Vancleef et al., *Cogent Psychology* (2019), 6: 1629079
https://doi.org/10.1080/23311908.2019.1629079

cogent psychology

HEALTH PSYCHOLOGY | RESEARCH ARTICLE

The injury illness sensitivity index – Revised: Further validation in a Dutch community sample

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Received: 11 March 2019
Accepted: 30 May 2019
First Published: 14 June 2019

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Reviewing editor:
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Abstract: Injury/illness sensitivity (IS) is conceptualized as a fundamental fear that underlies fear-related psychopathology and chronic health conditions, including chronic pain. The current study examines the internal consistency, test–retest reliability, and factor structure of the Dutch version of the injury/illness sensitivity index-revised (ISI-R). In addition, we aimed to further validate the ISI-R by studying convergent and divergent validity. Participants (N = 255) were recruited in a Dutch community sample to complete an online questionnaire battery including the ISI-R and several validation measures. Four weeks later, 117 participants completed the ISI-R a second time. The ISI-R showed good internal consistency and test–retest reliability. Confirmatory factor analysis confirmed two correlated factors in the ISI-R: Fear of Injury and Fear of Illness. The measure's validity was supported by strong correlations between the ISI-R and well-established pain and physical health-related anxiety measures, moderate correlations with measures that reflect general negative emotionality (e.g. anxiety, depression), and weak correlations with fear constructs that do not entail a direct link to a health threat. These results indicate the appropriateness of working with the Dutch ISI-R and its two subscales as a reliable and valid measure of fear of physical harm, Fear of Illness and Fear of Injury.

ABOUT THE AUTHOR

Linda M. G. Vancleef is Assistant Professor at the department Clinical Psychological Science, Faculty Psychology and Neurosciences, Maastricht University, The Netherlands. Her research is embedded within the research group Experimental Health Psychology (EHP), where experimental and clinical research is initiated to further our understanding of chronic bodily distress disorders including chronic (aspecific) pain, tinnitus and sexual dysfunctions. Dr. Vancleef focuses on the experimental study of psychological vulnerability and resilience in the onset and exacerbation of chronic (aspecific) pain. Main research topics include the role of cognitive processes (interpretational processes, executive functioning, working memory), individual difference constructs (pain anxiety, optimism), emotion regulatory processes, and physical and social contextual influences in the experience of pain and onset of pain chronicity, in adult and adolescent populations.

PUBLIC INTEREST STATEMENT

Injury/illness sensitivity has been suggested a key psychological factor within the development and exacerbation of chronic health conditions. Injury/illness sensitivity is measured with the injury/illness sensitivity index (ISI). The ISI was originally developed in English language in 1993, and revised into a shortened 9-item version in 2005: the ISI-R. The ISI and ISI-R have been frequently used by researchers interested in elucidating the role of injury/illness sensitivity in various anxiety-related disorders (e.g. blood phobia, health anxiety) and chronic health conditions (e.g. chronic pain). Despite availability and use of a Dutch translation of the ISI-R in research, a study on its psychometric properties remained absent. To address this caveat in the literature, this paper describes the structural validity, reliability and validity of the Dutch translation of the ISI-R. Results confirm a correlated two-factor structure, good reliability and validity of the Dutch ISI-R.

Subjects: Health Psychology; Testing, Measurement and Assessment; Psychometrics/ Testing & Measurement Theory; Psychological Disorders - Adult; Pain in Adults; Anxiety in Adults; Psychological Disorders; Pain in Children & Adolescents; Anxiety in Children & Adolescents

Keywords: injury/illness sensitivity; fundamental fears; factor analysis; validity; reliability; Dutch ISI-R

Together with anxiety sensitivity (AS) and fear of negative evaluation (FNE), injury/illness sensitivity (IS) is conceptualized as one of three fundamental fears that underlie common fear-related psychopathologies (Carleton et al., 2005; Lilienfeld, Turner, & Jacob, 1993; Taylor, 1993). Defined as an exaggerated fearfulness of potential physical harm, IS was initially considered particularly relevant in explaining specific fears related to imminent bodily threat, such as blood injury fears or animal fears (Taylor, 1993). Later research suggested that IS has unique explanatory value for chronic health conditions, such as chronic pain (Carleton, Thibodeau, Osborne, Taylor, & Asmundson, 2014; Keogh & Asmundson, 2004; Vancleef, Vlaeyen, & Peters, 2009). IS was shown to be closely associated with, yet qualitatively distinct from, other negative emotional constructs that influence pain and related disability (Boichat, Eccleston, & Keogh, 2018; Carleton et al., 2014; Vancleef, Peters, Roelofs, & Asmundson, 2006). In a hierarchical model of negative emotional constructs considered relevant for chronic pain, IS constitutes a higher order factor of pain-specific fears and concerns such as fear of pain and pain catastrophizing (Carleton et al., 2014; Carleton, Park, & Asmundson, 2006; Keogh & Asmundson, 2004; Lilienfeld et al., 1993; Vancleef et al., 2009). On a cognitive behavioral level, IS was found to be associated with reduced tolerance for experimentally induced pain, increased preventive health behavior (e.g. avoiding risky situations, wear braces to prevent recurrence of pain), use of health-care services (e.g. self-initiated doctor visits, medication use), and the tendency to make negative interpretations of pain-related ambiguity (Vancleef & Peters, 2008; Vancleef, Peters, Gilissen, & De Jong, 2007).

IS is typically assessed by means of the injury/illness sensitivity index (ISI), a questionnaire specifically developed for this purpose by Taylor in 1993 (Carleton et al., 2005, 2006; Taylor, 1993). In this self-report instrument, respondents indicate their agreement with a number of statements that express concerns and worries regarding the possibility of getting injured or ill (e.g. “I can’t stand the thought of being injured”; “ I get scared when I think I am coming down with an illness). The ISI is predominantly used in research settings that focus on the conceptualization of IS in relation to other constructs residing in the higher and lower order levels of the hierarchical model of negative emotional constructs (Lilienfeld et al., 1993; Vancleef et al, 2009; Carleton et al., 2014; Boichat et al., 2018). Furthermore, the ISI is adopted in empirical studies that aim to elucidate the role of IS in anxiety-related psychopathology and (chronic) physical health conditions (e.g. Schmidt & Mallott, 2006; Vancleef, Hanssen, & Peters, 2016; Watt, O’connor, Stewart, Moon, & Terry, 2008).

Psychometric studies on the original English 11-item ISI suggested removal of two items from the original scale, resulting in a 9-item revised version: the ISI-R (Carleton et al., 2005, 2006). Two subscales are identified within the scale, i.e. Fear of Injury (5 items), and Fear of Illness (4 items), while the total scale score reflects a general fear of physical harm. Confirmatory factor Analyses (CFA) offered support for the two-factor structure of both the English (Carleton et al., 2006) and the German translated (Schützler, Carleton, & Witt, 2012) version of the ISI-R. Furthermore, the English version and its German translation were found to have good internal consistency, test–retest reliability, and construct validity.

Although a Dutch translation of the original ISI, and thus also of the therefrom derived ISI-R, is readily available (Vancleef et al., 2006), a comprehensive study on the internal validity of the Dutch ISI-R remained to be initiated. A first goal of the present study was to address this caveat in the literature by evaluating the structural validity and reliability of the Dutch ISI-R in a Dutch community sample. Specifically, a CFA was used to test the proposed two-factor structure of the Dutch

ISI-R (Carleton et al., 2006; Schützler et al., 2012), and internal consistency and test–retest reliability of the questionnaire were evaluated.

As a second goal, we aimed to advance the validation of the ISI-R by evaluating its relationship with a broad range of health-related measures, including pain-specific as well as more generalized negative emotionality measures (Carleton et al., 2006; Schützler et al., 2012). Convergent validity was hypothesized to be reflected by: (1) strong positive correlations with established measures of health-related anxiety and fear constructs; (2) strong positive correlations between both ISI-R subscales and respective VAS ratings of Fear of Illness and Fear of Injury (Schützler et al., 2012); and (3) moderate positive correlations with measures of negative emotional constructs that are conceptualized as higher or lower order factors of IS in a hierarchical model on negative emotional constructs related to pain, i.e. trait anxiety, depression, and fear of negative evaluation (Boichat et al., 2018; Carleton et al., 2014; Lilienfeld et al., 1993; Vancleef et al., 2009). Divergent validity was expected to be indicated by weak correlations between ISI-R and measures tapping into specific fears that are not clearly related to physical injury and illness, like social phobia and agoraphobia.

1. Method

1.1. Participants

Participants were recruited by means of online (social media) and poster advertisements that were spread in the university building, a local supermarket and sports club, the personal network of the experimenters, and the snowball method. The advertisement invited participants to partake in an online questionnaire study that tapped into thoughts and beliefs about (physical) health. The following inclusion criteria were formulated: age between 18 and 65 years, no current pregnancy, and having Dutch as a mother tongue. The advertisement contained a URL address that could be visited to obtain more information about the study and to sign up for participation.

Initially, 401 unique visits to the study URL address were registered. After reading the study information on the website, 367 individuals consented to participate in the study and were redirected to the online questionnaire environment (Qualtrics, Provo, UT). Incomplete (N = 35) and duplicate responses (N= 1) were disregarded, leading to data from 332 respondents in the raw data file. Data from another 47 participants were excluded, because Dutch was not their mother tongue. The remaining and final sample for the CFA and construct validation analyses consequently consisted of 255 respondents (M_{age} = 31.27 years; SD_{age} = 14.42 years, $range_{age}$ = 18–65 years; 192 female). About half of the participants (N = 123) had a job for at least 30 h a week, about a quarter (N = 85) of the participants were students. The majority of participants (N = 245, 96.5%) finished high school or higher education. Importantly, 124 (48.6%) respondents reported pain in the musculoskeletal system, of whom 32 (25.8%) reported the experience of acute pain (<6 months), and 92 (74.2%) reported chronic pain (≥6 months). Most common locations of pain were back (17.2%), shoulders (8.6%), knees (5.5%) and ankle/foot (5.5%). A total of 238 respondents agreed to receive an email invitation for the follow up study 4 weeks later.

One hundred and forty-five respondents followed the link to the follow-up study that was sent to them via email. Of these 145 respondents, 28 were deleted from the datafile to calculate test–retest reliability because they either terminated their participation before completing the ISI-R (N= 17) or were found to be non-eligible in the main study already (for reasons mentioned above; N= 11). The final dataset that was used to calculate test–retest reliability therefore consisted of 117 participants (M_{age} = 35.18 years; SD_{age} = 15.75 years, $range_{age}$ = 18–65 years; 90 female). From these 117 participants, six participants reported to have suffered serious injury or illness in the 4-week period between both completions of the ISI-R. Amongst the 117 participants were 63 respondents (53.8%) who reported to suffer from musculoskeletal pain in the first phase of the study: 10 (15.9%) reported acute

pain (<6 months), and 53 (84.1%) reported chronic pain complaints (≥6 months). Most common locations of pain were back (19.2%), shoulders (7.7%) and knees (7.7%).

1.2. Measures

The Injury Illness Sensitivity Index—Revised (ISI-R; Carleton et al., 2005, 2006).

The ISI-R contains nine items that tap into the fear of physical health threat, i.e. injury/illness sensitivity. Respondents indicate their agreement with each of nine statements on a 5-point Likert scale, ranging from 0 ("very little") to 4 ("very much"). Two subscales are suggested to exist within the ISI-R, i.e. "Fear of Injury" (e.g. "I am frightened of being injured") and "Fear of Illness" (e.g. "I get scared when I think I'm coming down with an illness"). The Dutch ISI-R was obtained by deriving the nine items from the original 11-item Dutch ISI, that has been subjected to a state-of-the-art translation and backward translation procedure (Vancleef et al., 2006).

1.2.1. Convergent and divergent validity measures

The *Anxiety Sensitivity Index* (ASI) (Peterson & Heilbronner, 1987) contains 16 items that assert the negative consequences of experiencing anxiety and consists of three subscales, namely physical concerns (8 items, e.g. "It scares me when I feel 'shaky' (trembling)"), cognitive concerns (4 items, e.g. "It scares me when I am unable to keep my mind on a task"), and social concerns (4 items, e.g. "It is important to me not to appear nervous") (Peterson & Heilbronner, 1987; Zinbarg & Barlow, 1996). Studies have suggested that especially the physical concerns subscale is important to consider in the context of pain (e.g. Keogh, 2004; Stewart & Asmundson, 2006). All items are scored on a 5-point Likert-scale, ranging from 0 ("not at all agree") to 4 ("totally agree"). The reliability and validity of both the English and the Dutch version of the ASI have been established as good (Peterson & Heilbronner, 1987; Rodriguez, Bruce, Pagano, Spencer, & Keller, 2004; Sandin, Chorot, & McNally, 2001; Vancleef & Peters, 2006).

The *Brief Fear of Negative Evaluation Scale* (BFNE) (Leary, 1983) consists of 12 items measuring the fear of negative social evaluation (e.g. "I worry about what kind of impression I make on people"). Participants indicate their degree of agreement with each statement on a 5-point Likert scale, ranging from 0 ("very little") to 4 ("very much"). Both the original and Dutch version of the BFNE have good reliability and validity (Collins, Westra, Dozois, & Stewart, 2005; Leary, 1983; Vancleef et al., 2006).

As the ASI, BFNE and ISI-R all tap into one of three fundamental fears that have repeatedly been shown to be interrelated (Carleton et al., 2014; Vancleef, Vlaeyen, & Peters, 2009; Vancleef et al., 2006), ASI and BFNE are hypothesized to be positively correlated with ISI-R. However, it is expected that the ISI-R and its subscales will show strong positive correlations with the ASI physical concerns and cognitive concerns subscales, whereas weak to moderate correlations are expected with the ASI social concerns subscale and the BFNE given their focus on social aspects.

The 9-item Fear of Illness, Death, Disease and Pain subscale was included from the *Illness Attitudes Scales* (IAS) (Hadjistavropoulos, Frombach, & Asmundson, 1999). Respondents indicate how often they experience the event as stated in the item (e.g. "Does the thought of a serious illness scare you?") on a 5-point Likert-type scale with anchors at 0 ("no") to 4 ("most of the time"). The total IAS has good psychometric properties (Hadjistavropoulos et al., 1999; Speckens, Spinhoven, Sloekers, Bolk, & van Hemert, 1996). The Fear of Illness, Death, Disease and Pain subscale is expected to be strongly related to ISI-R scores, as these measures both assess health-related fear constructs.

Three subscales from the *Fear Questionnaire* (FQ; Marks & Mathews, 1979) were used to assess agoraphobia (5 items, e.g. "Walking alone in busy streets"), blood-injury phobia (5 items, e.g. "Sight of blood") and social phobia (5 items, e.g. "Eating or drinking with other people"), respectively. Participants indicate how much they would avoid the situations stated in the items on a 9-point Likert scale, with endpoints at 0 ("would not avoid it") to 8 ("always avoid it"). The reliability and

validity of the Dutch version of the FQ have been documented as good (Van Zuuren, 1988). Blood phobia is hypothesized to be strongly correlated with ISI-R, as these scales both pertain to health-related aspects of fear. By contrast, zero to weak correlations are expected between agoraphobia and social phobia on one hand and ISI-R on the other hand, as these scales assess specific fears that are not so much related to injury and illness.

The short form of the *Pain Anxiety Symptoms Scale* (PASS-20; McCracken & Dhingra, 2002) was included as a specific measure of pain-related fear. The PASS-20 contains four subscales, each with five items: fear of pain (e.g. "Pain sensations are terrifying"), cognitive anxiety (e.g. "I can't think straight when in pain"), physiological anxiety (e.g. "Pain seems to cause my heart to pound or race"), and escape/avoidance behavior (e.g. "Try to avoid activities that cause pain"). Participants are instructed to rate each item in terms of frequency on a 6-point Likert scale, ranging from 0 ("never") to 5 ("always"). Validity and reliability of the PASS-20 have been established as good (McCracken & Dhingra, 2002). Psychometric properties of the Dutch version have been studied in chronic pain patients and found to be good (Roelofs et al., 2004). The subscales of the PASS-20 were used to examine convergent validity: strong correlations were expected with ISI-R, ISI Fear of Illness subscale and ISI Fear of Injury subscale.

The *Hospital Anxiety and Depression scale (HADS)* (Spinhoven, Ormel, Sloekers, & Kempen, 1997; Zigmund & Snaith, 1983) was administered as a measure of general anxiety and depression. It consists of an anxiety (e.g. "I get sudden feelings of panic") and a depression subscale (e.g. 'I feel as if I am slowed down'), each consisting of seven items. All items are scored on a 4-point Likert scale with anchors at 0 ("almost never") to 3 ("almost always"). The psychometric properties of both the original and Dutch version of the HADS have been demonstrated to be good (Bjelland, Dahl, Haug, & Neckelmann, 2002; Spinhoven et al., 1997). The HADS subscales were hypothesized to moderately correlate with ISI-R, as these measures reflect negative emotional constructs that are conceptualized as more generalized higher order factors of IS within a hierarchical model of negative emotional constructs (Keogh & Asmundson, 2004; Lilienfeld et al., 1993; Vancleef et al., 2009).

Four 0–100 visual analog scales (VAS) were administered to tap into participants' *fear of (serious) future injury* ("How fearful are you of getting injured in the future?" and "How fearful are you of getting seriously injured in the future?"), and *fear of (serious) future illness* ("How fearful are you of getting ill in the future?" and "How fearful are you of getting seriously ill in the future?"). All VAS scales were labeled "not at all fearful" (0) on one extreme and "extremely fearful" (100) on the other extreme. These VAS scales were included to further investigate the convergent validity of the ISI-R. Strong correlations were expected between mean VAS scores for fear of (serious) future injury and the ISI-R Fear of Injury subscale, as well as between mean VAS score for fear of (serious) future illness and the ISI-R Fear of Illness subscale (Schützler et al., 2012).

1.3. Procedure

Data were collected using Qualtrics software (Qualtrics, Provo, UT). Upon visiting the study URL address as stated in the advertisements, participants reached the study website where they could read more information about the study purpose, inclusion criteria, and procedure. After obtaining informed consent, participants were redirected to the first question of the questionnaire battery.

The questionnaire battery started with socio-demographic questions, querying for age, gender, educational level, work situation, and marital status. Furthermore, a question was included that tapped into the current presence of pain complaints (yes/no) and, if applicable, the location, severity, and duration of these pain complaints were also inquired. Next, the ISI-R was administered, immediately followed by the validation measures. Upon completion of the last questionnaire, participants could sign up to be contacted again four weeks later to participate in the online follow-up study.

The invitation for the follow-up study was sent via e-mail and contained a unique URL address to get direct access to the Qualtrics environment of this follow-up study. The link remained valid for

two weeks; if necessary, a reminder e-mail was sent out after one week. After obtaining informed consent, the follow-up study started with a check for the occurrence of injury and/or illness experiences in the time lag between both test moments. Using a dichotomous answer format (yes/no), participants indicated whether they had suffered from injury or illness since their participation in the prior study four weeks earlier. If applicable, they rated the severity and level of experienced disability for this injury/illness on a VAS (0–100). Next, the ISI-R was administered.

Both the main study and the follow-up study furthermore contained measures that were included for other study purposes that are consequently disregarded in the present study (e.g. measures tapping into sensory processing sensitivity, daily activities, interpretation bias). It took about 40 min to complete all measures of the main study and 20 min to complete the follow-up study. For both studies, gift vouchers (valued 10, 20 and 50 €) were raffled amongst participants, with a chance of 1/10 to win a voucher.

The study protocol was approved by the Ethical Review Committee Psychology and Neuroscience (ERCPN) of Maastricht University, The Netherlands.

2. Results

2.1. Descriptives

In the main study sample (N = 255) a mean ISI-R total score of 7.20 (SD = 5.79, range 0–30), mean Fear of Injury score of 2.33 (SD = 2.60, range 0–18) and a mean Fear of Illness score of 4.87 (SD = 3.97, range 0–16) were found. Because Carleton et al. (2006) reported sex differences for ISI-R scores, we first checked for sex differences on age, ISI-R total and ISI-R subscale scores. Men (M_{age} = 36.64 years, SD = 16.02 years) were found to be significantly older than women (M_{age} = 29.63 years, SD = 13.51 years) with $F(1,250) = 11.13$, $p = .001$. No sex differences were found for ISI-R total score or ISI-R subscale scores (all $p > .05$). Furthermore, we examined whether differences existed between participants who reported to suffer from no or acute pain (duration < six months; N = 92) and those who reported to suffer from chronic pain complaints (duration ≥ six months; N = 163). These differences were not significant. Results indicated higher, but not significantly higher, mean scores in the chronic pain than in the no pain group for the ISI-R (M = 8.08; SD = 6.45 vs. M = 6.08; SD = 5.33), the Fear of Illness subscale (M = 5.45; SD = 4.32 vs. M = 4.54; SD = 3.73), and the Fear of Injury subscale (M = 2.63; SD = 3.09 vs. M = 2.16, SD = 2.27) (all $p > .07$).

2.2. Internal consistency and test–retest reliability

Internal consistency was evaluated in the main study sample (N= 255) by calculating Cronbach's alpha (*Cronbach's* α) for the ISI-R and both subscales separately, resulting in excellent values for the total ISI-R (*Cronbach's* α = .87; 95% CI [.847, .894]) and the Fear of Illness subscale (*Cronbach's* α = .87; 95% CI [.848, .897]), and a good value for the Fear of Injury subscale (*Cronbach's* α = .78; 95% CI [.735, .823]). Removal of items would not further improve the alpha value (*see* Table 1 for item total statistics).

Stability over time was calculated in the sample of 117 participants who completed the ISI-R in the follow-up study 4–6 weeks after participation in the main study (see Table 1). Pearson correlation coefficients indicated good test–retest reliability for the ISI-R ($r(117) = .80$, $p < .001$), the Fear of Illness subscale ($r(117) = .79$, $p < .001$), and the Fear of Injury subscale ($r(117) = .71$, $p < .001$). Paired samples t-tests indicated lower mean ISI-R and mean Fear of Illness scores in the follow-up study, compared to the main study (*see* Table 2).

Because getting ill or injured in between the first and second completion of the ISI-R could affect responses during the second completion, we also calculated test–retest reliability while excluding those participants who reported to have suffered serious injury/illness in the time lag between both assessments (N = 6). However, this did not substantially affect the measures' stability over

Table 1. Item total statistics for the total Injury/illness Sensitivity Index-Revised (ISI-R), Fear of Illness, and Fear of Injury subscales in the main study sample (N = 255)

Item	ISI-R Total scale	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
2	De gedachte aan verwonding benauwt me	6.52	27.40	.56	.86
9	Ik kan de gedachte dat ik gewond zou kunnen raken niet verdragen	6.90	29.25	.56	.86
6	Ik maak me zorgen dat ik in de toekomst een ernstige lichamelijke ziekte kan krijgen	6.05	25.99	.61	.86
8	Ik word bang als ik eraan denk dat ik ziek ga worden	6.49	26.16	.69	.85
1	Ik ben bang om gewond te raken	6.59	27.27	.64	.86
4	De gedachte aan lichamelijke ziekte maakt me angstig	6.23	25.48	.71	.85
5	Ik maak me zorgen om geblesseerd te raken	6.46	28.32	.42	.87
3	Ik maak me zorgen om lichamelijk ziek te worden	6.22	25.33	.74	.85
7	Ik maak me zorgen over mijn lichamelijke gezondheid	6.14	26.76	.58	.86
	Fear Of Illness subscale				
6	Ik maak me zorgen dat ik in de toekomst een ernstige lichamelijke ziekte kan krijgen	3.73	10.02	.72	.84
7	Ik maak me zorgen over mijn lichamelijke gezondheid	3.81	10.86	.62	.87
8	Ik word bang als ik er aan denk dat ik ziek ga worden	4.16	10.79	.67	.85
4	De gedachte aan lichamelijke ziekte maakt me angstig	3.90	10.19	.73	.84
3	Ik maak me zorgen om lichamelijk ziek te worden	3.89	10.05	.77	.83
	Fear of Injury Subscale				
2	De gedachte aan verwonding benauwt me	1.65	3.72	.64	.70
9	Ik kan de gedachte dat ik gewond zou kunnen raken niet verdragen	2.03	4.62	.64	.72
1	Ik ben bang om gewond te raken	1.72	3.75	.72	.66
5	Ik maak me zorgen om geblesseerd te raken	1.59	4.23	.42	.82

time, with $r(111) = .80$, $p < .001$ for the ISI-R, $r(111) = .72$, $p < .001$ for the Fear of Illness scale and $r(111) = .79$, $p < .001$ for the Fear of Injury scale.

Paired samples t-tests, excluding the six participants who reported to have suffered serious injury or illness in between both ISI-R completions, also showed significantly lower ISI-R ($M_1 = 6.61$, $SD_1 = 5.99$ vs. $M_2 = 5.26$, $SD_2 = 5.13$; $t(110) = 3.94$, $p = < .001$), Fear of Illness ($M_1 = 4.39$, $SD_1 = 3.99$ vs. $M_2 = 3.44$, $SD_2 = 3.36$; $t(110) = 5.05$, $p < .001$), and Fear of Injury scores ($M_1 = 2.23$, $SD_1 =$

Table 2. Descriptive statistics (M, SD, minimum score, maximum score) and results of paired samples t-tests for the ISI-R total and subscale scores between first and second completion (N = 117)

	Main study		Follow up study			
	M (SD)	***Min-Max***	***M (SD)***	***Min-Max***	***t(116)***	***p***
ISI-R	6.47 (5.96)	0–30	5.28 (5.12)	0–24	3.54	.001
ISI-R Fear of Injury	2.15 (2.60)	0–12	1.81 (2.29)	0–12	1.92	.058
ISI-R Fear of Illness	4.32 (3.99)	0–18	3.47 (3.38)	0–15	3.72	< .001

Note. ISI-R = Injury/Illness Sensitivity Index—Revised.

2.62 vs. M_2 = 1.82, SD_2 = 2.33; $t(110) = 2.27$, $p = .025$) in the follow-up study compared to the main study. Participants who suffered injury or illness in the time lag between both measures ($N = 6$) showed no decrease in ISI-R total or subscale scores.

2.3. Confirmatory factor analysis (CFA)

A CFA was performed on ISI-R covariance matrix as obtained in the main study (N = 255) using a robust maximum likelihood estimation procedure in Mplus (version 7.3: (Muthén & Muthén, 1998-2012; Satorra & Bentler, 1994). Following Carleton et al. (2006) and Schützler et al. (2012) a one-factor model representing a "fear of physical harm" factor and a two-factor model consisting of the two correlated factors "Fear of Injury" and "Fear of Illness" were tested (see Figure 1).

Model fit was evaluated on the basis of following goodness of fit guidelines: Chi square/df ratio (χ2/df: should be <2.0); comparative fit index (CFI; should be > .90), Tucker Lewis index (TLI: should be > .90); standardized root-mean-square residual (SRMR: should be < .08); root-mean-square error of approximation (RMSEA: should be < .08); and Akaike Information Criterion (AIC: lower values indicate a better fit) (Hu & Bentler, 1999; Schreiber, Nora, Stage, Barlow, & King, 2006). Table 3 displays the goodness-of-fit indices for the one- and the two-factor model. While the one-factor

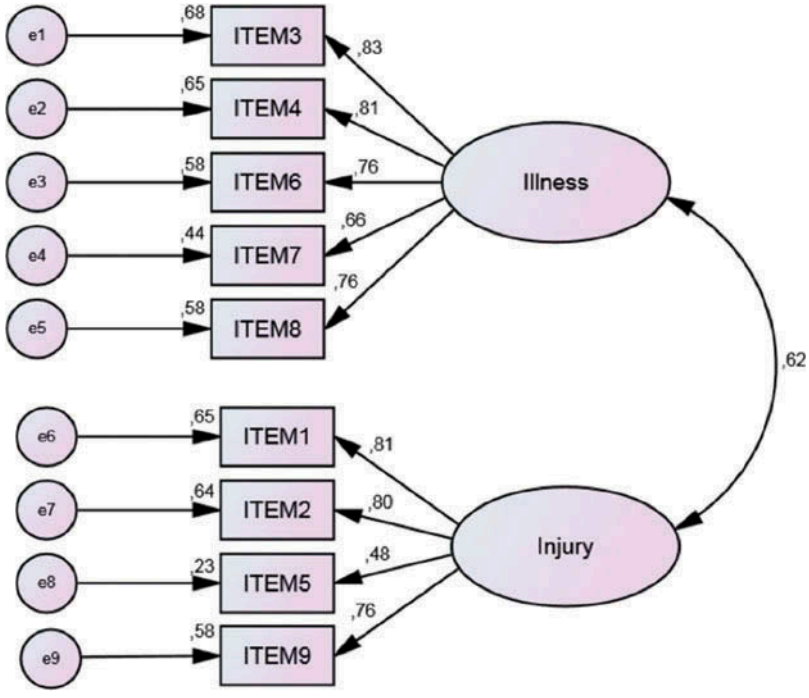

Figure 1. Standardized estimation coefficients for the two-factor model (Factor 1: Fear of Illness; Factor 2: Fear of Injury).

Table 3. Goodness of fit indices for the one-factor and the two-factor model using Robust Maximum Likelihood estimation method (N = 255)

Model	χ^2	*df*	χ^2/df	*RMSEA*	*CI RMSEA*	*SRMR*	*CFI*	*TLI*	*AIC*
One-factor	193.53*	27	7.16	.16	.13—.18	.10	.78	.71	5212.04
Two-factor	88.99*	26	3.42	.10	.08—.12	.06	.92	.89	5040.00

Notes. *$p < .001$

χ^2/df = Chi square/df ratio; CFI = comparative fit index; TLI = Tucker Lewis Index; (TLI); SRMR = standardized root-mean -square residual; RMSEA = root-mean-square error of approximation; AIC = Akaike Information Criterion: AIC

model showed unacceptable fit for all fit indices, reasonable fit was observed for the two-factor model with χ2/df = 3.42, CFI = .92, TLI = .89, SRMR = .06, RMSEA = .10, and AIC = 5040 in the two-factor model (versus 5212 in the one-factor model).[1] Figure 1 shows the standardized coefficients for the two-factor model. The inter-correlation between both factors is strong with $r(255) = .62$, $p < .001$. A second-order CFA in which both subfactors underlie one overarching factor can be consequently be suggested as a suitable model to test. Since there are only two first-order factors (and hence 1 intercorrelation) it is not possible to identify such a model, unless arbitrary constraints are imposed on one of the factor loadings of the two first-order factors on the second-order factor (e.g. if one of the two is set to 1.0, the other loading is equal to the factor correlation between the first-order factors). Hence, the two higher order factor loadings cannot be uniquely estimated (also see Carleton et al., 2005).

We next performed a scaled chi-square difference test (Satorra & Bentler, 2001; Satorra & Bentler, 2010) to compare model fit of the correlated two-factor model (i.e. baseline model) with a two-factor model in which the correlation between both factors is constrained to zero (i.e. nested comparison model). Results of this chi-square difference test showed that the correlated two-factor model provides a significantly better fit to the data with Δχ2 SB = 90,382; t(6) = 90,38,206, p < .0001.

2.4. Convergent and divergent validity

Pearson correlation coefficients were calculated between the ISI-R and its subscales and the validation measures to evaluate convergent and divergent validity of the ISI-R (Table 4). Correlation coefficients were interpreted following the guidelines of Cohen (1988), with *weak* correlations ranging from .10—.29, *moderate* correlations ranging from .30—.49, and *strong* correlations ranging from .50 to 1.0.

The ISI-R total score correlated strongly with ASI total, ASI fear of physical sensations, IAS fear of illness and Pain, PASS fear of pain, and PASS physiological anxiety scales. Moderate correlations were found with all other measures. The Fear of Injury subscale correlated weakly with FQ agoraphobia, FQ social phobia, PASS escape/avoidance, HADS anxiety and HADS depression scales, while moderate correlations were found with all other measures. The Fear of Illness subscale correlated strongly with ASI total scores, ASI physical concerns, IAS fear of illness, and PASS fear of pain, while weak correlations are found with HADS depression, and the ASI social concerns subscale. Moderate correlations are found between Fear of Illness subscale and all other measures.

Following Shützler et al. (2012) we also validated the ISI-R with VAS ratings that tapped specifically in participants' fear of injury and illness. As predicted, the ISI-R correlated strongly with VAS fear of future (serious) illness, fear of future (serious) illness and VAS fear of future injury with $r(255)$ ranging between .55 and .59, all $p < .001$. On subscale level, ISI-R Fear of Injury correlated especially strong with VAS fear of future (serious) injury ($r(255) = .64$, $p < .001$; $r(255) = .58$, $p < .001$) and moderately

Table 4. Pearson correlation coefficients between the ISI-R scores and validation measures

	ISI-R total	ISI-R Fear of Injury	ISI-R Fear of Illness
BFNE	**.42**	**.33**	**.39**
ASI total	***.59***	**.46**	***.56***
ASI physical concerns	***.59***	**.41**	***.60***
ASI cognitive concerns	**.49**	**.42**	**.43**
ASI social concerns	**.33**	**.31**	.27
FQ agoraphobia	**.34**	.21	**.35**
FQ blood injury phobia	**.49**	**.42**	**.44**
FQ social phobia	**.352**	.22	**.37**
IAS fear of illness and pain	***.71***	**.46**	***.73***
PASS cognitive anxiety	**.43**	**.31**	**.43**
PASS escape/avoidance behavior	**.36**	.26	**.36**
PASS fear of pain	***.56***	**.38**	***.56***
PASS physiological anxiety	***.53***	**.45**	**.48**
HADS anxiety	**.42**	.28	**.43**
HADS depression	**.31**	.25	.29

Notes. Strong correlations are indicated in bold italics (r = .50—r = 1.0), moderate correlations are indicated in bold (r = .30—r = .49), weak correlations (r = .10—r = .29) are indicated in regular font

all $p < .001$; BFNE = brief fear of negative evaluation scale; ASI = anxiety sensitivity index; FQ = fear questionnaire; IAS = illness attitudes scale; PASS = pain anxiety symptoms scale; HADS = hospital anxiety and depression scale

with fear of future (serious) illness ($r(255) = .31$, $p < .001$; $r(255) = .29$, $p < .001$). ISI-R Fear of Illness correlated especially strong with VAS fear of future (serious) illness ($r(255) = .60$, $p < .001$; $r(255) = .66$, $p < .001$, respectively) and moderately with VAS fear of future (serious) injury, ($r(255) = .43$, $p < .001$; $r(255) = .48$, $p < .001$, respectively).

3. Discussion

The present study aimed to evaluate the structural and construct validity of the Dutch ISI-R in a Dutch community sample. Results of the CFA indicated that while a one-factor model results in unacceptable model fit, the proposed two-factor structure, with four items tapping into Fear of Injury and five items tapping into Fear of Illness, provides a reasonable fit to the data. However, three fit indices (χ^2/df (3.42, should be <2,0), TLI (.89; should be >,90) and RMSEA (.10, should be < .08) only approached the conventional cut-off values for good for model fit (Hu & Bentler, 1999; Schreiber et al., 2006). This can partly be accounted for by residual covariance between items that are not allowed in the original run of the model. Indeed, good model fit was obtained for all fit indices when five covariances between items were added to the model based on derivations as provided by MPlus output (Muthén & Muthén, 1998-2012).

Results furthermore showed a substantial correlation between the Fear of Injury and the Fear of Illness factor. It was not possible to test a second-order model in which both factors underly one overarching Fear of Physical Harm due to unidentified model. However, when the correlated two-factor model was compared to the non-correlated two factor model using the Chi-square difference test (Satorra & Bentler, 2010), the former was found to fit the data significantly better than the noncorrelated model. Taken together, findings do suggest that it is indeed appropriate to continue working with the total ISI-R score to represent a general fear of physical harm (Carleton et al., 2006; Schützler et al., 2012).

Factor loadings of items were good to satisfactory, with one exception for which a relatively low value was observed (i.e. item 5: "I worry about getting injured"). Former psychometric evaluation of the English or German version of the ISI-R did not reveal problems for this particular item (Carleton et al., 2006; Schützler et al., 2012). An explanation for the lower factor loading might be sought in the specific wording of this item, which makes it deviant form all other injury-related items in the ISI-R. Specifically, whereas other items adopted a commonly used Dutch word to refer to injury (i.e. "verwonding"), this particular item used a different term (i.e. 'blessure'), which is typically associated with sports injury in Dutch language. An exploratory factor analyses on a questionnaire for measuring fundamental fear constructs (including ISI items) (Vancleef et al., 2006), and a study in which hierarchical cluster analyses were used to examine item overlap between various pain-related anxiety scales (including ISI; Vancleef et al., 2009) did not detect problems with this specifically worded Dutch ISI-R item nor its belonginess to the ISI(-R) scale. In the present study, the item formed no threat to the internal consistency of the ISI-R total score. We, therefore, decided to retain the item in the scale but recommend considering an adapted wording of this particular item in future use of the Dutch ISI-R that is in line with wording as used throughout the rest of the scale.

Corroborating findings of Carleton et al. (2006) and Schützler et al. (2012), internal consistency and test–retest reliability of the ISI-R total and both subscales were found to be good. It should be noted that mean scores on the ISI-R were significantly lower at second completion. This lower mean score might reflect carry over effects from the first to the second ISI-R assessment. Notably, individuals who experienced serious illness or injury during the time lag between both ISI-R completions did not show a reduction in ISI-R scores over time. Furthermore, although mean ISI-R scores in our community sample are somewhat lower than those reported in Canadian and German samples (both undergraduate student and community samples; Carleton et al., 2006; Schützler et al., 2012), they are comparable to scores as previously reported in Dutch study samples (Traxler, Schrooten, Dibbets, & Vancleef, 2018; Vancleef et al., 2016).

Convergent validity of the Dutch ISI-R was supported by strong correlations of ISI-R with scales and subscales that are tapping in health and physical concerns and fears, like ASI physical sensations, IAS fear of illness and death, PASS fear of pain, and the FQ blood phobia scale. On a subscale level, it is remarkable that especially the Fear of Illness subscale showed the strongest correlations with these physical health measures. One explanation might be that the Fear of Illness scale is applicable to a broad range of health problems, including injury-related symptoms, while the Fear of Injury scale entails a more concrete referral to injury in terms of *actual* tissue damage or physical damage. Similar to Schützler et al. (2012) we observed moderate correlations between ISI-R scores and VAS ratings of general fear of future (serious) injury and illness. The moderate to high correlations between PASS subscales of escape/avoidance, cognitive avoidance, and physiological anxiety were unexpected at first sight. However, these three PASS scales tap into a general future-oriented pain-related anxiety, and resulting correlations probably indicate overlap with the future-oriented anxiety components that reside in the ISI-R scales (Abrams, Carleton, & Asmundson, 2007; Roelofs et al., 2004).

In general, correlations between ISI and more general negative emotional constructs, like anxiety, or more specific constructs, like health anxiety or social anxiety can be understood from a hierarchical conceptualization of interrelated negative emotional constructs related to pain (Lilienfeld, Turner, & Jacob, 1998). Within such a conceptualization, validity of ISI-R is expected to be reflected by stronger correlations with concepts that are specifically tapping into health, illness and injury concerns, but by weaker correlations with those constructs that lack direct referral to illness, injury or pain. Indeed, weaker, yet still significant correlations were observed with the Depression subscale from the HADS, the social situations subscale of the ASI and the FNE scale.

The moderate correlation between ISI-R and social fear constructs deserves some further attention (i.e. FNE, ASI social concerns, FQ social phobia). Positive associations between IS and

social fears have been repeatedly reported (Asmundson & Carleton, 2005; Carleton et al., 2014). On a cognitive level, IS has been found positively related to the tendency to make negative interpretations of social ambiguous situations (Vancleef & Peters, 2008). Furthermore, social phobia was suggested to contribute to both suffering and disability in workers with chronic musculoskeletal pain (Asmundson, Jacobson, Allerdings, & Norton, 1996). Carleton et al. (Carleton et al., 2006) argued that a relation between IS and FNE might be explained by the expectation of social stigma, or the fear of appearing "weak" in the eyes of others when injured or ill. Further research is needed to disentangle the relation between social fears and injury/illness fears, thereby also taking the possibility of overarching fundamental fear constructs, like the fear of the unknown into consideration (Carleton, 2016).

Several strengths and weaknesses are to be identified in this study. First, the online nature of this study implies a lack of (experimenter) control over the circumstances in which the questionnaires were being completed (Benfield & Szlemko, 2006). Notwithstanding the fact that participants are instructed to undertake actions aimed at minimalizing potential external and internal distractors (e.g. switch off notifications, complete study measures when alone and in a quiet environment), it cannot be ruled out that some participants did not adhere to this. On the other hand, the online nature of the study offers several benefits: more respondents could be reached, respondents can complete the measures in their own familiar environment when it fits their schedule best, and more truthful responses are expected to be boosted due to increased anonymity (Benfield & Szlemko, 2006). Second, including a community sample is considered a strength and includes more diversity on relevant individual difference variables (e.g. age, presence of health complaints, work status). Third, the representation of individuals with and without acute and chronic pain complaints offers additional information to prior validation studies of ISI-R that included pain-free participants predominantly participants were included (Carleton et al., 2006; Schützler et al., 2012). Further research might consider inclusion diverse chronic health conditions (e.g. aspecific musculoskeletal pain, neuropathic pain) to further examine the valid use of ISI-R in those specific populations.

Taken together, results of the present study indicate the appropriateness of working with the Dutch ISI-R and its two subscales as a reliable and valid measure of fear of physical harm, Fear of Illness and Fear of Injury. Future research is warranted to identify the role of injury/illness sensitivity in the development and exacerbation of chronic physical health complaints.

Acknowledgements
The authors are grateful to Ramon Reinders and Bas Salama for their help in data collection and preparation of datafiles.

Funding
The authors received no direct funding for this research.

Conflict of Interest
Author L.M.G.V, Author A.M., and Author J.S. declare that they have no conflict of interest.

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Citation information
Cite this article as: The injury illness sensitivity index – Revised: Further validation in a Dutch community sample, Linda M. G. Vancleef, Astrid Meesters & Jan Schepers, *Cogent Psychology* (2019), 6: 1629079.

Note

1. Note that adding five covariance between items (item 2<->item 9; item 4 <->item8; item 4 <->item 2; item 4<-> item 6; item 1 <-> item 6) on the basis of derivations (unscaled modification indices) results in good model fit for all fit indices with χ^2/df =1.98, CFI = .97, TLI = .95, SRMR = .05, RMSEA = .06, and AIC = 4987.

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***Cogent Psychology* (ISSN: 2331-1908) is published by Cogent OA, part of Taylor & Francis Group.**