Psychology & Health
Vol. 28, No. 1, January 2013, 84–102

Routledge
Taylor & Francis Group

Musculoskeletal pain illness perceptions: Factor structure of the Illness Perceptions Questionnaire-Revised

Elaine E. Nicholls*, Susan Hill and Nadine E. Foster

Arthritis Research UK Primary Care Centre, Primary Care Sciences, Keele University, Staffordshire, UK

(*Received 23 February 2012; final version received 17 July 2012*)

Background: The Revised Illness Perceptions Questionnaire (IPQ-R) is commonly used to measure illness perceptions. We tested whether the structure of the IPQ-R was appropriate for use with primary care musculoskeletal pain patients.
Methods: Confirmatory (C) and exploratory (E) factor analyses (FA) were used to test whether the structure of the IPQ-R was supported for patients with knee pain ($n = 393$), hand pain ($n = 2113$) and back pain ($n = 1591$). CFA was used to test whether the timeline acute/chronic, timeline cyclical, consequences, personal control, treatment control, illness coherence and emotional representation dimensions of the IPQ-R were distinct; EFA was used to explore potential structure for patients' views on the cause of their condition.
Results: Goodness-of-fit indices for the CFA were below our criteria for good model fit. Removal of six items from the model improved model fit, but our criteria for good model fit was still not achieved. An interpretable factor solution could not be determined for the causal items on the questionnaire.
Conclusions: Our data show limited evidence that the seven dimensions of the IPQ-R are distinct. A clear structure for the causal items was not determined. Further work is needed to develop the IPQ-R for use with primary care musculoskeletal pain patients.

Keywords: illness perceptions; musculoskeletal pain; factor analysis; IPQ-R; IPQ; questionnaire

Introduction

Musculoskeletal pain represents a significant health problem (White & Harth, 1999), and accounts for approximately 25% of general practitioner consultations in the UK (Jordan et al., 2010). Studies investigating knee, hand and back pain have shown patients' illness perceptions to be significantly associated with health and behavioural outcomes, including consultation and treatment attendance (Foster et al., 2008; French, Cooper, & Weinman, 2006; Hill, Dziedzic, Thomas, Baker, & Croft, 2007; Hobro, Weinman, & Hankins, 2004; Orbell, Johnston, Rowley, Espley, & Davey, 1998).

*Corresponding author. Email: e.nicholls@keele.ac.uk

ISSN 0887–0446 print/ISSN 1476–8321 online

http://dx.doi.org/10.1080/08870446.2012.714782
http://www.tandfonline.com

Illness perceptions are an individual's personal representations about their illness and within the Common Sense Model (CSM) of self-regulation (Leventhal, Meyer, & Nerenz, 1980), are grouped into five dimensions: identity, timeline, consequences, cure/controllability and cause. *Identity* represents an individual's belief about the illness label and symptoms; *timeline* refers to an individual's perception of the course of their condition; *consequences* reflects an individual's belief about the likely short and long-term effects of their condition and its impact on physical, psychological and social functioning; *cure/controllability* represents the extent to which an individual believes their condition to be amenable to cure or control and *cause* represents beliefs about factors responsible for causing the condition.

The Illness Perceptions Questionnaire (IPQ) (Weinman, Petrie, MossMorris, & Horne, 1996) was developed to measure illness perceptions and includes within it measures of the five dimensions of the CSM of self-regulation (illness identity, timeline, consequences, cure/controllability and cause). Subsequent to publication of the IPQ, further development of the tool was undertaken, leading to the development of the IPQ-Revised (IPQ-R) (Moss-Morris et al., 2002). The aim of the IPQ-R was to address some of the psychometric limitations of the IPQ and also to add three additional dimensions to the questionnaire: illness coherence (assessing the extent to which an individual's illness representations provide a coherent understanding of their condition), timeline cyclical (a measure of how an individual's symptoms fluctuate over time) and emotional representation (a measure of an individual's emotional response to illness). Since its publication in 2002, the IPQ-R has become a widely used measure to assess illness perceptions across a range of populations and clinical conditions (e.g. Hobro et al., 2004; Moss-Morris & Chalder, 2003).

The IPQ-R was developed using data from individuals with a range of conditions, including asthma, diabetes, rheumatoid arthritis, chronic pain, acute pain, multiple sclerosis, HIV and myocardial infarction (Moss-Morris et al., 2002). A key aspect of the development of the IPQ-R was to assess the factor structure of the questionnaire. After exclusion of the identity and causal subscales, it was found that seven factors accounted for 64% of the variance in the data, with most items loading only on their hypothesised factor. Exceptions were a single consequences item (that also loaded on the timeline factor), and two personal control items (that also loaded on the treatment control factor). In addition, factor analysis (FA) conducted on the 18 causal items produced a four-factor model (psychological attribution, risk factors, immunity and accident/chance) that accounted for 57% of the total variance (Moss-Morris et al., 2002).

A number of authors have tested whether the factor structure of the IPQ-R (Moss-Morris et al., 2002) is replicated in patient populations distinct from those used to develop it (e.g. cancer (Dempster & McCorry, 2012; Giannousi, Manaras, Georgoulias, & Samonis, 2010; Hagger & Orbell, 2005), atopic dermatitis (Wittkowski, Richards, Williams, & Main, 2008), mild brain injury (Snell, Siegert, Hay-Smith, & Surgenor, 2010), hypertension (Chen, Tsai, & Lee, 2008), depression (Cabassa, Lagomasino, Dwight-Johnson, Hansen, & Xie, 2008), fibromyalgia (van Ittersum, van Wilgen, Hilberdink, Groothoff, & van der Schans, 2009) and renal disease (Chilcot, Norton, Wellsted, & Farrington, 2012)); however, to our knowledge, the factor structure of the IPQ-R has not yet been tested across a broad spectrum of common musculoskeletal pain problems in primary care. The aim of this study was therefore to test whether the factor structure of the IPQ-R could be replicated using data from three common regional, musculoskeletal pain conditions;

knee, hand and back pain. It was hypothesised that the theoretically derived structure of the IPQ-R, based on the CSM of illness representations, would be supported.

Design

Participants

Data were analysed from three, large, musculoskeletal pain studies conducted in the Midlands region of the UK. The studies form three 'illness' groups, referred to for simplicity as 'knee pain', 'hand pain' and 'back pain' groups, respectively. All studies gained full ethical approval to be conducted and all participants gave written consent to take part.

Knee pain: Participants in the knee pain group were aged 50 years and over, referred from general practitioners to physiotherapy departments for pain with or without stiffness in one or both knees, had a clinical diagnosis of knee osteoarthritis and were included in a randomised control trial of acupuncture and exercise for knee pain (Foster et al., 2007).

Hand pain: Participants with hand pain or hand problems were recruited from a community-based cohort study evaluating joint pain in older adults (North Staffordshire Osteoarthritis Project) (Thomas et al., 2004). Participants were aged 50 years and over and reported hand pain or hand problems in the 12 months prior to completion of the IPQ-R.

Back pain: Participants with back pain were recruited from a consultation-based cohort study evaluating back pain in general practice (Foster et al., 2008). Eligible patients were aged between 18 and 59 years and had a recent consultation with their general practitioner for non-specific low back pain.

All three studies did not exclude participants based on pain severity or duration. Key characteristics of each patient group are given in Table 1. As would be expected, participants in the back pain sample were younger than the hand and knee pain groups. All three samples had a similar proportion of female responders and social class distribution (ONS, 2002) although slightly more participants in the hand pain group were classified as having a routine occupation. Hand pain participants were more likely to have had their condition longer than the knee pain sample.

Main outcome measure

Participants were invited to complete the IPQ-R at baseline and at each follow-up time point in their respective studies (Foster et al., 2007, 2008; Thomas et al., 2004). For simplicity, only baseline data are analysed here. As recommended by the authors of the IPQ-R, the IPQ-R was presented to the participants after it had been modified to refer directly to the musculoskeletal condition of interest so phrases such as 'my illness' or 'my condition' were replaced with 'my knee', 'hand' or 'back' pain or problem respectively. Items included in the analysis were measured on a five-point likert scale, with responses ranging from 'strongly disagree' to 'strongly agree'. Prior to analysis, item response options were coded from 1 to 5, ensuring that if items were summed within each dimension the resulting score could be interpreted (see Table 2

Table 1. Sample characteristics.

Musculoskeletal pain group	*n*	Female gender *n* (%)	Age mean (SD)	Duration of illness[a] *n* (%)		Complaint specific measure of pain disability[a] Mean (SD)		Socio-economic classification[ab] *n* (%)	
Knee	393	241 (62)	63.5 (9.0)	Overall duration		WOMAC[c]		Higher managerial	19 (5)
				Less than 5 years	294 (75)	Pain (0–20)	9.2 (3.8)	Higher professional	11 (3)
				5–10 years	45 (12)	Stiffness (0–8)	4.0 (1.8)	Lower managerial/professional	61 (17)
				More than 10 years	54 (14)	Function (0–68)	30.7 (13.5)	Intermediate occupations	64 (18)
								Self-employed	26 (7)
								Lower supervisory/technical	23 (6)
								Semi-routine occupations	91 (25)
								Routine occupations	71 (19)
Hand	2113	1327 (63)	65.4 (9.6)	Overall duration		AUSCAN[d]		Higher managerial	60 (3)
				Less than 5 years	753 (39)	Pain (0–20)	6.9 (4.5)	Higher professional	26 (1)
				5–10 years	418 (21)	Stiffness (0–4)	1.2 (1.0)	Lower managerial/professional	272 (14)
				More than 10 years	784 (40)	Function (0–36)	11.2 (9.0)	Intermediate occupations	287 (15)
								Self-employed	117 (6)
								Lower supervisory/technical	138 (7)
								Semi-routine occupations	494 (25)
								Routine occupations	585 (30)
Back	1591	930 (59)	43.9 (10.3)	Duration of most recent episode		Pain[e] (0–10)	4.6 (2.7)	Higher managerial	82 (6)
				Less than one month	579 (38)	RMDQ[f] (0–24)	8.6 (6.0)	Higher professional	58 (4)
				1–3 months	444 (29)			Lower managerial/professional	301 (22)
				4–6 months	148 (10)			Intermediate occupations	251 (18)
				7 months to 3 years	177 (12)			Self-employed	73 (5)
				More than 3 years	182 (12)			Lower supervisory/technical	76 (5)
								Semi-routine occupations	318 (23)
								Routine occupations	236 (17)

Notes: SD = Standard deviation.
[a]Subject to missing data.
[b]Office for National Statistics Social Occupational Classification 2000: SOC 2000 (ONS, 2002).
[c]WOMAC = Western Ontario and McMaster Universities Osteoarthritis Index (Bellamy, 1996).
[d]AUSCAN = Australian Canadian Osteoarthritis Hand Index (Bellamy et al., 2002).
[e]Pain intensity measured as average usual pain intensity in the last two weeks (0–10 scale).
[f]RMDQ = Roland Morris Disability Questionnaire (Roland & Morris, 1983).

Table 2. Interpretation of IPQ-R dimension scores.

Dimension	Interpretation
A high dimension score indicates stronger agreement that.....	
Timeline acute/chronic	Problem will last a long time
Timeline cyclical	Condition is cyclical in nature
Consequences	Condition had a major impact on life
Personal control	Good perceived personal control over symptoms
Treatment control	Treatment could control symptoms
Illness coherence	Little understanding of condition
Emotional representation	Condition affects them emotionally
Psychological attributions	Psychological attributes caused their condition
Risk factors	Risk factors caused their condition
Immunity	Immunity caused their condition
Accident/chance	Accident or chance caused their condition

and footnote of Table 3). Items in the identity scale, although included in the questionnaire, were not included in this analysis as they were rated as a symptom checklist (with patients indicating (a) yes/no to each symptom on the checklist that they had experienced and (b) yes/no to each symptom on the checklist they considered related to the illness under study) so no factor structure was hypothesised for these items in the original development of the IPQ-R.

Statistical analysis

Confirmatory factor analysis (CFA)

A seven-factor CFA model was hypothesised for the timeline acute/chronic, timeline cyclical, consequences, personal control, treatment control, illness coherence and emotional representation dimensions of the IPQ-R as proposed in the original development of the IPQ-R. Items in each model were restricted to load only on their hypothesised factor and were measured with independent errors. Inter-correlations between factors were included in the model. All CFA models were fitted using AMOS version 6.0 (Arbuckle, 2003).

Before the CFA models were fitted, we assessed whether maximum likelihood could solely be used as the estimation method. For this to be achieved, normally distributed data were required. We judged an item to be normally distributed if its skew statistic divided by its standard error, and kurtosis statistic divided by its standard error were both less than 1.96 (absolute value) (Tabachnick & Fidell, 2007). We also assessed multivariate normality using Mardia's coefficient of multivariate kurtosis (Mardia, 1970). If multivariate normality was not achieved, model estimates were calculated using full information maximum likelihood but presented with 90% bias corrected confidence intervals (CIs) rather than maximum likelihood CIs. The 90% bias-corrected CIs were generated by bootstrapping 500 data sets sampled with replacement (Byrne, 2001). We also conducted a sensitivity analysis (data not shown) to test whether our model results differed if estimates were derived using an asymptotically distribution-free (ADF) approach i.e. an estimation method that does not assume (multivariate) normality (Arbuckle, 2003).

Table 3. Factor loadings and 90% bias-corrected CIs for the seven-factor CFA.

Problem area	Knee pain ($n = 330$)		Hand pain ($n = 1621$)		Back pain ($n = 1319$)	
	Factor loading[a]	90% bias-corrected CI	Factor loading[a]	90% bias-corrected CI	Factor loading[a]	90% bias-corrected CI
Timeline acute/chronic						
- My X problem will last short time[b]	**0.63**	(0.53, 0.72)	**0.55**	(0.50, 0.61)	**0.79**	(0.76, 0.82)
- My X problem is likely to be permanent rather than temporary[c]	**0.87**	(0.79, 0.92)	**0.84**	(0.79, 0.87)	**0.87**	(0.85, 0.89)
- My X problem last long time[c]	**0.85**	(0.79, 0.88)	**0.93**	(0.90, 0.94)	**0.90**	(0.87, 0.91)
- My X problem will pass quickly[b]	**0.69**	(0.59, 0.78)	**0.63**	(0.58, 0.69)	**0.78**	(0.75, 0.80)
- I expect to have this X problem for the rest of my life[c]	**0.77**	(0.70, 0.84)	**0.77**	(0.73, 0.80)	**0.80**	(0.78, 0.83)
- My X problem will improve in time[b]	**0.53**	(0.41, 0.64)	**0.56**	(0.52, 0.62)	**0.70**	(0.67, 0.73)
Timeline cyclical						
- The symptoms of my X problem change a great deal from day to day[c]	**0.62**	(0.53, 0.71)	**0.62**	(0.59, 0.66)	**0.48**	(0.44, 0.53)
- My symptoms come and go in cycles[c]	**0.79**	(0.71, 0.88)	**0.85**	(0.82, 0.87)	**0.83**	(0.79, 0.85)
- My X problem is very unpredictable[c]	**0.78**	(0.66, 0.86)	**0.78**	(0.74, 0.81)	**0.70**	(0.66, 0.74)
- I go through cycles in which my X problem gets better or worse[c]	**0.70**	(0.61, 0.77)	**0.78**	(0.75, 0.81)	**0.75**	(0.71, 0.79)
Consequences						
- My X problem is a serious condition[c]	**0.71**	(0.64, 0.77)	**0.70**	(0.59, 0.76)	**0.72**	(0.69, 0.75)
- My X problem has major consequences on my life[c]	**0.89**	(0.84, 0.93)	**0.78**	(0.68, 0.84)	**0.85**	(0.82, 0.86)
- My X problem does not have much effect on life[b]	**0.72**	(0.65, 0.79)	**0.57**	(0.48, 0.63)	**0.69**	(0.64, 0.73)
- My X problem strongly affects the way others see me[c]	0.40	(0.29, 0.51)	**0.69**	(0.60, 0.76)	**0.66**	(0.62, 0.69)
- My X problem has serious financial consequences[c]	**0.46**	(0.34, 0.56)	**0.72**	(0.63, 0.79)	**0.75**	(0.72, 0.77)
- My X problem causes difficulties for those close to me[c]	**0.59**	(0.48, 0.66)	**0.77**	(0.68, 0.84)	**0.75**	(0.71, 0.78)
Personal control						
- There is a lot I can do to control my X symptoms[c]	**0.62**	(0.52, 0.70)	**0.58**	(0.54, 0.62)	**0.60**	(0.55, 0.65)
- What I do can determine whether my X problem gets better or worse[c]	**0.61**	(0.51, 0.70)	**0.72**	(0.69, 0.76)	**0.68**	(0.63, 0.71)
- The course of my X problem depends on me[c]	**0.66**	(0.57, 0.73)	**0.76**	(0.72, 0.79)	**0.70**	(0.65, 0.74)
- Nothing I do will affect my X problem[b]	**0.43**	(0.28, 0.55)	0.35	(0.29, 0.42)	**0.44**	(0.38, 0.50)
- I have power to influence my X problem[c]	**0.78**	(0.71, 0.83)	**0.73**	(0.69, 0.76)	**0.67**	(0.63, 0.71)
- My actions will have no effect on the outcome of my X problem[b]	**0.49**	(0.37, 0.61)	0.38	(0.32, 0.45)	**0.45**	(0.38, 0.50)

(*continued*)

Table 3. Continued.

Problem area	Knee pain ($n=330$)		Hand pain ($n=1621$)		Back pain ($n=1319$)	
	Factor loading[a]	90% bias-corrected CI	Factor loading[a]	90% bias-corrected CI	Factor loading[a]	90% bias-corrected CI
Treatment control						
- There is very little that can be done to improve my X problem[b]	**0.59**	(0.49, 0.66)	0.40	(0.34, 0.46)	**0.73**	(0.69, 0.77)
- My treatment will be effective in curing my X problem[c]	**0.74**	(0.66, 0.82)	**0.73**	(0.69, 0.77)	**0.72**	(0.69, 0.76)
- Negative effects of my X problem can be prevented (avoided) by my treatment[c]	**0.81**	(0.74, 0.86)	**0.80**	(0.76, 0.83)	**0.66**	(0.62, 0.71)
- My treatment can control my X problem[c]	**0.78**	(0.71, 0.83)	**0.82**	(0.79, 0.84)	**0.66**	(0.61, 0.70)
- There is nothing which can help my X problem[b]	**0.59**	(0.48, 0.68)	**0.48**	(0.42, 0.53)	**0.72**	(0.68, 0.76)
Illness coherence						
- The symptoms of my X problem are puzzling to me[c]	**0.85**	(0.80, 0.89)	**0.88**	(0.86, 0.90)	**0.83**	(0.81, 0.85)
- My X problem is a mystery to me[c]	**0.91**	(0.87, 0.94)	**0.93**	(0.92, 0.95)	**0.91**	(0.89, 0.92)
- I don't understand my X problem[c]	**0.94**	(0.92, 0.96)	**0.89**	(0.86, 0.91)	**0.91**	(0.90, 0.93)
- My X problem doesn't make any sense to me[c]	**0.90**	(0.87, 0.93)	**0.81**	(0.78, 0.84)	**0.92**	(0.90, 0.93)
- I have a clear picture or understanding of my X problem[b]	**0.63**	(0.55, 0.70)	**0.55**	(0.50, 0.59)	**0.72**	(0.69, 0.75)
Emotional representation						
- I get depressed when I think about my X problem[c]	**0.80**	(0.72, 0.85)	**0.89**	(0.86, 0.91)	**0.86**	(0.85, 0.88)
- When I think about my X problem I get upset[c]	**0.82**	(0.76, 0.87)	**0.91**	(0.89, 0.93)	**0.85**	(0.83, 0.87)
- My X problem makes me feel angry[c]	**0.68**	(0.60, 0.76)	**0.79**	(0.76, 0.81)	**0.73**	(0.70, 0.76)
- My X problem doesn't worry me[b]	0.40	(0.30, 0.50)	**0.47**	(0.43, 0.52)	**0.53**	(0.48, 0.57)
- Having this X problem makes me feel anxious[c]	**0.66**	(0.57, 0.72)	**0.76**	(0.72, 0.79)	**0.80**	(0.77, 0.82)
- Having this X problem makes me feel afraid[c]	**0.68**	(0.60, 0.76)	**0.77**	(0.73, 0.80)	**0.77**	(0.74, 0.80)

Notes: X – Substituted to give reference to relevant body area: knee, hand or back.
Factor loadings greater than 0.4 are in bold.
[a]Factor loadings are standardised regression coefficients.
[b]Coded 5='strongly disagree', 4='disagree', 3='neither agree nor disagree', 2='Agree', 1='Strongly agree'.
[c]Coded 1='strongly disagree', 2='disagree', 3='neither agree nor disagree', 4='Agree', 5='Strongly agree'.

The number of cases included in the analysis was dependent on the method used to calculate the CIs for analysis. If the assumptions were valid for CIs to be calculated using full information maximum likelihood, participants completing at least one item were included in the analysis. If the assumptions were not valid, only participants completing all of the items on the IPQ-R were included in the analysis (this restriction was necessary for bias-corrected CIs to be calculated). A sensitivity analysis (data not shown) was used to investigate whether the method used to estimate the CIs, and hence define case inclusion for the study, altered our overall conclusions (Olinsky, Chen, & Harlow, 2003).

To assess model goodness-of-fit, multiple indices were used including: the chi-square ($\chi 2$) statistic, the goodness-of-fit index (GFI), parsimony adjusted GFI (PGFI), comparative fit index (CFI) and the root mean square error of approximation (RMSEA). Multiple indices were needed because the chi-square statistic is sensitive to sample size (Byrne, 2001). For the model to fit the data well, we required a GFI > 0.90, PGFI > 0.50, CFI > 0.95 and an RMSEA value < 0.06 (Byrne, 2001; Hu & Bentler, 1999; MacCallum, Browne, & Sugawara, 1996; Mulaik et al., 1989).

To further assess the model suitability, we required all standardised regression coefficients to be greater than 0.4 and statistically significant (Ferguson & Cox, 1993). We also required the model estimates to be statistically plausible and interpretable given the content of each IPQ-R dimension. Statistical plausibility was achieved if all estimates of variance were positive, and between-factor correlations were between plus and minus one.

In the event that the CFA models were a poor fit to the data, modification indices were explored to suggest potential changes that could be made to the model to improve model fit. Potential changes were only considered if they were theoretically plausible and replicated in all three datasets. Items with low factor loadings (<0.4) or large standardised residuals (>2.58) (Byrne, 2001) were considered for removal from the model to improve model fit.

Exploratory factor analysis (EFA)

A separate EFA model was fitted to assess the factor structure of the 18 items in the causal dimension. Although, the original authors of the IPQ-R propose a four factor model (psychological attributions, risk factors, immunity and accident/chance), a confirmatory analysis was not used as the authors of the IPQ-R suggest that the factor structure of the causal items should be explored separately for each clinical condition as perceptions relating to the cause of illness are likely to be condition specific.

EFA was conducted using IBM SPSS version 20.0 (IBM, 2011). Prior to analysis the data were assessed and defined as suitable for EFA if Bartlett's test of Sphericity was statistically significant ($p < 0.05$) and the Kaiser–Meyer–Olkin (KMO) test was greater than 0.5 (Ferguson & Cox, 1993). In order to replicate (as closely as possible) the analysis presented in the development of the IPQ-R (Moss-Morris et al., 2002), factors were extracted using the principal components method and rotated using Varimax. Items were considered to load on a factor if the absolute value of the factor loading was greater than 0.4 and the item did not cross-load on another factor (i.e. the difference between the item's two highest loadings was ≥ 0.2) (Ferguson & Cox, 1993).The number of factors extracted was based on the data and was defined as the number of factors with eigenvalues >1. In the event that this did not produce a

four-factor solution, the four-factor model was also run so that a direct comparison could be made with the results shown in the development paper of the IPQ-R (Moss-Morris et al., 2002). Additionally, we explored whether the factor solutions were sensitive to the choice of extraction and rotation method used in the analysis by re-running the models using principal axis factoring extraction and direct oblimin rotation. Using a non-orthogonal rotation method allowed factors in the model to be correlated, in contrast to (orthogonal) Varimax rotation, where the relaxed assumption of correlated factors does not apply.

The EFA model was conducted using participants completing at least two causal items (i.e. that could be used to generate a single correlation value to add to the analysis). As the analysis was exploratory, 95% CIs were not calculated. Item normality was therefore less of an issue as maximum likelihood parameter estimates have been shown to be robust even when items do not follow a normal distribution (Muthen & Kaplan, 1985).

Results

Sample

The numbers of participants in each of the three illness groups were: knee pain $n = 393$; hand pain $n = 2113$ and back pain $n = 1591$. Missing data rates were low for all groups: knee pain 0–3%; hand pain 4–13% and back pain 1–3%. The majority of items were not normally distributed by our skew and kurtosis criteria: knee pain 95%; hand pain 98% and back pain 96%. Mardia's coefficient of multivariate Kurtosis was significant in all factor models, rejecting the hypothesis of multivariate normality.

Seven-factor CFA

Table 3 gives the standardised regression coefficients for the seven-factor CFA model applied to the three 'illness' groups. All standardised regression coefficients were statistically significant, and the majority were greater than 0.4. The goodness-of-fit statistics for the seven-factor model (Table 4) were below our criteria for defining a good model, although one fit index (PGFI) did exceed our threshold of 0.5. Table 5 shows the estimated correlations between the dimensions. All correlations were between plus and minus one. Four dimension pairs had a correlation greater than 0.5 in at least one illness group e.g. personal and treatment control or consequences and emotional representations.

As the seven-factor model did not meet our criteria for good model fit, modification indices were examined. In all three data sets, it was suggested that model fit would be improved if correlated error terms were added to the following items in the model: (1) 'Nothing I do will affect my X problem' (Personal Control) with 'My actions will have no effect on the outcome of my X problem' (Personal Control); (2) 'There is very little that can be done to improve my X problem' (Treatment Control) with 'There is nothing which can help my X problem' (Treatment Control) and (3) 'Having this problem makes me feel anxious' (Emotional Representation) with 'Having this problem makes me feel afraid' (Emotional Representation).

Table 4. Model goodness-of-fit for the seven-factor CFA model.

	Problem area		
	Knee ($n = 330$)	Hand ($n = 1621$)	Back ($n = 1319$)
Goodness of fit measure			
Chi-square (χ^2)	1506 (d.f. = 644, $p < 0.001$)	5471 (d.f. = 644, $p < 0.001$)	3629 (d.f. = 644, $p < 0.001$)
GFI	0.80	0.82	0.85
PGFI	0.69	0.71	0.74
CFI	0.86	0.86	0.90
RMSEA (90% CI)	0.064 (0.060, 0.068)	0.068 (0.066, 0.070)	0.059 (0.057, 0.061)

As these item pairs also produced relatively large standardised residuals and, for items in the first two pairings, had factor loadings less than 0.4 in at least one dataset, it was decided to re-run the model excluding these six items. After re-running the model, the following goodness-of-fit statistics were obtained: knee pain: chi-square = 1038.45 (degrees of freedom, d.f. = 443), GFI = 0.83, PGFI = 0.70, CFI = 0.89, RMSEA = 0.064 (95% CI (0.059, 0.069)); hand pain: chi-square = 3456.19 (d.f. = 443), GFI = 0.86, PGFI = 0.72, CFI = 0.90, RMSEA = 0.065 (95% CI (0.063, 0.067)); back pain: chi-square = 2415.34 (d.f. = 443), GFI = 0.89, PGFI = 0.74, CFI = 0.92, RMSEA = 0.058 (95% CI (0.056, 0.060)). Although the revised model showed a statistically significant improvement in chi-square model fit for all datasets ($p < 0.001$), this improvement was not reflected by the remaining fit indices; improvement in these indices was small and the revised model did not achieve our criteria for good model fit.

Causal items EFA

The causal items were suitable for EFA in all three pain groups (Bartlett's test was statistically significant ($p < 0.05$) and KMO was > 0.88 in all datasets). The EFA models (based on extracting the number of factors with eigenvalues >1) gave models that varied in the number of factors extracted (Table 6) and that accounted for 62%, 56% and 51% of the variance respectively in the knee, hand and back pain data. The EFA models did not show an interpretable factor structure that was replicated across the three data samples (Table 6). Constraining the factor model to only extract four factors did not improve interpretability of the model solution (Table 7). The overall conclusion of the analysis was not changed by altering the extraction and rotation method used in the analysis (data not shown).

Sensitivity analyses

For the seven-factor CFA model, incorporating missing data had little impact on the regression coefficients and factor correlations (the mean absolute difference in estimates from the model with and without missing data was less than 0.02, with a

Table 5. Inter-correlations between IPQ-R dimensions as estimated from the seven-factor CFA model.

	Timeline acute/chronic	Timeline cyclical	Consequences	Personal control	Treatment control	Illness coherence	Emotional representation
Timeline acute/chronic							
Knee pain	1						
Hand pain	1						
Back pain	1						
Timeline cyclical							
Knee pain	−0.05 (−0.17, 0.08)	1					
Hand pain	−0.22 (−0.27, −0.17)	1					
Back pain	0.13 (0.06, 0.20)	1					
Consequences							
Knee pain	**0.48** (0.37, 0.57)	−0.14 (−0.24, −0.03)	1				
Hand pain	**0.31** (0.22, 0.38)	−0.04 (−0.10, 0.02)	1				
Back pain	**0.62** (0.57, 0.66)	0.10 (0.04, 0.18)	1				
Personal Control							
Knee pain	−0.22 (−0.34, −0.08)	0.14 (0.01, 0.28)	−0.13 (−0.26, 0.03)	1			
Hand pain	−0.33 (−0.39, −0.28)	0.26 (0.20, 0.30)	−0.18 (−0.25, −0.11)	1			
Back pain	−0.33 (−0.38, −0.28)	0.01 (−0.06, 0.08)	−0.30 (−0.36, −0.24)	1			
Treatment control							
Knee pain	**−0.26** (−0.37, −0.14)	−0.07 (−0.18, 0.07)	−0.02 (−0.15, 0.09)	**0.54** (0.44, 0.62)	1		
Hand pain	**−0.39** (−0.44, −0.33)	0.22 (0.17, 0.28)	−0.20 (−0.27, −0.14)	**0.66** (0.62, 0.71)	1		
Back pain	**−0.64** (−0.68, −0.60)	−0.07 (−0.15, −0.01)	−0.44 (−0.49, −0.38)	**0.58** (0.53, 0.63)	1		
Illness coherence							
Knee pain	−0.19 (−0.29, −0.08)	0.14 (0.03, 0.25)	0.00 (−0.14, 0.09)	−0.26 (−0.37, −0.16)	0.04 (−0.06, 0.18)	1	
Hand pain	−0.15 (−0.20, −0.10)	0.15 (0.09, 0.20)	0.12 (0.06, 0.17)	0.00 (−0.05, 0.06)	0.07 (0.02, 0.13)	1	
Back pain	0.14 (0.10, 0.20)	0.24 (0.18, 0.29)	0.22 (0.17, 0.27)	−0.27(−0.32, −0.21)	−0.21 (−0.27, −0.16)	1	
Emotional representation							
Knee pain	0.11 (−0.02, 0.21)	0.05 (−0.07, 0.17)	**0.52** (0.40, 0.60)	−0.19 (−0.33, −0.05)	−0.04 (−0.14, 0.11)	0.17 (0.06, 0.26)	1
Hand pain	0.14 (0.09, 0.20)	0.00 (−0.06, 0.06)	**0.66** (0.61, 0.70)	−0.09 (−0.16, −0.05)	−0.11 (−0.16, −0.05)	0.21 (0.16, 0.26)	1
Back pain	0.47 (0.42, 0.51)	0.15 (0.09, 0.23)	**0.71** (0.69, 0.74)	−0.28 (−0.34, −0.22)	−0.35 (−0.40, −0.28)	0.31 (0.26, 0.37)	1

Notes: Figures are estimated dimension correlations and 90% bias-adjusted CIs.
Bold indicates dimensions with a correlation >0.5 in at least one dataset
Knee pain $n = 330$, hand pain $n = 1621$ and back pain $n = 1319$.

Table 6. EFA of illness cause.

	Knee pain					Hand pain				Back pain		
	Component					Component				Component		
	1	2	3	4	5	1	2	3	4	1	2	3
Psychological attributions												
Stress or worry	0.36	0.21	**0.65**		−0.13	**0.78**	0.13			**0.63**	0.26	−0.28
My mental attitude, e.g. thinking about life negatively	**0.69**	0.32	0.17		0.11	**0.78**	0.18	0.23		**0.73**	0.34	
Family problems or worries caused by my X problem	**0.68**	0.30	0.27	0.12		**0.80**	0.12	0.22		**0.75**	0.26	−0.11
Overwork	**0.57**			−0.22	0.18	0.20		**0.52**		0.24	**0.66**	
My emotional state, e.g. feeling down, lonely, anxious, empty	**0.76**	0.26	0.23			**0.68**	0.24	0.13		**0.75**	0.28	−0.11
My personality	0.38	**0.72**		0.14	0.13	0.49	0.54	0.20		**0.70**	0.13	0.25
Risk factors												
Hereditary – it runs in my family		0.15	**0.68**	−0.20	0.20	0.21		−0.14	**0.70**	**0.45**	0.24	−0.25
Diet or eating habits	0.27	0.17	**0.68**	0.17	0.26	0.52	0.18	0.17	0.50	**0.61**	0.25	
Poor medical care in the past	**0.59**			0.26		0.54		0.38	0.17	**0.46**	0.15	0.14
My own behaviour	0.16			0.47	**0.67**	0.29	0.12	**0.58**			**0.71**	0.13
Ageing	0.13		0.20	−0.27	**0.73**				**0.70**	0.20	**0.64**	
Smoking	0.13	**0.82**	0.16			0.20	**0.85**		0.14	**0.71**		0.24
Alcohol	0.25	**0.82**	0.16			0.23	**0.83**		0.19	**0.73**		0.22
Immunity												
A germ or virus	0.40	0.16	**0.71**			**0.66**	0.13	0.20	0.31	**0.72**		
Pollution in the environment	**0.64**	0.22	0.35	0.16		**0.60**	0.11	0.28	0.35	**0.77**	0.14	
Altered immunity	0.22	**0.56**	0.31		0.12	0.29	0.26	0.27	0.41	**0.69**	0.14	0.13
Accident/chance												
Chance or bad luck	0.23		0.19	**0.64**	−0.24	0.22		**0.60**	0.16	0.18	0.16	**0.49**
Accident or injury		0.13	−0.13	**0.73**	0.10	−0.10	0.46	0.61				**0.76**

Notes: X = word substituted with reference to relevant body area: knee, back or hand. Factor loadings <0.1 are not shown. The item's highest loading is shown in bold if the item does not cross-load on another factor. The number of factors extracted is based on the number of eigenvalues >1.

Table 7. EFA of illness cause items with the number of factors fixed to be 4.

	Knee pain				Hand pain				Back pain			
	Component				Component				Component			
	1	2	3	4	1	2	3	4	1	2	3	4
Psychological attributions												
Stress or worry	**0.70**	0.21	−0.19		**0.78**	0.13			0.20	**0.77**	0.12	−0.10
My mental attitude eg thinking about life negatively	**0.61**	0.37	0.20		**0.78**	0.18	0.23		0.39	**0.69**	0.24	
Family problems or worries caused by my X problem	**0.69**	0.34	0.17		**0.80**	0.12	0.22		0.36	**0.75**	0.14	
Overwork	**0.44**	0.13		0.19	0.20		**0.52**		0.15	0.22	**0.65**	
My emotional state e.g. feeling down, lonely, anxious, empty	**0.71**	0.31	0.11		**0.68**	0.24	0.13		0.37	**0.74**	0.17	
My personality	0.30	**0.74**	0.23		0.49	0.54	0.20		**0.60**	0.38	0.12	0.22
Risk factors												
Hereditary – it runs in my family	0.33	0.11	−0.40	0.40	0.21		−0.14	**0.70**	0.36	0.28	0.26	−0.31
Diet or eating habits	**0.63**	0.14		0.38	0.52	0.18	0.17	0.50	0.48	0.39	0.24	
Poor medical care in the past	0.45	0.14	0.39		0.54		0.38	0.17	0.31	0.36	0.11	0.18
My own behaviour	0.10		0.61	0.56	0.29	0.12	**0.58**			0.19	**0.67**	0.19
Ageing	0.12			**0.78**				**0.70**	0.29		**0.72**	
Smoking	0.18	**0.82**			0.20	**0.85**		0.14	**0.77**	0.17		
Alcohol	0.27	**0.83**			0.23	**0.83**		0.19	**0.79**	0.19	0.13	
Immunity												
A germ or virus	**0.77**	0.15	−0.13	0.11	**0.66**	0.13	0.20	0.31	**0.61**	0.39		
Pollution in the environment	**0.70**	0.25	0.18	0.11	**0.60**	0.11	0.28	0.35	0.57	0.52	0.11	
Altered immunity	0.34	**0.56**		0.18	0.29	0.26	0.27	0.41	**0.67**	0.27	0.18	
Accident/chance												
Chance or bad luck	0.38		0.47	−0.29	0.22		**0.60**	0.16		0.29		**0.64**
Accident or injury		0.10	**0.68**		−0.10	0.46	0.61		0.13	−0.23		**0.72**

Notes: X = word substituted with reference to relevant body area: knee, back or hand. Factor loadings < 0.1 are not shown. The item's highest loading is shown in bold if the item does not cross-load on another factor. The number of factors extracted was fixed at 4.

standard deviation of less than 0.02, for all factor models and illness groups). The conclusions from the seven-factor CFA models also did not change when the ADF estimation method was used; however, this was only tested in the hand and back pain samples. This was because the sample size in the knee pain group was too small for the ADF model to run.

Discussion

We used CFA to investigate if the seven hypothesised dimensions of the IPQ-R questionnaire (timeline acute/chronic, timeline cyclical, consequences, personal control, treatment control, illness coherence and emotional representation) were distinct when tested in primary care/community-based patients with regional musculoskeletal knee, hand or back pain. We found in all samples that a seven-factor model did not meet all our criteria for good model fit. Although model fit improved, we still could not conclude good model fit when six items were removed from the model. An EFA of the 18 causal items also produced an unstable factor structure that could not be interpreted, and did not replicate in the knee, hand and back pain samples.

Although the seven-factor model was below our criteria for good model fit, this finding is in line with several other studies that have previously explored the factor structure of the IPQ-R for a wide range of patient populations (e.g. cancer (Dempster & McCorry, 2012; Giannousi et al., 2010; Hagger & Orbell, 2005), atopic dermatitis (Wittkowski et al., 2008), mild brain injury (Snell et al., 2010), hypertension (Chen et al., 2008), depression (Cabassa et al., 2008), fibromyalgia (van Ittersum et al., 2009) and renal disease (Chilcot et al., 2012)). These studies have all shown some support for the seven-factor model, but this has only been achieved by removing selected items from the questionnaire to improve model fit (for example, by removing the items 'The problem with my cervix strongly affects the way others see me' and 'The problem with my cervix has serious financial consequences', Hagger and Orbell (2005) reported improvement in the fit of the factor model). This suggests that the item content relating to the seven dimensions has the potential to be valid if assessed using a subset of items from the seven dimensions of the full IPQ-R; however, it remains inconsistent across studies and clinical conditions as to which specific items to remove to make this part of the questionnaire fit the data well.

One potential reason why the seven-factor model does not generally provide a good fit to the data could be related to the presentation of items to respondents. Most dimensions present a mixture of positively and negatively worded items, which may confuse some respondents, and limit the overall consistency of within dimension response. There is some evidence in our data (suggested by the modification indices) that positively worded items are more highly correlated with each other than negatively worded items, and vice-versa. This has also been supported in the factor model reported by Wittkowski et al. (2008) who showed that for patients with atopic dermatitis, the two negatively worded treatment control items loaded on a separate factor to the remaining treatment control items, suggesting a different correlation pattern between the positively and negatively worded items. In addition, Cabassa et al. (2008) found that dropping the negatively worded items in the personal and the

treatment control subscales improved model fit when evaluating the IPQ-R in a depression context.

In our study, we have shown a high correlation between the personal and treatment control, and emotional and consequences dimensions of the IPQ-R, similar to (Brink, Alsen, & Cliffordson, 2011; Dempster & McCorry, 2012; Snell et al., 2010; Wittkowski et al., 2008). This suggests that such correlations are likely to arise independently of the clinical condition of interest, although it is noted in one study (Hagger & Orbell, 2005) that a low correlation between personal and treatment control was observed. For the musculoskeletal pain patients in this study, a high correlation between personal and treatment control could be anticipated as many patients will not have (yet) received much in the way of treatment for their condition so issues around treatment effectiveness may not be easily distinguished from those relating to personal control. Also, the association between emotional representations and consequences is likely, as it is expected that the more consequences a health condition is perceived to have, the greater the emotional impact. Our findings therefore do not contradict the proposition of overlap between the cognitive and emotional dimensions of the CSM model (Leventhal et al., 1980).

Although the seven-factor model shows some replication to other studies, there is less support for the factor structure of the causal items, with several studies, like ours, producing factors that cannot be interpreted (Snell et al., 2010; Wittkowski et al., 2008). However, it has been reported in two cancer studies (Giannousi et al., 2010; Hagger & Orbell, 2005) and one diabetes study (Abubakari et al., 2012), that after the causal items have been modified to relate solely to the condition of interest (either by removing items or including new items not in the original IPQ-R), an interpretable solution was achieved producing a solution based on three factors rather than the four proposed in the original development of the IPQR (psychological attribution, risk factors, immunity and accident/chance). This suggests that a satisfactory factor solution could potentially be found if the list of causal items were sufficiently modified to more clearly relate specifically to musculoskeletal pain patients.

We also note that a potential reason why our CFA and EFA factor models do not fit our data well could be related to our sample selection. Participants in our studies were recruited from primary/community-care settings so include a broad spectrum of patients that vary by severity and duration of their pain problem; they include those with longstanding pain problems and those with more acute and episodic pain problems, who may not consider their musculoskeletal problem a diagnosed ‘illness’. Additionally, participants in the hand pain sample may not have consulted a health professional about their problem, simply seeing their problem as part of getting older, rather than an illness for which medical intervention is needed. As development and validation research of the IPQ-R has largely been based in hospital/secondary care settings, it is possible that the IPQ-R items do not provide sufficient breadth to explain the cognitive representations for the broad spectrum of musculoskeletal pain patients that are likely to be present in primary/community-care settings.

Strengths and weaknesses

A strength of our study is that large patient samples have been used which represent a wide range of patients by age, type of regional musculoskeletal pain problem and

study recruitment method (from GP consultation, physiotherapy referrals and from the community). The completion rate of the IPQ-R was also satisfactory (Bowling, 2002). Taken together, these factors improve both the generalisability and validity of our study findings. We have also completed a sensitivity analysis to ensure that excluding participants with missing data from the CFA did not influence our findings.

The majority of data in this study did not follow a normal distribution and was not measured on a continuous scale. We accounted for this by using bootstrapping to estimate our CIs; bootstrapping is more reliable than maximum likelihood when data are not normally distributed (Byrne, 2001). Furthermore, a simulation study concluded that CFA techniques are robust to departures from continuous measurement if the number of likert categories is greater than four (Byrne, 2001).

Implications

The IPQ-R has been developed to be applicable to a wide range of conditions and the authors of the IPQ-R (Moss-Morris et al., 2002) encourage researchers to modify the questionnaire to be specific to the condition under study. As we have not shown clear support for the factor structure of the IPQ-R, our findings suggest that a modified version of the IPQ-R is likely to be needed for use with musculoskeletal pain patients in the future. This could potentially be achieved by shortening the IPQ-R and removing items that did not fit the model well.

We went some way to explore this using exploratory analysis to remove six items from the seven-factor model. Although these models did not meet the criteria for a well fitting model, their removal improved the fit of the model in all data samples. A shorter version of the IPQ-R would be useful for research studies where reducing respondent burden is important, for example when information on illness perceptions is sought alongside many other outcome measures of interest. A short version of the IPQ-R has been developed as a generic measure of illness perceptions that can be applied to all conditions (Broadbent, Petrie, Main, & Weinman, 2006); however, a short-form IPQ-R that is specific to musculoskeletal pain requires further exploration.

In the absence of clear support for the factor structure of the causal items in the IPQ-R, further work is needed to fully explore patient's perceptions of the cause of their musculoskeletal pain, and to investigate if the new causes identified fit with the broad dimension headings suggested by the developers of the IPQ-R (Moss-Morris et al., 2002). There have been some attempts to begin to do this for low back pain (Dean, 2003) and hand/knee pain (Peat, Handy, Mallen, Hill, & Dziedzic, 2009), however further work is needed to more clearly incorporate these items into the causal dimension of the IPQ-R and test their validity in a revised causal scale.

Conclusion

We tested whether the hypothesised factor structure of the IPQ-R is supported in three samples of patients with common musculoskeletal pain (knee, hand and back pain). Although there is theoretical justification for a seven-factor model, our data show potential overlap between items across the IPQ-R dimensions resulting in goodness-of-fit statistics that did not meet our criteria for a good model fit. We also

have been unable to demonstrate a clear factor structure for the causal items on the questionnaire. Further work is therefore needed to improve, and ideally, shorten the IPQ-R for use with patients with common musculoskeletal pain problems.

Acknowledgements

The three studies included in this analysis were supported by Arthritis Research UK, the Medical Research Council and the North Staffordshire Primary Care Research Consortium in the UK. The authors would like to thank the Principal Investigators for use of the data, the administrative and health informatics staff and the three study teams at the Arthritis Research UK Primary Care Centre, Keele University. We also thank the Keele General Practice Partnership, the regional research network of physiotherapists and participating clinicians and patients. We are also grateful to Professor Elaine Hay, Dr Elaine Thomas and Professor Krysia Dziedzic for helpful comments on the manuscript.

References

Abubakari, A.R., Jones, M.C., Lauder, W., Kirk, A., Devendra, D., & Anderson, J. (2012). Psychometric properties of the revised illness perception questionnaire: Factor structure and reliability among african-origin populations with type 2 diabetes. *International Journal of Nursing Studies, 49*, 672–681.

Arbuckle, J. (2003). *Analysis of moment structures (AMOS) version 6.0*. Chicago, IL: SPSS Inc.

Bellamy, N. (1996). *WOMAC osteoarthritis index. A user's guide*. Ontario: London Health Services Centre, McMaster's University.

Bellamy, N., Campbell, J., Haraoui, B., Buchbinder, R., Hobby, K., Roth, J.H., & MacDermid, J.C. (2002). Dimensionality and clinical importance of pain and disability in hand osteoarthritis: Development of the Australian/Canadian (AUSCAN) osteoarthritis hand index. *Osteoarthritis and Cartilage/OARS, Osteoarthritis Research Society, 10*, 855–862.

Bowling, A. (2002). *Research methods in health: Investigating health and health services*. Buckingham: Open University Press.

Brink, E., Alsen, P., & Cliffordson, C. (2011). Validation of the revised illness perception questionnaire (IPQ-R) in a sample of persons recovering from myocardial infarction – The Swedish version. *Scandinavian Journal of Psychology, 52*, 573–579.

Broadbent, E., Petrie, K.J., Main, J., & Weinman, J. (2006). The brief illness perception questionnaire. *Journal of Psychosomatic Research, 60*, 631–637.

Byrne, B.M. (2001). *Structural equation modeling with AMOS. Basic concepts, applications and programming*. Mahwah, NJ: Lawrence Erlbaum Associates.

Cabassa, L.J., Lagomasino, I.T., Dwight-Johnson, M., Hansen, M.C., & Xie, B. (2008). Measuring Latinos' perceptions of depression: A confirmatory factor analysis of the illness perception questionnaire. *Cultural Diversity & Ethnic Minority Psychology, 14*, 377–384.

Chen, S.L., Tsai, J.C., & Lee, W.L. (2008). Psychometric validation of the chinese version of the illness perception questionnaire-revised for patients with hypertension. *Journal of Advanced Nursing, 64*, 524–534.

Chilcot, J., Norton, S., Wellsted, D., & Farrington, K. (2012). The factor structure of the revised illness perception questionnaire (IPQ-R) in end-stage renal disease patients. *Psychology, Health & Medicine, 17*, 578–588.

Dean, S. G. (2003). *Adherence to physiotherapy for low back pain: An illness perception approach* (Unpublished thesis submitted for Doctor of Philosophy). Guy's, King's and St Thomas' Medical and Dental Schools, King's College, London.

Dempster, M., & McCorry, N.K. (2012). The factor structure of the revised illness perception questionnaire in a population of oesophageal cancer survivors. *Psycho-Oncology, 21*, 524–530.

Ferguson, E., & Cox, T. (1993). Exploratory factor analysis: A users' guide. *International Journal of Selection and Assessment, 1*, 84–94.

Foster, N.E., Bishop, A., Thomas, E., Main, C., Horne, R., Weinman, J., & Hay, E. (2008). Illness perceptions of low back pain patients in primary care: What are they, do they change and are they associated with outcome? *Pain, 136*, 177–187.

Foster, N.E., Thomas, E., Barlas, P., Hill, J.C., Young, J., Mason, E., & Hay, E.M. (2007). Acupuncture as an adjunct to exercise based physiotherapy for osteoarthritis of the knee: Randomised controlled trial. *BMJ (Clinical Research Ed.)*, *335*, 436–448.

French, D.P., Cooper, A., & Weinman, J. (2006). Illness perceptions predict attendance at cardiac rehabilitation following acute myocardial infarction: A systematic review with meta-analysis. *Journal of Psychosomatic Research, 61*, 757–767.

Giannousi, Z., Manaras, I., Georgoulias, V., & Samonis, G. (2010). Illness perceptions in greek patients with cancer: A validation of the revised-illness perception questionnaire. *Psycho-Oncology, 19*, 85–92.

Hagger, M.S., & Orbell, S. (2005). A confirmatory factor analysis of the revised illness perception questionnaire (IPQ-R) in a cervical screening context. *Psychology & Health, 20*, 161–173.

Hill, S., Dziedzic, K., Thomas, E., Baker, S.R., & Croft, P. (2007). The illness perceptions associated with health and behavioural outcomes in people with musculoskeletal hand problems: Findings from the north Staffordshire osteoarthritis project (NorStOP). *Rheumatology (Oxford, England), 46*, 944–951.

Hobro, N., Weinman, J., & Hankins, M. (2004). Using the self-regulatory model to cluster chronic pain patients: The first step towards identifying relevant treatments? *Pain, 108*, 276–283.

Hu, L., & Bentler, P.M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6*(1), 1–55.

IBM (2011). *SPSS version 20.0*. Retrieved from http://www-01.ibm.com/software/analytics/spss/

Jordan, K.P., Kadam, U.T., Hayward, R., Porcheret, M., Young, C., & Croft, P. (2010). Annual consultation prevalence of regional musculoskeletal problems in primary care: An observational study. *BMC Musculoskeletal Disorders, 11*, 144–155.

Leventhal, H., Meyer, D., & Nerenz, D.R. (1980). The common-sense representations of illness danger. In S. Rachman (Ed.), *Contributions to medical psychology* (Vol. 2, pp. 17–30). New York, NY: Pergamon Press.

MacCallum, R.C., Browne, M.W., & Sugawara, H.M. (1996). Power analysis and determination of sample size for covariance structure modeling. *Psychological Methods, 1*, 130–149.

Mardia, K.V. (1970). Measures of multivariate skewness and kurtosis with applications. *Biometrika, 57*, 519–530.

Moss-Morris, R., & Chalder, T. (2003). Illness perceptions and levels of disability in patients with chronic fatigue syndrome and rheumatoid arthritis. *Journal of Psychosomatic Research, 55*, 305–308.

Moss-Morris, R., Weinman, J., Petrie, K.J., Horne, R., Cameron, L.D., & Buick, D. (2002). The revised illness perception questionnaire (IPQ-R). *Psychology & Health, 17*, 1–16.

Mulaik, S.A., James, L.R., Vanalstine, J., Bennett, N., Lind, S., & Stilwell, C.D. (1989). Evaluation of goodness-of-fit indexes for structural equation models. *Psychological Bulletin, 105*, 430–455.

Muthen, B., & Kaplan, D. (1985). A comparison of some methodologies for the factor-analysis of non-normal likert variables. *British Journal of Mathematical & Statistical Psychology, 38*, 171–189.

Office for National Statistics (ONS) (2002). *The national statistics socioeconomic classification user manual (version 1)*. London: Office for National Statistics.

Olinsky, A., Chen, S., & Harlow, L. (2003). The comparative efficacy of imputation methods for missing data in structural equation modeling. *European Journal of Operational Research, 151*, 53–79.

Orbell, S., Johnston, M., Rowley, D., Espley, A., & Davey, P. (1998). Cognitive representations of illness and functional and affective adjustment following surgery for osteoarthritis. *Social Science & Medicine (1982), 47*, 93–102.

Peat, G., Handy, J., Mallen, C., Hill, S., & Dziedzic, K. (2009). Lay symptom attributions for knee pain and hand pain: A cross-sectional study. *Rheumatology, 48*, I12–I12.

Roland, M., & Morris, R. (1983). A study of the natural history of back pain. Part I: Development of a reliable and sensitive measure of disability in low-back pain. *Spine, 8*, 141–144.

Snell, D.L., Siegert, R.J., Hay-Smith, E.J., & Surgenor, L.J. (2010). An examination of the factor structure of the revised illness perception questionnaire modified for adults with mild traumatic brain injury. *Brain Injury, 24*, 1595–1605.

Tabachnick, B.G., & Fidell, L.S. (2007). *Using multivariate statistics*. Boston, MA: Pearson/Allyn & Bacon.

Thomas, E., Wilkie, R., Peat, G., Hill, S., Dziedzic, K., & Croft, P. (2004). The north Staffordshire osteoarthritis project – NorStOP: Prospective, 3-year study of the epidemiology and management of clinical osteoarthritis in a general population of older adults. *BMC Musculoskeletal Disorders, 5*, 2–9.

van Ittersum, M.W., van Wilgen, C.P., Hilberdink, W.K., Groothoff, J.W., & van der Schans, C.P. (2009). Illness perceptions in patients with fibromyalgia. *Patient Education and Counseling, 74*, 53–60.

Weinman, J., Petrie, K.J., MossMorris, R., & Horne, R. (1996). The illness perception questionnaire: A new method for assessing the cognitive representation of illness. *Psychology & Health, 11*, 431–445.

White, K.P., & Harth, M. (1999). The occurrence and impact of generalized pain. *Bailliere's Best Practice & Research Clinical Rheumatology, 13*, 379–389.

Wittkowski, A., Richards, H.L., Williams, J., & Main, C.J. (2008). Factor analysis of the revised illness perception questionnaire in adults with atopic dermatitis. *Psychology, Health & Medicine, 13*, 346–359.