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Reliability and validity of the Brief Illness Perception Questionnaire (B-IPQ) in individuals with a recently acquired spinal cord injury

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Reliability and validity of the Brief Illness Perception Questionnaire (B-IPQ) in individuals with a recently acquired spinal cord injury

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Abstract

Objective: To assess the reliability and validity of the Brief Illness Perception Questionnaire (B-IPQ) and possible subscales, and to interpret Brief Illness Perception Questionnaire (B-IPQ) total scores, in individuals with a spinal cord injury.

Design: Cross-sectional

Setting: Seven Dutch rehabilitation centres

Subjects: Individuals with a recently acquired traumatic or non-traumatic spinal cord injury at the start of inpatient spinal cord injury rehabilitation (N = 270).

Main measure: The Brief Illness Perception Questionnaire (B-IPQ) consists of eight items on an individual's cognitive and emotional representation of one's health conditions. Principal component analysis was performed to identify possible Brief Illness Perception Questionnaire (B-IPQ) subscales. Validity was assessed by testing hypotheses on correlations between the Brief Illness Perception Questionnaire (B-IPQ) and other measures. Cut-off points of the Brief Illness Perception Questionnaire (B-IPQ) total score were determined.

Results: Mean (SD) age of participants was 60.1 (16.5) years, 188 (71%) were male, and 119 (44%) had tetraplegia. Three potential subscales were revealed. Cronbach's alpha was acceptable for only one subscale. This subscale was named 'consequences' and included the items 'consequences', 'symptom burden', 'concern', and 'emotions'. The Brief Illness Perception Questionnaire (B-IPQ) total and the consequence subscale showed the expected strong correlations (>.50) with symptoms of anxiety and depression. Mean (SD) scores were 40.9 (12.3) on the 8-item Brief Illness Perception Questionnaire (B-IPQ) (range 0–80) and 25.1 (8.1) on the consequences subscale (range 0–40). Cut-off points for the Brief Illness Perception

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Questionnaire (B-IPQ) total score were determined as follows: <42 indicating low experienced threat, 42–49 indicating moderate experienced threat, and ≥ 50 indicating high experienced threat.

Conclusion: The Brief Illness Perception Questionnaire (B-IPQ) total and consequences subscale seem applicable in individuals with a spinal cord injury in the rehabilitation practice and research.

Keywords

Spinal cord injuries, psychology, rehabilitation, validation studies

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Introduction

Spinal cord injury (SCI) is a medical condition that is caused by the traumatic or non-traumatic damage of spinal cord nerves. The symptoms of the SCI include the loss of sensory and motor function and the loss of automatic regulation. In complete injuries, no sensory and motor functions are preserved. In incomplete injuries, either the sensory or the motor function is preserved. In addition to these physical consequences of the SCI, individuals with the SCI experience mental health problems more frequently compared to people without this diagnosis.^{1–3} How these individuals experience their conditions is often referred to as the reflections of ‘illness perception’ or ‘illness cognition’.

In the common-sense model of self-regulation, illness perception is an umbrella term for cognitive and emotional representations of one’s own health conditions that guide coping strategies, which ultimately determine physical and psychosocial outcomes.^{4–6} Therefore, gaining insights into illness perception are important to predict how individuals adjust to living with the SCI.⁵

Based on the common-sense model of self-regulation, the Illness Perception Questionnaire (IPQ) is a measure developed to assess experienced threat.^{4,7} An abbreviated version of the IPQ, the Brief Illness Perception Questionnaire (B-IPQ), consists of eight single items and has been used and validated in many different populations and languages. A systematic review with meta-analyses concluded that the single items of this measure have good psychometric properties.⁸ There is, however, no consensus on the reliability and interpretation of a total score on the B-IPQ and

diverging subscales have been proposed.^{7,9} Furthermore, despite its frequent use, the IPQ has rarely been used among people with the SCI. Only one study was found, but with a highly modified version to assess the more specific concept of hope for recovery.¹⁰ The usefulness of the B-IPQ to measure illness perception among individuals with the SCI is, therefore, still unclear.

The objective of the current research was to study the (a) reliability and validity of the B-IPQ with eight items and possible subscales and (b) the interpretation of B-IPQ total scores, among rehabilitation inpatients with the SCI. We tested four hypotheses: (1) it is possible to compose reliable subscales with items of the B-IPQ, (2) strong correlations will be found between scores on the B-IPQ and measures of anxiety, depression, and resilience,¹¹ (3) weak correlation coefficients will be found between B-IPQ scores and demographic and injury-related characteristics, and (4) appropriate B-IPQ cut-off points will be determined for the interpretation of the level of experienced threat.

Methods

Data were collected as part of the standard psychological screening among individuals admitted for their first inpatient rehabilitation to one of the seven rehabilitation centres specialized in the SCI in the Netherlands between May 2018 and May 2019. National and institutional regulations for the ethical use of participants who volunteered, were followed in this study. The Medical Ethics Review Board of the University Medical Center Groningen decided that this study did not need

approval according to the Dutch law on Medical Research Involving Human Subjects (number 201800303). Permission to perform this study was granted by the boards of directors of all seven rehabilitation centres.

The psychological screening took place in the first two weeks after admission to inpatient rehabilitation. Inclusion criteria were: (1) a minimum age of 18 years at the time of the screening and (2) sufficiently fluent in the Dutch language to fill out the questionnaires.

Demographic and psychological variables included age, gender, level of education, living situation, and history of cognitive and psychological problems, and were retrieved by the treating psychologists from medical files and de-identified before linking this data to the psychological data. Living situations indicated whether someone lived with or without a partner. Educational levels were merged into two levels: (1) lower education up to the completed high school education and (2) higher education including college or university education. The level (paraplegia or tetraplegia) and completeness: (1) complete (American Spinal Injury Association (ASIA) impairment scale (AIS) A) and (2) incomplete (AIS B, C, and D) were recorded according to the International Standards for Neurological Classification of Spinal Cord Injury.¹²

The Brief Illness Perception Questionnaire (B-IPQ) is a measure consisting of eight questions to assess the following illness representations: (1) consequences, (2) timelines, (3) personal controls, (4) treatment controls, (5) symptom burden, (6) concern, (7) illness comprehensibility, and (8) emotions.^{7,13} The ninth question on ranking the most important causes of the SCI was omitted since the cause of the SCI was considered evident for most participants. To the questionnaire, we added two introductory sentences to contextualize the questions: 'People can have different ideas about the SCI. Please, for each of the following questions, circle the number that best reflects your opinion.' Further, the word 'illness' was replaced by 'spinal cord injury' in every question. All questions were answered on a 0 to 10 numerical rating scale (Appendix). Scores on questions 3, 4, and 7 were

reversed so that, for each item, 0 indicates no experienced threat and 10 indicates the highest possible experienced threat. Using the sum score of these items resulted in a total score that ranges from 0 to 80. The Dutch B-IPQ has been frequently used and cross-cultural validation studies concluded that its psychometric properties are acceptable to good.^{8,9,13}

The Hospital Anxiety and Depression Scale (HADS) was a part of the standard psychological screening to assess the symptoms of depressed mood and anxiety. It has 14 items in two subscales. The total scores between 8 and 10 indicate 'possible anxiety/depression', and the total scores ≥ 11 indicate 'probable anxiety/depression'.¹⁴ Previous studies showed good psychometric properties of the HADS in individuals with the SCI.^{15,16}

The Connor-Davidson Resilience Scale with 10 items (CD-RISC 10) was a part of the psychological screening to assess resilience, meaning the individual's self-perceived ability to bounce back after stressful events, tragedies, or traumas.¹⁷ The CD-RISC 10 is a reliable, valid, and practical measure of resilience in individuals admitted for inpatient SCI rehabilitation.¹⁸

All data analyses were performed with SPSS (Statistical Package for the Social Sciences) version 25 (IBM(International Business Machines), Armonk New York). To answer the first research hypothesis, principal component analysis with oblique rotation was performed to explore underlying structures of the B-IPQ. Then, the internal consistency of each identified component was analyzed using Cronbach's alpha and compared with the alpha of the B-IPQ total score.

To determine the construct validity of the B-IPQ total score and the B-IPQ subscale score, Spearman's correlations were calculated. We expected strong ($\geq .50$) correlations with the symptoms of anxiety, depression, and resilience ('convergent validity'),¹¹ and weak ($\leq .30$) correlations with gender, age, living situation, educational levels, level of injury, and completeness of the injury ('divergent validity').^{18,19} The validity was confirmed when at least 75% (7/9) of these expectations were met.¹⁹

B-IPQ cut-off points to interpret the level of experienced threat ('low', 'moderate', and 'high')

were determined using the cut-off points from the HADS as a reference. The HADS cut-off point of ≥ 8 was used to determine the B-IPQ cut-off point between the categories of low and moderate experienced threat. The HADS cut-off point of ≥ 11 was used to determine the B-IPQ cut-off point between the categories of moderate and high experienced threat. The receiver operating characteristic (ROC) curve and Youden's J (sensitivity + specificity - 1) were used to identify the optimal B-IPQ cut-off points.²⁰ Sensitivity indicated the ability of the B-IPQ to correctly allocate a proportion of participants inside the golden standard category. Specificity indicated the ability of the B-IPQ to correctly allocate a proportion of participants outside the golden standard category.

Results

In total, 482 individuals with the SCI started their rehabilitation trajectory in one of the seven centres during the study period. Screening data at admission were available for 279 participants, but nine of them were excluded from the current study because they completed fewer than six B-IPQ items. Participant characteristics and mean screening outcomes on the symptoms of anxiety and depression, and resilience are shown in Table 1.

The mean (SD) score was 40.9 (12.3). The B-IPQ total score showed no floor or ceiling effects. The internal consistency of the B-IPQ total score was satisfactory (.74). The assumptions for principal component analysis with the B-IPQ items were met, as shown by the good Kaiser-Meyer-Olkin value (.76) and the significance of Bartlett's test ($p < .001$). The principal component analysis revealed three components with eigenvalues > 1 (Table 2). Together these three components accounted for an acceptable 67.6% of the variance. The strongest component (named 'consequences') represented items 1 (consequences), 5 (symptom burden), 6 (concern), and 8 (emotions). The total score of this subscale has a range of 0–40 and the mean (SD) score was 25.1 (8.1). The internal consistency of the consequence component was better compared to the

Table 1. Demographic and injury-related characteristics, and mean scores on the psychological screening at the admission of inpatient rehabilitation (N = 270).

Characteristics	n (%) or mean (SD). min. – max.
<i>Gender</i>	
Male	188 (70)
Female	82 (30)
<i>Age</i>	
(Mean (SD). range)	60.1 (16.5). 18.0–91.4
<i>Living situation</i>	
Living without a partner	105 (39)
Living with partner	160 (59)
Missing data	5 (2)
<i>Educational level</i>	
Lower	173 (64)
Higher	95 (35)
Missing data	2 (1)
<i>Level injury</i>	
Paraplegia	145 (54)
Tetraplegia	119 (44)
Missing data	6 (2)
<i>Completeness injury</i>	
Complete	38 (14)
Incomplete	217 (80)
Missing data	15 (6)
<i>History of psychological problems</i>	
Yes or possibly	32 (12)
No	233 (86)
Missing data	5 (2)
<i>History of cognitive problems</i>	
Yes or possibly	41 (15)
No	225 (83)
Missing data	4 (2)
<i>Symptoms of anxiety</i>	5.2 (4.1). 0–18
<i>Symptoms of depression</i>	5.8 (5.0). 0–20
<i>Resilience</i>	29.5 (6.6). 9–47

n - Number, and SD - Standard Deviation.

Measures: Anxiety and depression: Hospital Anxiety and Depression Scale. Resilience: Connor-Davidson Resilience Scale with 10 items (CD-RISC 10).

total score. Internal consistency was unacceptable for comprehension and control components. Therefore, only the consequences component was considered to be a reliable B-IPQ subscale.

As expected, both the total B-IPQ and the B-IPQ consequences subscales were strongly associated

Table 2. Principal component analysis and internal consistency of Brief Illness Perception Questionnaire components.

	Factor loadings**			Communalities
	Component 1 Consequences	Component 2 Comprehension	Component 3 Control	
6. Concern	.83*	-.11	.01	.71
5. Symptom burden	.82*	.05	-.04	.65
1. Consequences	.80*	.12	-.12	.60
8. Emotions	.69*	-.17	.19	.63
7. Illness comprehensibility	.21	-.81*	.09	.73
2. Timeline	.42*	.68*	.22	.70
4. Treatment control	-.19	.12	.96*	.87
3. Personal control	.30	-.18	.55*	.52
<i>Eigenvalues</i>	3.09	1.24	1.08	
<i>% of variance</i>	38.7	15.6	13.4	
<i>Cronbach's alpha</i>	.81	-.35	.42	

*Factor loadings represent loadings >.40.

**Factor loadings from the pattern matrix.

with outcomes on the symptoms of anxiety, symptoms of depression, and resilience; and were weakly or non-significantly correlated with gender, age, living situation, educational levels, level of injury, and completeness of the injury (Table 3).

The strongest correlations were found between the B-IPQ and the depression subscale of the HADS. Therefore, cut-off scores of the depression subscale of the HADS were used as references to determine the interpretation of B-IPQ total scores. Scores between 42 and 49 were interpreted as moderate experienced threat and B-IPQ scores ≥ 50 were interpreted as high experienced threat (Figure 1 and Table 4).

Discussion

The study has shown that illness perception among individuals with a recent SCI can be assessed with the reliable and valid B-IPQ and its 'consequences' subscale that was composed by items 1 (consequences), 5 (symptom burden), 6 (concern), and 8 (emotions). Higher experienced threat according to both scales correlated strongly with more symptoms of anxiety and depression, and lower resilience, and was weakly correlated with

demographic, injury-related, and psychological variables. The interpretation of the level of experienced threat with the B-IPQ total score was as

Table 3. Convergent and divergent validity of the 8-item B-IPQ and the B-IPQ consequences subscale with spearman's correlations.

	B-IPQ with 8 items	B-IPQ consequences subscale**
<i>Convergent</i>		
Anxiety	.56*	.60*
Depression	.66*	.61*
Resilience	-.53*	-.47*
<i>Divergent</i>		
Gender	-.05	-.01
Age	.13*	.09
Living situation	.05	.10
Educational level	.07	.06
Level of injury	-.10	-.08
Completeness of injury	-.27*	-.19*
% of validity expectations met	100.0	88.9

B-IPQ - Brief Illness Perception Questionnaire.

*p < 0.01.

**Composited by items 1 (consequences), 5 (symptom burden), 6 (concern), and 8 (emotions).

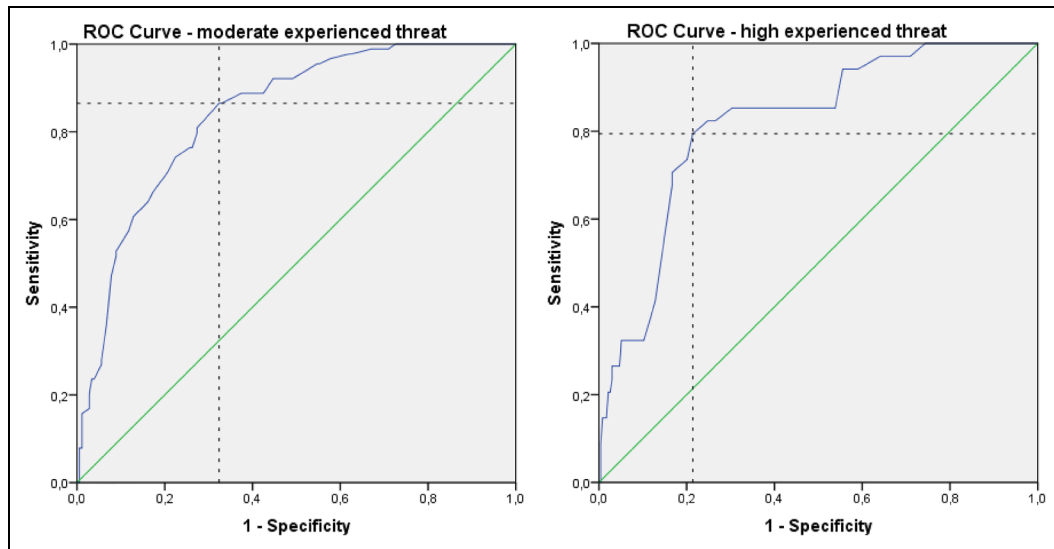


Figure 1. ROC curves for moderate experienced threats at B-IPQ cut-off points between 42 and 49 (left) and for high experienced threat at B-IPQ cut-off points ≥ 50 (right).

follows: ‘low’ for scores < 42 , ‘moderate’ for scores between 42 and 49, and ‘high’ for scores and ≥ 50 .

Analyses revealed a three-component structure of the B-IPQ in SCI rehabilitation inpatients. This finding was almost similar to results from studies in other diagnostic groups.^{9,21} Among patients with heart failure as well as among patients with cancer, items 1 ‘consequences’, 5 ‘identity’ (called ‘symptom burden’ in our study), 6 ‘concern’, and 8 ‘emotional response’ (‘emotions in our study’) were clustered into one component, and items 3 ‘personal control’, 4 ‘treatment control’, and ‘understanding’ (‘illness comprehensibility’ in our study)

were clustered into another component, and the timeline item was left out.^{9,21}

The internal consistency of the 8-item B-IPQ in our study was slightly higher than in other Dutch samples since Cronbach’s alpha was .69 in the sample of heart failure patients ($N = 585$) and .73 in the sample of individuals with acute low back pain ($N = 84$).^{9,22} Our consequences subscale showed similar internal consistency compared to the consequences subscale in patients with heart failure (Cronbach’s alpha of .80) and patients with cancer (Cronbach’s alpha of .83).^{9,21} The internal consistency of the 8-item total score was lower

Table 4. Predictive values of the B-IPQ total score using the depression subscale of the HADS as the reference measure.

ROC curve reference measure	95% CI	Best cut-off point	Sensitivity	Specificity	Youden’s J*	Interpretation/ level of experienced threat
HADS-D total score ≥ 8	.793 – .888	42	.865	.676	.541	42–49 ‘Moderate’
HADS-D total score ≥ 11	.749 – .889	49	.794	.786	.580	≥ 50 ‘High’

B-IPQ - Brief Illness Perception Questionnaire, and HADS-D Hospital Anxiety and Depression Scale - Depression subscale.

ROC - receiver operating characteristic, CI - confidence interval.

*Youden’s J = sensitivity + specificity – 1.

compared to our consequences subscale. The analysis of inter-correlations between B-IPQ items showed weak and partly negative associations between items in the consequences scale and the timeline and treatment control items (data not shown). Elsewhere, we reported an increase in the level of threat on the timeline and treatment control items, contrasting with a decrease in threat on the other items.¹⁸ This probably reflects these individuals' growing awareness of the chronic character of the SCI during inpatient rehabilitation. The developers of the B-IPQ indeed advised that the clinical use of B-IPQ subscales needs caution and the coherence of subscales varies among illnesses.⁷

Whereas, personal- and treatment control items were allocated to different scales within the more comprehensive revised IPQ,²³ these two items clustered into one component in our study. This clustering might be an effect of the inpatient rehabilitation treatment in which patients are being actively involved in goal- and decision making. Within the previously mentioned studies among the patients with heart failure and patients with cancer, these two control items were clustered into one component as well, although together with the illness comprehensibility item.^{9,21}

Our expectations concerning the strong correlations of illness perception with the symptoms of anxiety and depression and resilience were met. Our expectations concerning the weak correlations of illness perception with other variables were met as well. Yet, the completeness of the injury showed a significant correlation with illness perception that was only slightly weaker than the <.30 cut-off point. Previous research showed a significant correlation between comparable variables, i.e. cognitive appraisal and American Spinal Injury Association Impairment Score.¹¹

Strengths and limitations

To the best of our knowledge, this is the first study to determine B-IPQ cut-off points on a total score to provide clinicians with means for interpreting the level of experienced threat according to the B-IPQ total scores. In our study, the HADS was chosen as

the reference standard based only on data availability and its generally accepted cut-off points for possible and probable anxiety/depression, and our expectations about strong correlations between illness perception and the symptoms of depression and anxiety.^{14,24} Yet, it is expected that the B-IPQ cut-off points which were found, are appropriate within several samples and research aims. Furthermore, the B-IPQ included items, mainly the timeline and comprehensibility items, of which the interpretation of experienced level threat as reported by people with the SCI, seemed to be ambiguous. However, rigorous modifications or the deletion of these items as done in the previous research,¹⁰ does not seem to be necessary.

Conclusion

The reliability and validity of the 8-item B-IPQ and its' consequences subscale found in the current study were good. Hence both instruments can be used by clinicians and SCI researchers. Besides, the cut-off scores of the B-IPQ with 8 items could enhance the interpretation of the level of experienced threat. Of the two B-IPQ total scores that were investigated, the 8-item version covers the construct of illness perception more comprehensively according to the common-sense model of self-regulation. Moreover, the 4-item consequences subscale has slightly higher internal consistency and is easier to interpret because it does not include the timeline and comprehensibility items.

Clinical messages

- Clinicians can use the B-IPQ and its consequences subscale to assess the illness perception of persons with the SCI and the possible need for education about the SCI or treatment such as cognitive behavioural therapy.
- B-IPQ cut-off scores were defined to interpret the level of threat a person experiences after the SCI.

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Author contributions

Heleen Kuiper performed data analysis and drafted the paper. Christel M.C. van Leeuwen provided feedback on data analyses and the paper. Janneke M. Stolwijk-Swüste provided feedback on the paper. Marcel W.M. Post provided feedback on data analyses and the paper.


Conflict of interest

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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