for all that I have gone through*	0.777	0.934
Item 10 *I feel as if I have been robbed of something very precious*	0.819	0.933
Item 11 *I am troubled by fears that I may never achieve my dreams*	0.826	0.932
Item 12 *I can´t believe this happened to me*	0.754	0.935

[a]Should be larger than 0.3. [b]Should not be larger than the overall Cronbach's alpha=0.941.

the two factors. Hence, our results support the conclusion derived by Sullivan et al. [1] "*Due to the overlap in item content of the two factors, separate subscales were not derived*.", p. 252.

The concurrent criterion validity analyses showed similar results to previous studies. There was a moderate [34] correlation between the IEQ-S and the WAI. High levels of perceived injustice were associated with low work ability. This is in line with a study of the Danish version of the IEQ, which revealed a significant correlation between injustice and current unemployment [5]. Sullivan et al. [1] examined the construct validity of the IEQ and found that high IEQ-scores predict failure to return to work. Our results confirm that there is a relationship between perceived injustice and work ability.

High levels of perceived injustice were also associated with high levels of pain catastrophizing in our study. There was a strong relationship between the IEQ-S and the PCS-SW. Sullivan et al. [1] investigated the relationship between the IEQ and PCS, resulting in an unexpectedly high correlation, making the authors concerned that the construct of perceived injustice might be redundant with the construct of catastrophizing. However, regression analysis revealed that the IEQ and the PCS each contributed to unique variance in the prediction of pain and depression, supporting the discriminant validity of the IEQ. Our results are similar to the correlational analyses of the Japanese [22] as well as the Spanish [23] versions of the IEQ, which also showed strong correlations to the PCS.

Our study showed moderate correlations between the IEQ-S and the PHQ-9 as well as the GAD-7, with high levels of perceived injustice associated with high levels of depression and generalized anxiety. The Spanish IEQ strongly correlated with the depression subscale, and moderately with the anxiety subscale, of the Hospital Anxiety and depression Scale [23]. Sullivan et al. [1] revealed a significant correlation between perceived injustice and depression, using the Beck Depression Inventory II. In summary, our study supports the concurrent criterion validity of the IEQ-S, in relation to measures of work ability, pain catastrophizing, depression and generalized anxiety.

The internal consistency reliability of the IEQ-S was high. An item-total analysis showed that all the IEQ-S items correlated with the total score. Furthermore, deleting any of the 12 items did not result in a higher Cronbach's alpha than the overall value. Our results are very similar to the internal consistency analyses of several other language versions of the IEQ [1, 5, 22, 23], with similar Cronbach's alpha values and no items behaving in a statistically unexpected manner. Thus, our study supports the internal consistency reliability of the IEQ-S.

The test-retest reliability of the IEQ-S, with a retest interval up to six weeks, was good. The coefficient was slightly lower than in the Japanese version of the IEQ, which had a retest done within 1–4 weeks of the baseline measure [22]. The ICC for the Spanish IEQ was even higher, calculated for a follow-up interval of 1–2 weeks [23]. The original IEQ was very stable across four weeks [1]. Our study showed the IEQ-S to be stable, even when allowing for a longer retest interval.

Almost half of the participants expressed clinically relevant [20] levels of injustice. The mean total score for the IEQ-S was higher than in the study of the original IEQ. The psychometric study of the Japanese version of the IEQ [22] also resulted in a slightly lower mean total score compared to our study. The samples of the original and the Japanese studies were comprised of participants who had injury-related pain. A minority of the participants in our study stated that their pains originated only from trauma related to an accident. The validation of the Danish IEQ included a more similar sample, with a mean total IEQ-score that was also very similar to ours [5]. The Spanish IEQ was studied with a sample of fibromyalgia patients [23] and showed even higher mean levels of perceived injustice. These results suggest that chronic pain, not necessarily originating only from trauma-related accidents, is associated with higher levels of perceived injustice. However, this is contradicted by the results of a pilot study, which compared levels of perceived injustice in patients with rheumatoid arthritis and fibromyalgia. The participants with rheumatoid arthritis had much lower levels of perceived injustice than in all the other studies mentioned [33]. Our study adds to the fact that much is yet to be understood about the relationship between different onsets of pain and perceived injustice.

Methodological considerations

The results have to be interpreted with some limitations in mind. The sample was recruited consecutively for a specific sample size, resulting in a sampling period of approximately six months. If the sample had been determined by a specific, longer, time period, the risk of potential bias could have been smaller, as it would have reduced biases due to seasonal or other time-related fluctuations [38]. There is a lack of scientifically sound recommendations for sample size determination for psychometric studies [39, 40]. However, the more homogeneous the sample, the smaller the sample size required [38]. The sample in this study can be considered heterogeneous with respect to many of the demographic variables presented, which may motivate that a larger sample size would have been desirable. This is particularly relevant for the confirmatory factor analysis, which should be seen as preliminary. At the same time, all

participants had chronic pain and were referred to Swedish tertiary care, which reflect an aspect of homogeneity, and could warrant the sample size chosen. Future research should study larger samples to get more insight into how injustice is perceived among patients with chronic pain.

A limitation with our concurrent criterion validity analysis between the IEQ-S and the WAI was that some of the participants did not have a current employment, making the assessment of work ability more difficult. About 8% of the participants stated that they were job seekers or in a labor market policy measure. Almost a third of the participants were on long-term sick leave. Whether or not they had a current employment was not specified in our background data. An additional instruction was added to the WAI to measure work ability for individuals with no current employment in this study, asking them to answer the questions based on the profession and the main work tasks of a previous employment, which might have introduced recall bias.

The number of days between the test at admission (test 1) and retest (test 2) in this study was not consistent, which might have affected the IEQ-S stability negatively. In this study, the test-retest interval was not decided in consideration to the specific questionnaire or variable analyzed since it was part of a large cohort study. The interval ranged from three to 42 days and depended on when the participants had their clinical visit scheduled, which was when they completed the retest (test 2). There is risk that participants who had short intervals remembered their initial answer, which might have affected their second answer. On the other hand, the risk that their perceptions of injustice had changed decreased [41]. With longer intervals, there is a risk that the test-retest reliability has naturally declined, which it tends to do even with more stable traits [38].

The IEQ was originally developed to assess individuals who have suffered an injury, asking the respondents to reflect on how their *injury* has affected them. A new, modified version of the IEQ, the IEQ-chr, has been created to target individuals who have not necessarily sustained their pain from a specific injury. In the IEQ-chr, the respondents are asked to reflect on how their *health condition* has affected their lives [4]. This new version might have been better suited for the sample of our study; nonetheless, the item content as well as the response format of the IEQ-chr are identical to that of the original IEQ.

Conclusions

This study has contributed with new information about the psychometric properties of the IEQ-S, for patients with chronic pain referred to tertiary care in Sweden. Our study supported structural validity of the IEQ-S based on a one-factor model. The concurrent criterion validity of the IEQ-S in relation to measures of work ability, pain catastrophizing, depression, and generalized anxiety was supported, as was the internal consistency reliability of the IEQ-S. The test-retest reliability of the IEQ-S, with a retest interval up to six weeks, was good.

Much is yet to be understood about the relationship between perceived injustice and other biopsychosocial factors in the context of chronic pain. Larger samples should be studied to get more insight into how injustice is perceived among patients with chronic pain. Future research should study the IEQ-S total score in association with other variables, such as the concurrent criterion validity between injustice and pain, and how perceptions of injustice vary depending on different onsets of pain. The predictive validity of the IEQ-S in relation to work ability should also be studied. A final remark is the need for further validation of Swedish versions of established questionnaires commonly used in different pain populations.

Clinical implications

The complexity of chronic pain requires a consideration of biopsychosocial factors when assessing the severity of the condition. Our study supports the use of the IEQ-S as an adjunct tool to assess appraisals of injustice in patients with chronic pain who are referred to tertiary care in Sweden. The added value might be identification of those who are at risk for slow or no improvement in the pain condition over time and sick-leave, but this has to be confirmed in future studies. There would also be possibilities to specifically target patients with high levels of injustice in psychological treatment and pain rehabilitation.

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