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Evaluation of the Brief Illness Perception Questionnaire in Sub-Acute and Chronic Low Back Pain Patients: Data Quality, Reliability and Validity

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Abstract

Background: Illness perceptions have received increasing attention in the treatment of a range of illnesses and medical conditions, however, the instruments available have not been evaluated on sub-acute and chronic low back pain patients. This study aims to evaluate the Brief IPQ in the prevailing patient group.

Methods: The Brief IPQ was administered to 90 patients attending care in Norway and evaluated for data quality, reliability and validity. The questionnaire was re-administered to 61 patients within a week for re-test purposes. The evaluation followed COSMIN recommendations for measurement properties.

Results: Item missing data ranged from 0% to 6.7%. Item-total correlation ranged from 0.12 to 0.67. Cronbach's alpha was 0.72 for the Brief IPQ scale. Test-retest intra class correlation (ICC) values were 0.86 for the scale and ranged from 0.64 to 0.88 for the individual items. The standard error of measurement (SEM) for the Brief IPQ scale (0-10) was 0.63 and the minimal detectable change (MDC) was 1.75. The MDC for single items (0-10) ranged from 3.16 to 4.40. Brief IPQ scale scores were approximately normally distributed and had small to moderate correlations with the reference scales supporting the hypotheses, however, the hypothesis were only partly supported on single item level.

Conclusions: The Brief IPQ can be applied as a concise instrument for assessing illness perceptions of patients with sub-acute and chronic low back pain. The Brief IPQ scale has evidence for reliability and validity however the evidence was less satisfactory at the item level.

Keywords: Illness perceptions; Low back pain; Data quality; Reliability; Validity

Introduction

Illness perceptions have received increasing attention in the treatment of a range of illnesses and medical conditions, including low back pain [1,2]. Several studies have shown how illness perceptions can help explain variation in physical and psychological adjustment and outcomes in illness independent of disability and dysfunction [3-5]. Health and quality of life outcomes are not solely related to preceding functioning and treatment, but may also be explained by beliefs and perceptions that patients hold about their illness.

Leventhal's theoretical model of illness perceptions postulates that the patient's beliefs and perceptions about their illness direct action and coping responses [6]. Patients' views about their illness are based around five interrelated components; identity of their illness, causal beliefs, timeline, beliefs about control and cure, and beliefs about consequences. In addition to these cognitive perceptions, patient's have emotional responses to illness including anger, anxiety and depression. Each of these components relates to a perception about one aspect of the illness and together they provide the patient's coherent view of an illness. Several studies have found that illness perceptions change over time and following health care [2,7,8]. Illness perceptions were found to be among the most important of 20 psychological variables for predicting outcomes in UK primary care for patients with low back pain [1]. Illness perceptions have also been associated with work disability and attendance to rehabilitation programs [7,9]. Hence, addressing illness perceptions alongside existing health care interventions can be important for achieving desired health outcomes.

Instruments that have necessary levels of data quality, reliability and validity are required before undertaking research assessing the role of illness perceptions for patients with low back pain. There are several instruments available within the literature for assessing illness perceptions which are based on Leventhal's model; the most widely applied being the Illness Perception Questionnaire (IPQ) [10]. Revised and short-form versions of the IPQ are known as the Revised Illness Perception Questionnaire (IPQ-R) [11] and the Brief Illness Perception Questionnaire (Brief IPQ) [12] respectively. These instruments have been translated into several languages and used cross-nationally, however to our knowledge; they have not been adequately evaluated for psychometric properties in patients with sub-acute and chronic non- specific low back pain although illness perceptions are commonly evaluated in patients with chronic illnesses [4]. In addition, they have not been evaluated in Norway. The IPQ-(R) is long relative to other patient reported outcome (PRO) instruments, which has important implications for acceptability to patients and feasibility for application within routine clinical practice. Hence, this study aims to evaluate data quality, reliability and validity of the Brief IPQ for patients with sub-acute and chronic non- specific low back pain attending care in Norway.

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Methods

Design

The Brief IPQ was administered by means of a self-completed questionnaire in a cross-sectional design and re-administered within approximately a week for test-retest purposes. Data collection took place over a one year period from September 2008- September 2009. Data collection followed the recommended sample size proposed for methodological studies including reliability and validity [13] and the Consensus- based Standards for the selection of Health Measurement Instruments (COSMIN) checklist informed instrument evaluation [14].

Participants and ethics

The Brief IPQ was administered to patients with low back pain attending primary or secondary care in one of six institutions in Oslo, Norway including three physiotherapy clinics, one outpatient rehabilitation clinic, one pain clinic and one orthopaedic department. To be included, patients had to have non-specific low back for six weeks or more prior to inclusion, aged 18 or over and to be competent in the Norwegian language and provide written informed consent. Patients were assessed for inclusion at the clinic by their clinicians who were mostly physical therapists. Exclusion criteria were sciatica or possible serious pathology often referred to as "red flags" in the literature such as infection, tumour, osteoporosis, ankylosing spondylitis, fracture, inflammatory process, radicular syndrome or cauda equina syndrome [15]. The clinician asked patients fulfilling the inclusion criteria if they would participate in the study. The study was approved by the Norwegian Regional Committee for medical Research Ethics and the Data Inspectorate.

Patient reported outcomes

The PROs included the Brief IPQ, and a number of other instruments for purposes of evaluating construct validity. The Brief IPQ has nine items comprising cognitive and emotional illness perceptions including illness consequences, timeline, personal and treatment control, identity, coherence, concern, emotions and illness cause. The items have a 0-10 scale with endpoint descriptors. An overall score can be computed which represents the degree to which the illness is perceived as threatening or benign. Higher scores represent a more threatening view of the illness. Patients are also asked to list what they believe to be the most important causal factors of their low back pain. The general version of the Brief IPQ uses the word "illness" when refering to illness perceptions which can be replaced with a particular health problem, here "low back pain". Both the Norwegian and English versions of the instrument are available on the IPQ website [16].

The baseline questionnaire also included measures of health status. Physical function was assessed by the back-specific Roland Morris Disability Questionnaire (RMDQ) [17] which has 24 yes/no items that sum to a score from 0-24, where 24 is the most severe disability. The RMDQ has been widely evaluated and applied in patients with LBP including those in Norway [18,19].

The EQ-5D is a generic utility measure with five items that have three-point descriptive scale of no problem, some problems and severe problems [20]. The EQ-5D index is based on utility weights from the general population and is scored from -0.59 to 1.0 scale were 1 is the best possible score indicating best health state. The EQ-5D has been evaluated on LBP patients in Norway [21].

Psychological distress was assessed by The Hopkin's Symptom Check List (HSCL-25) [22], which comprises 25 items relating to anxiety and depression. The HSCL-25 asks about symptom complaints during the last week and items have a four-point scale from "not at all" to "to a large extent". The items are summed to give a score from 0 to 4 where 4 are the most severe symptoms. The Norwegian HSCL-25 version has been used in several studies [23,24].

Fear- avoidance was assessed by the Fear Avoidance Beliefs Questionnaire (FABQ) [25] which comprises 16 items divided into two subscales; fear- avoidance for work (FABQ-W) and fear- avoidance beliefs for physical activity (FABQ-PA). The items have a seven-point scale from "completely disagree" to "completely agree". Scale scores range from 0 to 42 for the FABQ- W and 0-24 for the FABQ-PA where higher scores represent greater fear-avoidance beliefs. The questionnaire has been validated in Norway [26].

Pain catastrophizing was assessed by the 13-item Pain Catastrophizing Scale (PCS) [27] which asks about past painful experiences and the degree to which they are experienced on a five-point scale from "not at all" to "all the time". PCS total scores range from 0 to 52 where 52 is the highest level of catastrophizing. The questionnaire has been validated in Norway [28].

Finally, the questionnaire also included a ten-point numeric rating scale measuring pain (0-10) and questions relating to duration of low back pain, pain location, age, gender, ethnicity, education and employment. The test-retest questionnaire included a health transition item asking about change in low back pain since baseline with a six-point descriptive scale from "changed to the worst" to "completely recover".

Statistical analysis

Data quality: Missing data were evaluated. Floor and ceiling effect were considered to be present if more than 15% of the patients reported the lowest or highest possible score [13]. The internal consistency of the Brief IPQ scale and items were assessed using item-total correlation and Cronbach's alpha [29]. It was expected that item-total correlations would exceed 0.4 and that the Cronbach's alpha would exceed 0.7 which is considered acceptable for groups of patients [29,30].

Reliability and agreement: The interclass correlation coefficient was used to assess the test-retest reliability of the Brief IPQ scale and items which should exceed the criterion of 0.7 for use in groups of patients [29]. The standard error of measurement (SEM) and the minimal detectable change (MDC) were used to assess agreement. SEM was calculated by using the formula; $\sqrt{\sigma 2}$ residuals. The $MDC_{individual}$ was calculated by using the formula; 1.96 x $\sqrt{2}$ x SEM and the MDC_{group} were calculated by dividing the $MDC_{individual}$ by $\sqrt{n}$. The SEM is a measure of measurement error and the MDC is a measure of "change" above measurement error [13].

Construct validity: Construct validity was assessed by comparing the Brief IPQ scale scores and single items with those for the other instruments based on hypotheses derived from theory, a structured literature review of illness perceptions, and related variables literature and theory of illness perceptions suggests that illness perceptions are associated with both physical and mental health. A more threatening view of the illness has been found to be associated with poorer function and vitality as well as poorer mental health such as anxiety, depression and catastrophizing [3,4,6,12,31-33]. Spearman's rho correlations below 0.3, 0.3 to 0.6 and over 0.6 were considered low, moderate and high respectively [34].

Low to moderate correlations were expected between scores of the

Brief IPQ scale and RMDQ, EQ-5D, HSCL-25, FABQ, PCS and NRS pain. For the single items, it was hypothesised that Brief IPQ item of emotions, concern and coherence would correlate slightly higher but at a low to moderate level with the instruments assessing aspects of mental health, distress or specific beliefs including the EQ-5D, HSCL-25, FABQ and PCS compared to the other instrument scores. It was hypothesised that the identity and consequences items would have low to moderate correlations with the RMDQ, EQ-5D, HSCL-25 and NRS pain. Correlations between these two items and the FABQ and PCS scores were also expected but at a slightly lower level. Finally low levels of correlation were expected for the timeline and control items. SPSS version 17.0 was used for statistical analysis.

Results

Data collection and participants

The data collection procedures at the individual institutions meant that information on the total number of patients asked to participate was unavailable. The study included 90 patients, the majority of whom were attending primary care and an orthopaedic hospital department (60.6 %) and reported having chronic low back pain (78.9 %); 57.8 % were female, the mean age was 47.6 (SD 11.8) years and 54.5 % were sick-listed, unemployed or were receiving a retirement pension (Table 1). Most patients reported strain or degeneration (23.9%) as the first most important cause of their low back pain followed by injury/accident (17.4%) and work related (15.2%) causes.

Statistical analyses

Data quality: Levels of missing data ranged from 0 to 6.7 % for the single items in Brief IPQ (Table 2) and the data were approximately normally distributed. Floor and ceiling effects were not present for the Brief IPQ scale but there was a ceiling effect for the timeline item were 30 % of the patients scored the highest possible on the 0-10 scale indicating that low back pain will last forever. Item means ranged from 3.3 (SD 2.6) to 7.4 (SD 2.5) on the 0 to 10 scale where 10 represent a more threatening view of the illness.

Item-total correlations ranged from 0.12 to 0.67 for items measuring timeline and consequences respectively (Table 2). The three items representing timeline, treatment control and coherence did not reach the expected level of 0.4 (Table 2). Cronbach's alpha was acceptable for the scale. The Brief IPQ scale scores were calculated by taking the average score for the items were half or more were completed. Scores were approximately normally distributed with a mean of 5.2 (SD 1.4) on the 0-10 scale.

Reliability and agreement: The time interval between test and re-test had a median of seven days with a minimum of 1 day and a maximum of 31 days. A total of 61 patients responded to the second questionnaire. The resulting ICCs were acceptable for the Brief IPQ scale (0.86) and for the individual items ranging from 0.64 to 0.88 with the exception of the items measuring personal control and coherence (Table 3). The SEM for the Brief IPQ scale was 0.63 and the $MDC_{individual}$ and MDC_{group} were 1.75 and 0.22 respectively. There were large variations for the single items with SEM values ranging from 1.14 to 1.59 for the items measuring timeline, identity and coherence respectively. $MDC_{individual}$ ranged from 3.16 to 4.40 and MDC_{group} ranged from 0.40 to 0.56 for the individual items. The 34 patients stating that they were "unchanged" on the health transition item had similar results to the total test-retest sample.

Construct validity: The results of the correlations between the Brief IPQ scale scores and the RMDQ, EQ-5D, HSCL-25, FABQ, PCS and NRS pain supported the hypotheses. All correlations were statistically significant and ranged from 0.26 to 0.59 for FABQ physical activity and RMDQ respectively (Table 4). The hypotheses were less well supported at the item level where there was less evidence of an association for the Brief IPQ items of timeline, treatment control and coherence (Table 4). The item scores for coherence and treatment control both had one significant low correlation with the FABQ scores as hypothesised. The correlations for the timeline item were all low or non-existent and not significant. There were several correlations of a low to moderate level for the remainder of the items. As expected, slightly higher correlations were seen between the item measuring emotions and concern and the EQ-5D, HSCL- 25 and PCS compared with the other instrument

Variables	Baseline n= 90	Test-retest n=61
Recruited from (n %)		
Primary health care	30 (33.3)	14 (23.0)
Outpatient rehab clinic	24 (26.7)	22 (36.1)
Orthopedic hospital dep	30 (33.3)	21 (34.4)
Pain clinic hospital	6 (6.7)	4 (6.6)
Duration current episode (n %)		
< 3 months	19 (21.1)	11 (18.0)
> 3 months	71 (78.9)	50 (82.0)
Disability (RMDQ)[a] (mean, SD)	7.6 (5.2)	7.2 (5.2)
EQ-5D[b] (mean, SD)	0.5 (0.3)	0.6 (0.3)
HSCL- 25[c] (mean, SD)	1.6 (0.5)	1.6 (0.5)
FABQ[d] (mean, SD)		
Physical activity	9.4 (5.5)	8.8 (5.4)
Work	16.7 (12.0)	17.0 (11.8)
Back pain (NRS)[e] (mean, SD)	4.8 (2.1)	4.9 (2.1)
Sex (n %)		
Male	38 (42.2)	29 (47.5)
Female	52 (57.8)	32 (52.5)
Age years (mean, SD)	47.6 (11.8)	
Employment status (n %)		
Employed	41 (45.6)	25 (41.0)
Not employed/sick leave	24 (26.7)	18 (29.5)
Pension	25 (27.8)	18 (29.5)

[a] RMDQ (0-24): The higher the score, the greater the overall disability
[b] EQ-5D (-0.59 to 1.0): Lower score represent poorer health-related quality of life
[c] HSCL-25 (1 to 4): Lower scores represent less severe symptoms
[d] FABQ physical activity (0-24), FABQ work (0-42): Higher scores represent increased levels of fear avoidance beliefs
[e] NRS (0-10): 0= no pain, 10= worst possible pain

Table 1: Patient characteristics at baseline and test-retest.

Brief IPQ[a]	Missing %	Mean (SD)	Lowest n (%)	Highest n (%)	Cronbach's alpha/Item-total correlation
BIPQ scale scores[b]	0	5.2 (1.4)	0	0	0.72
Consequences	0	6.1 (2.2)	0	6 (6.7)	0.67
Timeline	5.6	7.4 (2.5)	0	30 (33.3)	0.12
Personal control	6.7	4.8 (2.3)	2 (2.2)	3 (3.3)	0.50
Treatment control	6.7	3.6 (2.5)	9 (10.0)	2 (2.2)	0.32
Identity	2.2	5.6 (2.1)	0	0	0.46
Concerned	3.3	5.5 (2.8)	1 (1.1)	6 (6.7)	0.59
Coherence	3.3	3.3 (2.6)	12 (13.3)	1 (1.1)	0.24
Emotional representation	3.3	5.2 (2.6)	2 (2.2)	1 (1.1)	0.44

[a] Items are scored on a 0-10 point scale where 10 represent a more threatening view of the low back pain. Item 3, 4 and 7 are reversed prior to score calculation.
[b] Brief IPQ scale is scored from 0-10 where a higher score reflects a more threatening view of illness.

Table 2: Data quality and internal consistency of the Brief IPQ (n=90).

Brief IPQ[a]	Mean (SD) (baseline)	Mean (SD) (retest)	Mean (SD) difference	SEM[c]	MDC_{ind}[d]	MDC_{group}[e]	ICC[f]
BIPQ scale scores[b]	5.24 (1.33)	5.03 (1.18)	0.21 (0.89)	0.63	1.75	0.22	0.86
Consequences	6.18 (2.22)	6.25 (1.94)	-0.07 (1.88)	1.33	3.68	0.47	0.75
Timeline	7.38 (2.42)	7.30 (2.40)	0.07 (1.62)	1.14	3.16	0.40	0.88
Personal control	4.66 (2.10)	4.72 (1.76)	-0.06 (1.93)	1.36	3.77	0.48	0.68
Treatment control	3.32 (2.43)	3.46 (2.21)	-0.14 (1.67)	1.18	3.27	0.42	0.85
Identity	5.81 (2.00)	5.97 (1.87)	-0.16 (1.61)	1.14	3.16	0.40	0.79
Concerned	5.53 (2.73)	5.05 (2.56)	0.47 (2,01)	1.42	3.93	0.50	0.83
Coherence	3.28 (2.58)	2.84 (1.74)	0.44 (2,25)	1.59	4.40	0.56	0.64
Emotional representation	5.53 (2.56)	4.80 (2.72)	0.75 (2,22)	1.57	4.35	0.56	0.77

[a] Items are scored on a 0-10 point scale (10 represent a more threatening view of the low back pain). (Item 3, 4 and 7 have been reversed prior to analysis).
[b] Brief IPQ scale 0-10: overall score of all the BIPQ items. A higher score reflects a more threatening view of illness.
[c] SEM agreement: √within people residual mean square
[d] $MDC_{individual}$: (√within people residual mean square) x 2.77
[e] MDC_{group}: (MDC_{ind} / √n)
[f] ICC agreement: two-way random effects model (absolute agreement)

Table 3: Mean (SD) Brief IPQ scores at baseline and retest, mean difference and agreement (n=61).

Variable	RMDQ[a]	EQ-5D[b]	HSCL[c]	FABQ- PA[d]	FABQ-W[d]	PCS[e]	NRS Pain[f]
Brief IPQ scale scores	0.59**	-0.53**	0.51**	0.26*	0.39**	0.35**	0.53**
Consequences	0.56**	-0.58**	0.53**	0.16	0.41**	0.28**	0.54**
Timeline	0.17	-0.09	0.10	-0.14	0.03	-0.04	0.15
Personal control	0.30**	-0.31**	0.26*	0.27*	0.29*	0.13	0.31**
Treatment control	0.19	-0.17	0.08	0.11	0.23*	0.19	0.15
Identity	0.44**	-0.37**	0.36**	0.28**	0.42**	0.30**	0.45**
Concerned	0.31**	-0.47**	0.49**	0.25*	0.17	0.45**	0.24*
Coherence	0.12	-0.19	0.17	0.31**	0.10	0.08	0.17
Emotional representation	0.24*	-0.44**	0.50**	0.09	0.09	0.45**	0.29**

Asteriks denote statistical significance: ** p< 0.01 level *p< 0.05
[a] RMDQ (0-24): The higher the score, the greater the overall disability
[b] EQ-5D (-0.59 to 1.0): Lower score represent poorer health-related quality of life
[c] HSCL-25 (1 to 4): Lower scores represent less severe symptoms
[d] FABQ physical activity (0-24), FABQ work (0-42): Higher scores represent increased levels of fear avoidance beliefs
[e] PCS (0- 52): Higher scores represent higher levels of catastrophising
[f] NRS (0-10): 0= no pain, 10= worst possible pain

Table 4: Correlation between scores for the Brief IPQ and those for the other instruments (n = 90).

scores. For the items measuring identity and consequences correlations were slightly higher with the RMDQ, EQ-5D, HSCL-25 and NRS pain supporting the hypothesis.

Discussion

The aim of the study was to evaluate data quality, internal consistency, reliability and validity of the Brief IPQ for patients with sub-acute and chronic non-specific low back pain. Our study found that Brief IPQ scale was acceptable in this patient group with low back pain with low levels of missing data at the item and scale level.

The statistical analysis assessed both the individual items and a summary scale of illness perceptions. Data were approximately normally distributed and there were no floor or ceiling effects for the items or scale with the exception of the timeline item. The three items assessing timeline, coherence and treatment control had levels of item- total correlation from under the criterion of 0.4. The internal consistency of the Brief IPQ scale was acceptable; however, the three items with low levels of item-total correlation might be amended or considered for removal if further evidence of poor performance is found in future studies.

The results of test-retest reliability were also satisfactory for the scale scores and individual items, with the exception of the items measuring coherence and personal control. The items of coherence and personal control were also found to be the two items with the lowest correlations for test-retest reliability at three weeks compared with other items reported in the evaluation study of the IPQ-R and the Brief IPQ [11,12]. The results from the SEM and MDC show a similar pattern, with acceptable levels for the Brief IPQ scale scores but larger values for some items. The item of coherence had the largest SEM and MDCindividual of 1.59 and 4.40 respectively followed by the item of concern (1.42 and 3.93) and personal control (1.36 and 3.77). The results indicate that a change of above approximately 4 points on the 0-10 scale needs to be observed to ensure that the change is above measurement error at the individual level. This may be considered too large for clinical applications involving individual patients. We are only aware of one other study evaluating the Brief IPQ scale and our results are comparable, however our study found evidence for better test-retest and agreement results [35]. In addition, we are aware of one other study of the Brief IPQ that has reported similar statistics for the brief IPQ items [36] and the results are broadly in agreement, however slightly higher MDCs were found in our study. The results are also within the range of that reported for back pain patients for other PROs including the SF-36 [37].

Theoretical considerations suggest that all the items in the Brief IPQ scale are relevant and should therefore possibly be retained in the questionnaire, however results from studies evaluating the instrument, including our study have identified problems with some of the items [36,38]. The IPQ questionnaire family, including the Brief IPQ are generic instruments and it is possible that some of the items are less relevant for specific health problems [39]. This is supported by a study that used cognitive interviews with patients when developing a

version of the IPQ specific to patients with rheumatic disease [40]. For example, some patients might not be receiving treatment and hence it might be difficult to answer a question about treatment control. In addition, some patients are diagnosed with a chronic illness and it can be inappropriate to ask patients about the chronicity of the illness. A recent "think aloud" study using the Brief IPQ in a sample of patients with musculoskeletal complaints identified difficulities for patients when answering the Brief IPQ such as misinterpretation of items and finding some questions difficult to answer [38]. The items of coherence and personal control were among the items found to be the most ambiguous which were also among the poorest performing in this study together with timeline and treatment control. The wording of items with low levels of item-total correlation and test-retest reliability should be considered for improvement followed by testing including cognitive interviews with patients prior to psychometric testing in future studies.

Often, it will also be the case that patients find a questionnaire difficult to answer without a specific timeframe, and as a consequence it can be difficult to know if the patient answers questions based on how they felt today, last week or last month. This may lead to lower levels of reliability. It has been proposed that a time period to which the questions refer should be clearly stated and justified [13]. The results of cognitive interviews with patients showed that a version of the IPQ specific to rheumatic disease, the RD-IPQ, was more difficult to answer without a specific timeframe and a timeframe of two weeks was included in the final version of the instrument [40]. The inclusion of a specific time frame relevant to patients with back pain should also be considered in future studies.

The results of the correlations between the Brief-IPQ scale and the RMDQ, the EQ-5D, the HSCL, the FABQ, PCS and NRS pain, showed support for the hypotheses and are in line with previous research [4,32]. More threatening views of the illness were associated with poorer physical, social and psychological functioning including higher pain, catastrophizing beliefs and fear avoidance. However, there was little or no correlation for the item measuring timeline and only one low but significant correlation was found for each of the items measuring treatment control and coherence. These are the same items which performed poorly in tests of internal consistency and/or test-retest reliability. Again, problems with wording and hence comprehensibility must be explored before deciding to exclude these items from a revised instrument.

The lack of data available from the institutions meant that it was not possible to assess the overall response rate which is the main weakness of the study. Information was not available for non-respondents and therefore it was not possible to assess response bias. Another potential limitation may be that the time interval between test and re-test questionnaires was too long for some patients especially since they were recruited from treatment facilitators. The median was seven days which is considered acceptable [13]. For some patients the interval was considerably longer and it is possible that their illness perceptions may have changed between administrations which may or may not have been a result of pain management. However, there was very little difference in the test-retest correlations and MDCs for the overall sample and those responding that their health had not changed on the health transition item. A global item relating to illness perceptions would have been more appropriate but difficult to formulate in a way that is acceptable to patients. The lack of the IPQ-R as a reference scale to further assess the construct validity of the various Brief IPQ items and dimensions was also a weakness. However previous validation of the IPQ and a meta-analytic review gave sufficient information to form hypotheses relating to the expected associations between the Brief IPQ scores and those for the other instruments. It was not possible to assess predictive validity and responsiveness within our study design. This will be assessed in a future study.

To conclude, the Brief IPQ can be applied as a brief instrument for assessing illness perceptions of patients with sub-acute and chronic non-specific low back pain. The Brief IPQ scale scores have evidence for reliability and validity and these study findings lend support to the application of the instrument in clinical practice and as a patient-reported outcome instrument in intervention studies including randomised trials designed to assess patient's illness perceptions alongside other measures of health outcome. However, some individual items had poorer evidence for reliability and validity and should be further evaluated.

Conflict of Interest

The authors of this paper declare no conflicts of interest.

Authors' Contributions

IL contributed in the data collection, the statistical analysis and drafted the manuscript. EW revised the manuscript critically. MG, KS and AMG participated in the statistical analysis and revised the manuscript critically. All authors contributed in the design of the study and read and approved the final manuscript.

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