

Using the Common Sense Model of Illness Perceptions to Examine Osteoarthritis Change: A 6-Year Longitudinal Study

Ad A. Kaptein, Jessica Bijsterbosch,
and Margreet Scharloo

Leiden University Medical Center, Leiden, the Netherlands

Sarah E. Hampson

Oregon Research Institute, Eugene, Oregon

Herman M. Kroon and Margreet Kloppenburg
Leiden University Medical Center, Leiden, the Netherlands

Objective: To examine the association between changes in common sense models and changes in functional status over a 6-year follow-up in patients with osteoarthritis. **Design:** At baseline and follow-up, osteoarthritis outpatients ($N = 241$) recruited from a university medical center completed the Illness Perception Questionnaire—Revised (IPQ-R), the Australian/Canadian Osteoarthritis Hand Index, and the Western Ontario and McMaster Universities Osteoarthritis Index. Also, their physician-assessed pain intensity, and biomedical, and clinical measures of medical severity of osteoarthritis were recorded. **Main outcome measures:** Functional disability, pain intensity. **Results:** Over 6 years, functional disability and pain intensity increased. The IPQ-R dimensions of timeline, personal control, and illness coherence became more negative, and emotional representations became less negative (i.e., more accepting). Patients identified as sharing a similar profile of negative changes on the IPQ-R had significantly worse functioning on 2 of 3 outcomes, independent of objectively measured osteoarthritis severity. **Conclusions:** Changes in illness perceptions were associated with changes in outcomes. Interventions to prevent increasingly negative patterns of illness perceptions over time, with an emphasis on strengthening control cognitions, may benefit functional status outcomes in patients with osteoarthritis.

Keywords: common sense model, illness perceptions, longitudinal design, osteoarthritis, self-management

The outcome of medical care for patients with chronic physical illness is determined to a considerable extent by nonmedical factors (e.g., Leventhal, Weinman, Leventhal, & Phillips, 2008). According to the common sense model (CSM), illness perceptions (both cognitive and emotional) and coping responses are determinants of medical outcomes (Leventhal, Brissette, & Leventhal, 2003). There is considerable evidence in support of various aspects of the CSM, although studies of processes by which illness perceptions change and the health consequences of these changes remain relatively rare (Hagger & Orbell, 2003). The present study examined the association between changes in illness perceptions and changes in functional status over a 6-year follow-up period for patients with osteoarthritis (OA).

Longitudinal studies of illness perceptions for a chronic illness create the opportunity to examine whether illness perceptions

change over time. We are aware of only three previous longitudinal studies in which changes in illness perceptions were examined together with change in health status. Foster et al. (2008) found that the changes seen in several dimensions of the Illness Perception Questionnaire—Revised (IPQ-R; Moss-Morris, Weinman, Petrie, Horne, Cameron, & Buick, 2002; see also the Illness Perception Questionnaire Web site at <http://www.uib.no/ipq/index.html>) were different in patients with low back pain who had a good clinical outcome compared with those who had a poor outcome at 6-month follow-up. Furze, Lewin, Murberg, Bull, and Thompson (2005) found that change in beliefs about angina was the most significant predictor for physical status at 1-year follow-up. In a large sample of recently diagnosed patients with Type 2 diabetes, self-management and a patient education program led to changes in illness perceptions, with consequent changes in quality of life and metabolic control at the 3-month follow-up (Skinner et al., 2006).

Our study also enabled the exploration of a new theoretical issue regarding illness perceptions, namely the examination of clusters of persons characterized by similar change profiles across dimensions of illness perception and the relation of these clusters to changes on various outcomes. The developers of the CSM have emphasized the potential value of examining interrelations between combinations of illness perceptions as predictors of outcomes in patients with chronic physical illness (Leventhal et al.,

Ad A. Kaptein and Margreet Scharloo, Unit of Psychology, Leiden University Medical Center, Leiden, the Netherlands; Jessica Bijsterbosch and Margreet Kloppenburg, Department of Rheumatology, Leiden University Medical Center, Leiden, the Netherlands; Sarah E. Hampson, Oregon Research Institute, Eugene, Oregon; Herman M. Kroon, Department of Radiology, Leiden University Medical Center, Leiden, the Netherlands.

Correspondence concerning this article should be addressed to Ad A. Kaptein, Unit of Psychology, Leiden University Medical Center (LUMC), P.O. Box 9600 [post zone J9, r.84], 2300 RC Leiden, the Netherlands. E-mail: a.a.kaptein@lumc.nl

2003). Clatworthy, Hankins, Buick, Weinman, and Horne (2007) took up this challenge and maintained that “people do not hold illness representations in isolation, they are part of a schema . . . when it comes to the analysis, it may be more appropriate to use a method that takes into account all aspects of a patient’s illness schema. . . . cluster analysis enables the identification of groups of people who share similar illness perceptions, and the utility of the CSM in predicting coping and outcome from these beliefs can still be tested” (p. 125). An objective of our study, therefore, was to determine whether there would be differences on outcomes between groups of patients identified as sharing similar patterns of change in illness perceptions.

OA is one of the most common chronic conditions in elderly persons in developed societies, with a significant impact on their quality of life (e.g., Theis, Helmick, & Hootman, 2007). Current treatment for OA includes pharmacological therapy to alleviate the impact of inflammation and pain, physiotherapy to facilitate activities of daily living, and psychosocial interventions to reduce the negative psychosocial effects and to encourage social participation in society (Dieppe & Lohmander, 2005; Kratz, Davis, & Zautra, 2007; Newman, Steed, & Mulligan, 2004). We are aware of 13 previous empirical studies in which illness perceptions of OA patients were addressed (Appelt, Burant, Siminoff, Kwok, & Ibrahim, 2007; Ballantyne, Gignac, & Hawker, 2007; Botha-Scheepers et al., 2006; Elder, 1973; Ferreira & Sherman, 2007; Gignac, Cott, & Badley, 2002; Hampson & Glasgow, 1996; Hampson, Glasgow, & Zeiss, 1994; Hill, Dziedzic, Thomas, Baker, & Croft, 2007; Hudak et al., 2002; Orbell, Johnston, Rowley, Espley, & Davey, 1998; Peat, Greig, Wood, Wilkie, Thomas, & Croft, 2005; Toye, Barlow, Wright, & Lamb, 2006). These studies corroborate the CSM by demonstrating that OA patients’ illness perceptions are associated with limitations in daily activities, well-being, health status, and quality of life. A pattern emerged across these various studies to indicate that more negative perceptions of OA were associated with more functional disability. However, these studies shared the limitation of being cross-sectional, precluding inferences about causes and effects.

In the recent Genetics, Arthritis and Progression (GARP) study (Riyazi et al., 2005) illness perceptions were assessed at entry and 6 years later. The aim of the GARP cohort study is to identify determinants of OA susceptibility and progression (Riyazi et al., 2005). Given the longitudinal design of the GARP study and the detailed and objective assessments of biomedical and clinical characteristics, this study allowed examination of the association between changes in illness perceptions and changes in functional status over an extended follow-up period, controlling for various indicators of health status. Although OA is a chronic condition, treatment and self-management activities can prevent further decline in, or even improve, functional status. Over a 6-year follow-up, there is ample opportunity for illness perceptions to change in response to changes in health status and for health status to change in response to coping activities prompted by illness perceptions. In furtherance of Leventhal et al.’s (2003) and Clatworthy et al.’s (2007) work, we hypothesized that a group of patients sharing similar positive changes in illness perceptions would have reductions in functional impairments, whereas the patients with negative changes in illness perceptions would have a greater degree of functional impairment.

Method

Participants and Recruitment

The GARP study population comprises Caucasian sib-pairs of Dutch ancestry with familial OA at multiple sites. Details on the recruitment, selection, and inclusion have been published elsewhere (Riyazi et al., 2005). Patients were included in the study through rheumatology and orthopedic outpatient clinics or through practices of general practitioners (family physicians). Patients with secondary OA, familial syndromes with a clear Mendelian inheritance pattern, or a shortened life expectancy were excluded. The GARP study was approved by the Medical Ethics Committee of the Leiden University Medical Center, Leiden, the Netherlands.

OA diagnosis. All patients had familial OA. The OA had to have a polyarticular or generalized nature, defined as OA at multiple sites. Patients were eligible for inclusion if they had symptomatic OA at multiple joint sites in the hand or with OA in two or more of the following joint sites: hand, spine, knee, or hip. Patients with just one symptomatic joint site with OA were required to have structural abnormalities (radiographic OA or bony swelling) in at least one other joint site. This phenotype is in accordance with the definition by Kellgren and Lawrence of generalized OA (Kellgren & Moore, 1952; Lawrence, 1963). The generalized nature of the disease was not the same in all patients; for example, a combination of hand and spine or of knee and hand. The frequency of all combinations was described in Riyazi et al. (2005). More patients had involvement of hands (about 70%) than knees (approximately 30%) and hips (approximately 25%), but all patients had generalized OA.

Symptomatic OA in the knee and hip was defined with the American College of Rheumatology (ACR) criteria for knee and hip OA (Altman et al., 1991). Knee OA was defined as pain or stiffness on most days of the previous month and osteophytes at joint margins of the tibiofemoral joints. Hip OA was defined as pain or stiffness in the groin and hip region on most days of the previous month in addition to femoral or acetabular osteophytes of joint space narrowing on radiograph. Symptomatic hand OA was defined according to the ACR criteria (Altman et al., 1990) as pain or stiffness on most days of the previous month in addition to three of the following criteria: bony swelling of 2 or more of the 10 selected joints (bilateral distal interphalangeal joints 2 + 3, bilateral proximal interphalangeal joints 2 + 3, and carpometacarpal 1 joint), bony swelling of 2 or more distal joints, fewer than three swollen metacarpal joints, and deformity of at least one of the 10 selected joints. Symptomatic OA of the spine was defined as pain or stiffness in the spine on most days of the previous month in addition to a Kellgren–Lawrence score of 2 in at least one disk or one apophyseal joint.

Of the 384 patients evaluated at baseline (August 2000–March 2003), 317 (82.6%) gave informed consent to participate. Of the eligible patients, 241 completed the IPQ-R at baseline and follow-up (April 2007–May 2008). The mean follow-up time was 6.0 years ($SD = 0.4$; Riyazi, Rosendaal, Slagboom, Kroon, Breedveld, & Kloppenburg, 2008).

Measures. Sociodemographic characteristics (e.g., age, gender, marital status, body mass index [BMI], education) were collected at baseline. Three biomedical measures were used to assess severity of OA: The Australian/Canadian Osteoarthritis Hand In-

dex (AUSCAN) assesses hand pain, stiffness, and function by self-report (Bellamy et al., 2002); the Kellgren–Lawrence scale is a measure of radiologically assessed degree of OA (Kellgren, 1963); and the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) assesses lower extremity pain, stiffness, and function in OA of the knee or hip by self-report (Bellamy, Buchanan, Goldsmith, Campbell, & Stitt, 1988). Pain intensity was assessed during a physical examination in response to lateral pressure or passive movement of the joint, (0 = *no pain*, 1 = *complaining of pain*, 2 = *complaining of pain and wincing*, 3 = *complaining of pain and withdrawal of the joint*) in the hands, knees, hips, and spine, and on a dichotomous scale (0 = *no pain*, 1 = *pain*) in the acromioclavicular joints, sternoclavicular joints, elbows, ankles, and metatarsal phalangeal joints. This pain intensity score (range = 0–145) is a modification of the articular index for the assessment of OA described by Doyle, Dieppe, Scott, and Huskisson (1981).

We assessed CSMs of OA using the IPQ-R (Moss-Morris et al., 2002). In the instructions, patients were asked to answer the questions with regard to their OA, as suggested by the designers of the IPQ-R (for details, see the IPQ-R at <http://www.uib.no/ipq/index.html>). The IPQ-R measures illness perceptions, emotional representations, and perceived causes, and it assesses patients' beliefs about (1) the identity of the disease (labels and symptoms describing the illness [14 items]; in the instruction, "illness" was substituted with "osteoarthritis"); (2) whether the timeline is acute or chronic (6 items); (3) the consequences of the disease (the severity of the illness and the impact of the disease on life in general, self-image, finance, and family members [6 items]); (4) the degree of personal control over OA (6 items); (5) the extent to which treatment controls or cures the disease (5 items); (6) illness coherence (the degree to which patients believe they understand their illness, 5 items), (7) the cyclical nature of the disease (the likely variability of the disease and/or symptoms, 4 items), and (8) the emotional representation of the disease (negative emotions experienced due to OA, 6 items). The Causes subscale assesses the degree to which the patient attributes the cause of the disease to psychological factors, risk, immune function, and accident or chance. As in the Identity scale, in the fragment "Causes of my illness," "osteoarthritis" replaced "illness." All items were rated on 5-point Likert-type scales ranging from *strongly disagree* (1) to *strongly agree* (5). Items were coded so that high scores represent strong beliefs on these particular dimensions. Higher scores indicate a stronger belief that the experienced symptoms are part of the patient's illness, in the chronicity of OA, in serious negative consequences of OA, in the patient's own ability to control symptoms, in the effectiveness of treatment for controlling OA, in the coherence of OA, in the cyclical nature of OA, and a stronger negative emotional response to OA.

Statistical analysis. Two repeated measures of multivariate analyses of variance (MANOVAs) were conducted to compare IPQ-R scores and disease progression at baseline with scores at follow-up. Cluster analysis was used to classify patients into subgroups according to their change in illness perceptions from baseline to 6-year follow-up. Simple change scores (follow-up score minus baseline score) of the illness perceptions dimensions "identity," "timeline chronic," "timeline cyclical," "consequences," "personal control," "treatment control," and "emotional representations" were used to perform the two-stage clustering

method as researched and advised for research in illness perceptions by Clatworthy et al. (2007). All change scores were standardized to *z* scores before clustering. Ward's clustering method was conducted to determine the centroids and number of groups, followed by K-means analysis. Squared Euclidian distance was selected as the similarity measure, and the cluster centroids and numbers of clusters determined by Ward's method were used for the K-means analysis. The dendrogram and agglomeration schedule of the initial Ward's clustering method suggested that it would be appropriate to set the K-means clustering solution to produce two clusters.

Independent *t* tests were used to investigate differences in IPQ-R change scores between both cluster groups.

We performed three repeated measures analyses of covariance (ANCOVAs) to test the effects of cluster group on changes in pain intensity, AUSCAN score, and WOMAC score. The factors in these analyses were cluster group (Cluster 1: patients identified as having more negative illness perceptions over time; and Cluster 2: patients identified as having more positive illness perceptions over time), time (baseline and 6-year follow-up), and potentially confounding variables entered as covariates: age, gender, BMI, Kellgren–Lawrence score at baseline, and, additionally, pain intensity (at baseline and at 6 years) for the dependent variables AUSCAN and WOMAC. The reported values for the strength of the associations between independent and dependent variables in the MANOVAs and ANCOVAs are partial etas squared (η^2).

Results

Sample

At the time of the present study, 241 patients completed the IPQ-R, AUSCAN, and WOMAC at baseline and follow-up. Patient baseline characteristics are shown in Table 1. The majority of participants were older women, with a BMI at the lower end of overweight, representing a range of educational achievement.

Table 1
Patients' Baseline Demographic Characteristics

Demographic	Mean, frequency, or %
<i>N</i>	241
Age, <i>M</i> , (and <i>SD</i>)	59.0 (7.5)
Gender (% female)	82.2
Marital status	
Married/living together	186
Single	55
BMI, <i>M</i> , (and <i>SD</i>)	26.8 (4.7)
Education	
Elementary school	27
Junior high school	76
High school	85
College/university	53
<i>M</i> (and <i>SD</i>) for Kellgren–Lawrence score	43.9 (20.0)
Range	0–180

Note. BMI = body mass index. Kellgren–Lawrence is a measure of radiographically defined degree of osteoarthritis severity.

Mean scores on the IPQ-R dimensions, AUSCAN, WOMAC, and physician-reported pain intensity at baseline and at follow-up are presented in Table 2.

Change on IPQ-R dimensions and disease progression. We conducted a repeated measures MANOVA to investigate differences over time in scores on the IPQ-R dimensions. All dimensions and the perceived causes were entered as dependent variables. There was a statistically significant difference over time on the combined dependent variables, $F(12, 224) = 3.66, p < .01$, Wilks's $\lambda = 0.84$, multivariate $\eta^2 = .16$. When the results for the dependent variables were considered separately, five IPQ-R dimensions differed significantly between baseline and follow-up. For the entire sample, beliefs changed to a significantly more chronic timeline, $F(1, 235) = 8.28, p = .004, \eta^2 = .03$; less personal control over the illness, $F(1.235) = 8.69, p = .004, \eta^2 = .04$; increased sense of coherence, $F(1, 235) = 10.72, p = .001, \eta^2 = .04$; a reduction in the belief in OA as cyclical, $F(1, 235) = 4.91, p = .028, \eta^2 = .02$; and a less strong negative emotional response to OA (i.e., more positive), $F(1, 235) = 11.58, p = .001, \eta^2 = .05$. No significant differences between baseline and follow-up were found on the other IPQ-R dimensions or on the IPQ-R questions that explore perceived causes of OA.

A repeated measures MANOVA was also conducted to investigate differences over time in disease progression. AUSCAN, WOMAC, and pain intensity scores were entered as dependent variables. There was a statically significant difference over time on the combined dependent variables, $F(3, 206) = 11.41, p < .001$, Wilks's $\lambda = 0.86$, multivariate $\eta^2 = .14$. When the results for the dependent variables were considered separately, scores on the AUSCAN, $F(1, 208) = 10.31, p = .002, \eta^2 = .05$; and pain intensity, $F(1, 208) = 31.85, p < .0001, \eta^2 = .13$; indicated an increased (negative) impact on daily functioning and pain. No significant differences were observed for the sample as a whole on WOMAC scores.

Table 3 shows the mean IPQ-R change scores for the two subgroups of patients classified according to their profile of

change in illness perceptions. Increases in identity; chronic timeline; consequences; and decreases in personal control, treatment control, and emotional representations (cluster Group 1) describe an illness model that becomes more negative over time (Clatworthy et al., 2007; Hagger & Orbell, 2003; Leventhal et al., 2003). Decreases in identity, chronic timeline, consequences, emotional representations, and increases in personal control and treatment control (Cluster 2), represent an illness model that can be defined as positive. Both clusters had negative change scores on emotional representations, indicating a tendency for both to get less negative over time. However, the positive cluster became significantly less negative than the negative cluster, which is consistent with the theoretical model (Clatworthy et al., 2007; Hagger & Orbell, 2003; Leventhal et al., 2003).

Differences between cluster groups on functional status.

Pain intensity. A 2 (time) \times 2 (cluster group) mixed-model ANCOVA revealed that the main effects for cluster group, $F(1, 203) = 1.39, p > .05, \eta^2 = .01$; and time, $F(1, 203) = 2.80, p > .05, \eta^2 = .01$; were not significant (see Figure 1). Thus, there were no overall differences in the pain intensity scores of the negative cluster group ($M = 8.54$), compared with the positive cluster group ($M = 10.01$). Pain intensity scores at follow-up ($M = 10.76$) were not significantly higher than at baseline ($M = 7.80$). Of the potentially confounding variables (age, gender, BMI, Kellgren-Lawrence score), only the Time \times Gender interaction was significant, $F(1, 203) = 3.90, p < .05, \eta^2 = 0.02$; suggesting a sharper rise in pain intensity for females across both groups.

AUSCAN. A significant Time \times Cluster Group effect was obtained, $F(1, 201) = 9.96, p < .01, \eta^2 = .05$. Examination of the cell means indicated that, although there was an increase in AUSCAN scores for the negative cluster group from baseline ($M = 17.65$) to follow-up ($M = 22.86$), the positive cluster group did not change in AUSCAN scores from baseline ($M = 21.26$) to follow-up ($M = 21.60$; see Figure 2). At baseline, the negative cluster group had significantly better AUSCAN scores than did the positive cluster group, $t(238) = -1.99, p < .05$. Other significant

Table 2
Descriptive Statistics for Baseline and 6-Year Follow-Up Illness Perceptions and Disease Progression

Illness perception dimension	Range	Baseline		Follow-up		F^a	p
		M	SD	M	SD		
Identity	0–14	5.3	2.5	5.2	2.2	0.60	.438
Timeline acute/chronic	6–30	25.4	3.7	26.2	3.4	8.28	.004
Consequences	6–30	16.8	4.6	16.5	4.6	0.87	.351
Personal control	6–30	18.8	3.5	18.0	3.8	8.69	.004
Treatment control	5–25	13.9	2.8	13.6	3.0	2.50	.115
Illness coherence	5–25	17.9	4.1	18.6	4.0	10.72	.001
Timeline cyclical	4–20	14.3	3.1	13.8	3.2	4.91	.028
Emotional representations	6–30	14.3	5.2	13.3	5.4	11.58	.001
Psychological attribution	6–30	12.7	4.3	12.4	4.4	0.69	.407
Risk attribution	7–35	17.7	3.3	18.0	3.6	1.40	.237
Immune function attribution	3–15	6.7	2.0	6.4	2.2	2.69	.102
Accident/chance attribution	2–10	4.9	1.6	4.9	1.6	0.05	.823
AUSCAN total score	0–60	19.5	14.2	22.2	14.1	10.31	.002
WOMAC total score	0–100	27.2	22.9	28.9	23.1	0.28	.598
Pain intensity	0–145	7.9	8.3	10.8	9.5	31.85	.000

Note. AUSCAN = Australian/Canadian Osteoarthritis Hand Index; WOMAC = Western Ontario and McMaster Universities Osteoarthritis Index.

^a A repeated measures multivariate analysis of variance was conducted to investigate differences over time.

Table 3
Mean Differences in IPQ-R Change Scores^a Between Both Cluster Groups

Illness perception dimension	Cluster 1: Illness model more negative over time (n = 114)		Cluster 2: Illness model more positive over time (n = 126)		F	p
	M	SD	M	SD		
Identity	0.45	2.35	-0.71	2.39	3.793	.000
Timeline acute/chronic	3.01	3.42	-1.24	3.24	9.882	.000
Consequences	1.81	4.28	-2.31	4.06	7.648	.000
Personal control	-2.76	3.30	0.99	3.46	-8.582	.000
Treatment control	-2.19	2.70	1.38	2.59	-10.436	.000
Illness coherence	0.48	3.17	0.95	3.60	-1.077	.283
Timeline cyclical	-0.52	3.69	-0.42	3.12	-0.214	.831
Emotional representations	-0.06	4.14	-1.91	4.96	3.113	.002

Note. IPQ-R = Illness Perception Questionnaire—Revised.

^a Simple change scores = follow-up score - baseline score.

effects emerged for Kellgren–Lawrence scores, $F(1, 201) = 8.74$, $p < .01$, $\eta^2 = .04$; for baseline pain scores, $F(1, 201) = 19.17$, $p < .001$, $\eta^2 = .09$; and for follow-up pain scores, $F(1, 201) = 41.16$, $p < .001$, $\eta^2 = .17$; showing more negative AUSCAN scores across both time points for patients with higher Kellgren–Lawrence scores and higher pain intensity scores.

WOMAC. A significant Time \times Cluster group effect was obtained, $F(1, 200) = 9.43$, $p < .01$, $\eta^2 = .05$. Examination of the cell means indicated that, although there was an increase in WOMAC scores for the negative cluster group from baseline ($M = 25.51$) to follow-up ($M = 31.42$), the positive cluster group did slightly improve in WOMAC scores from baseline ($M = 28.97$) to follow-up ($M = 26.85$; see Figure 3). At baseline, the negative cluster group had slightly (nonsignificant) better WOMAC scores than did the positive cluster group.

Other significant effects emerged for BMI, $F(1, 200) = 32.89$, $p < .001$, $\eta^2 = .14$; for baseline pain scores, $F(1, 200) = 8.22$, $p < .01$, $\eta^2 = 0.04$; and for follow-up pain scores, $F(1, 200) = 37.44$, $p < .001$, $\eta^2 = .16$; showing more negative WOMAC scores across both time points for patients with higher BMI scores and higher pain intensity scores.

Although the two patient clusters were not significantly associated with changes over time in physician-reported pain intensity, they were associated with modest but meaningful changes at follow-up in AUSCAN and WOMAC scores. As hypothesized, the cluster with a more positive illness model was associated with better outcomes, and the cluster with a more negative illness model was associated with poorer outcomes on the two functional impairment scales, AUSCAN and WOMAC. These results corroborate the validity of the two-cluster solution for the IPQ-R dimen-

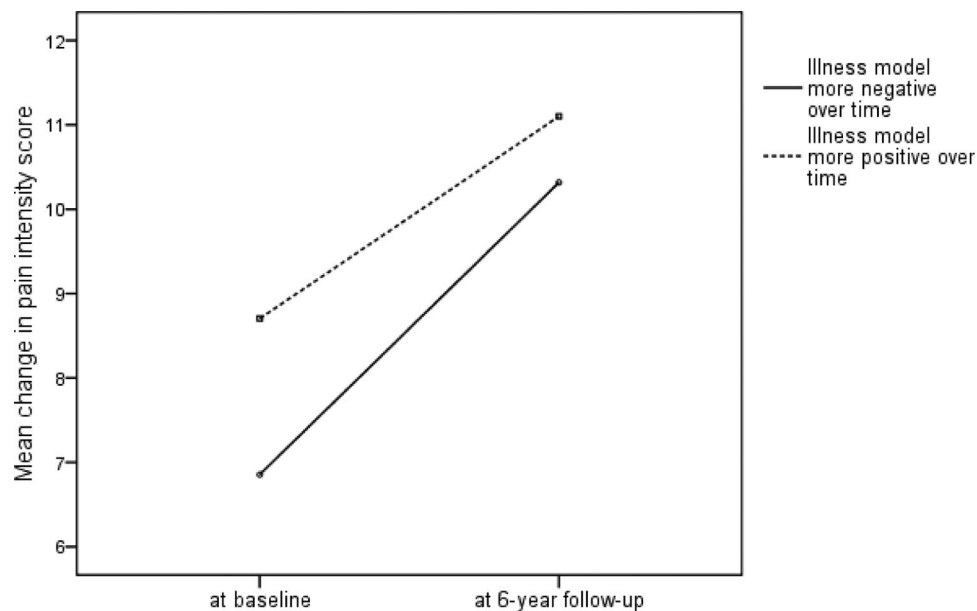


Figure 1. Change in pain intensity from baseline to 6-year follow-up for the two cluster groups.

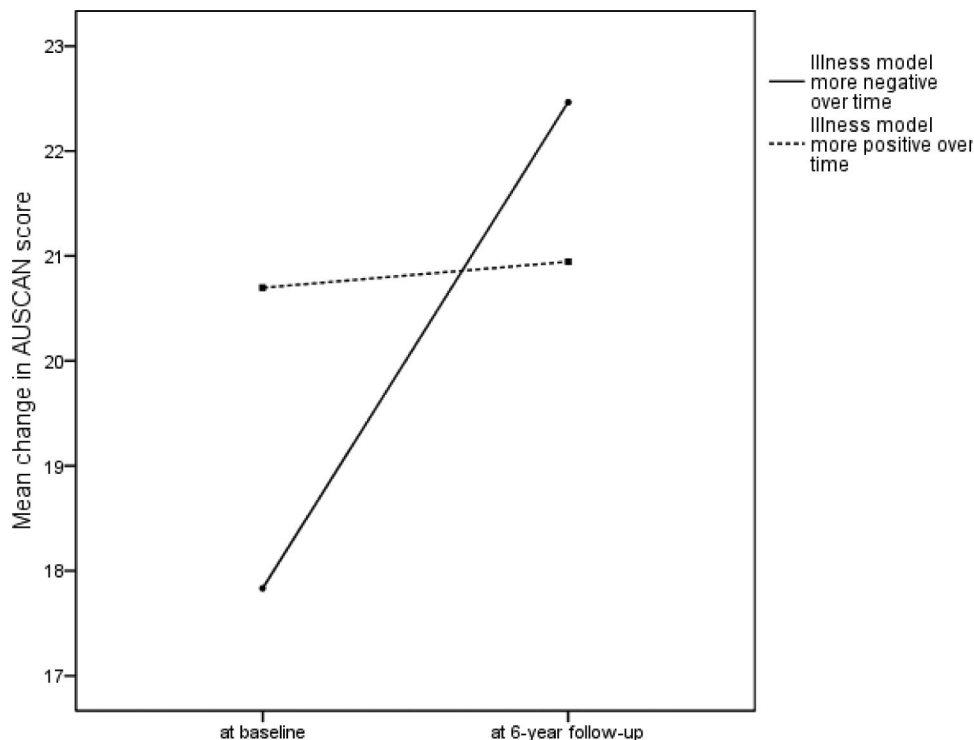


Figure 2. Change in Australian/Canadian Osteoarthritis Hand Index (AUSCAN) score from baseline to 6-year follow-up for the two cluster groups.

sions presented here and suggest that these clusters may be associated with clinically meaningful changes in functional impairment.

Discussion

The results of this prospective study with a 6-year follow-up add to the limited number of empirical studies in which longitudinal changes in IPQ-R dimensions were examined. They advanced our knowledge of changes in CSMs of OA over time, suggesting which IPQ-R dimensions remain stable and which ones change. For OA, it appears that attributions of causality remain relatively unaffected by the passage of time. However, over time, OA is increasingly perceived as a relatively chronic condition, as less cyclical, and as less amenable to personal control, independent of objectively assessed illness severity. Moreover, the identification of two patient clusters, each with similar change profiles across the dimensions of illness perceptions as recommended by Clatworthy et al. (2007), yielded additional meaningful associations between change in illness perceptions and change in functional status. Consistent with the conclusions from Hagger and Orbell's (2003) meta-analysis of illness perceptions, a deterioration in functional abilities over time was associated with a pattern of change on illness perceptions associated with poor outcomes: more passive and chronic views, perceiving less control, and experiencing a higher emotional load regarding the illness.

Demonstrating that change to a more negative illness representation is associated with deterioration of functional status across

long-term follow-up is indicative of a reciprocal process between illness representations and illness outcomes as proposed by the CSM (Leventhal et al., 2003). The present findings for OA are comparable with those of previous studies of low back pain (Foster et al., 2008), angina (Furze et al., 2005), venous thrombosis (Kaptein, van Korlaar, Cameron, Vossen, van der Meer, & Rosendaal, 2007), and diabetes (Skinner et al., 2006). Together, these results have important clinical implications. They suggest that identifying illness dimensions on which patients hold beliefs indicative of poor outcomes and intervening to change these beliefs may have beneficial effects on the course of a chronic disease (Clatworthy et al., 2007; Hagger & Orbell, 2003; Newman et al., 2004). As noted by Clatworthy et al. (2007):

[A]s the focus of illness perception research moves toward intervention development, there is a further practical advantage to grouping people in this way. Groups of people with schemata associated with poor coping or outcome would be ideal targets for interventions. The cluster analysis would not only identify these groups but would also provide information on the types of beliefs held by the groups that may need to be addressed in an intervention. (p. 126)

Strengths of the present study include the comparatively large sample size compared with previous research on OA illness perceptions, the unusually long follow-up period, and the relatively low level of subject attrition. The present sample was comparable with the samples of OA patients in the studies mentioned in the Introduction with regard to sociodemographic and other medical characteristics. The measure of the illness perceptions used here reflected the same theoretical base (the

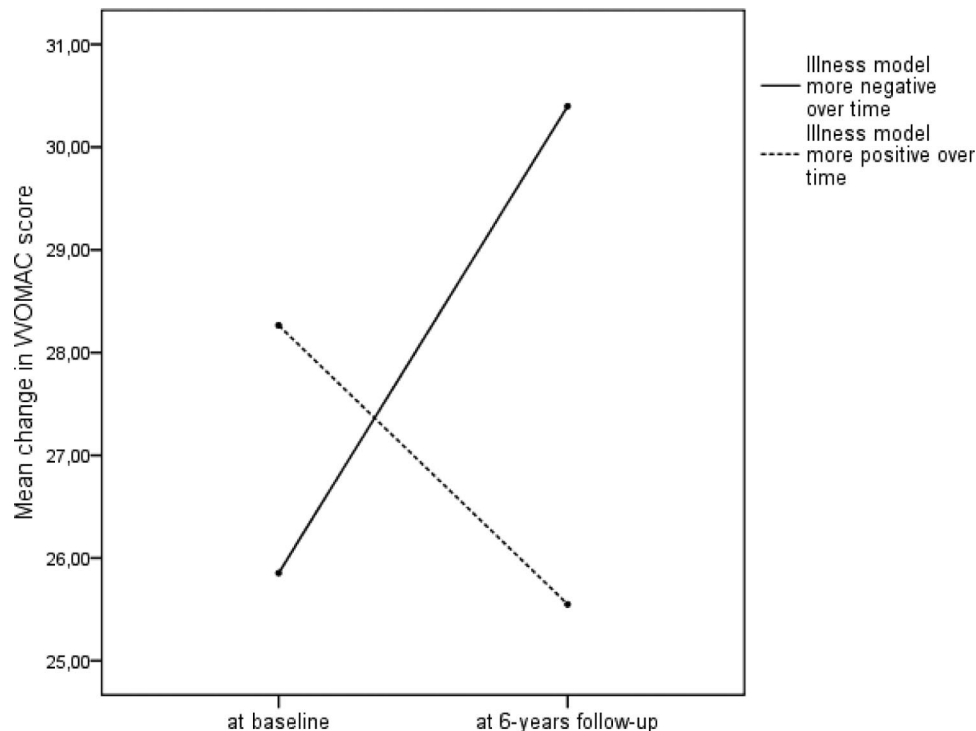


Figure 3. Change in Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) score from baseline to 6-year follow-up for the two cluster groups.

CSM of Leventhal et al., 2003) as many of these studies. Such comparability increases the external validity and, hence, the generalizability of our findings.

Limitations include the absence of a measure of functional status that was not based on self-report. However, the AUSCAN and WOMAC are widely used to assess the impact of OA in daily life and are considered the gold standard in research on OA patients. Moreover, unlike in many previous studies, pain intensity was measured objectively and controlled for in all analyses. Assessment of change on both illness perceptions and functional status at one or more times during the follow-up period could have yielded even more interesting results, enabling the examination of correlated change across time and investigated cross-lagged correlations. Multiple assessments are recommended for future studies.

The potential of interventions to change illness perceptions and examine effects thereof on disease outcomes is only just beginning to be recognized (Cameron & Jago, 2008). Only a few intervention studies have been published up to now (e.g., Foster et al., 2008; Furze et al., 2005; Goodman, Morrissey, Graham, & Bossingham, 2005; Hall, Weinman, & Marteau, 2004; Humphries & Ozakinci, 2008; Karamanidou, Weinman, & Horne, 2008; McAndrew et al., 2008; Petrie, Cameron, Ellis, Buick, & Weinman, 2002). Theoretical and conceptual issues in designing interventions in the context of the CSM are discussed by Deary (2008) and by Wearden and Peters (2008). The present study suggests that interventions that increase patients' pattern of positive beliefs, especially the control components in illness perceptions—that is, increase perceived ability to con-

trol their OA and the effectiveness of their medical treatment and reduce perceived symptoms and the perceived physical, social, and emotional consequences of the disease—could result in less self-reported functional disability. Future research on patients with OA should focus on identifying more precisely which patterns of illness perceptions are associated with more specific outcome measures and on developing interventions designed to change these patterns of beliefs.

References

- Altman, R., Alarcon, G., Appelrouth, D., Bloch, D., Borenstein, D., Brandt, K., Brown, C., et al. (1990). The American College of Rheumatology criteria for the classification and reporting of osteoarthritis of the hand. *Arthritis and Rheumatism*, *33*, 1601–1610.
- Altman, R., Alarcon, G., Appelrouth, D., Bloch, D., Borenstein, D., Brandt, K., Brown, C., et al. (1991). The American College of Rheumatology criteria for the classification and reporting of osteoarthritis of the hip. *Arthritis and Rheumatism*, *34*, 505–514.
- Appelt, C. J., Burant, C. J., Siminoff, L. A., Kwok, C. K., & Ibrahim, S. A. (2007). Arthritis-specific health beliefs related to aging among older male patients with knee and/or hip osteoarthritis. *Journals of Gerontology A, Biological Science and Medical Sciences*, *62*, 184–190.
- Ballantyne, P. J., Gignac, M. A. M., & Hawker, G. A. (2007). A patient-centered perspective on surgery avoidance for hip or knee arthritis: Lessons for the future. *Arthritis and Rheumatism*, *57*, 27–34.
- Bellamy, N., Buchanan, W. W., Goldsmith, C. H., Campbell, J., & Stitt, L. W. (1988). Validation study of the WOMAC: A health status instrument for measuring clinically important patient relevant outcomes to antirheumatic drug therapy in patients with osteoarthritis of the hip or knee. *Rheumatology*, *15*, 1833–1840.

- Bellamy, N., Campbell, J., Haroui, 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*, *10*, 855–862.
- Botha-Scheepers, S., Riyazi, N., Kroon, H. M., Scharloo, M., Houwing-Duistermaat, J. J., Slagboom, E., Rosendaal, F. R., et al. (2006). Activity limitations in the lower extremities in patients with osteoarthritis: The modifying effects of illness perceptions and mental health. *Osteoarthritis and Cartilage*, *14*, 1104–1110.
- Cameron, L. D., & Jago, L. (2008). Emotion regulation interventions: A common-sense approach. *British Journal of Health Psychology*, *13*, 215–221.
- Clatworthy, J., Hankins, M., Buick, D., Weinman, J., & Horne, R. (2007). Cluster analysis in illness perception research: A Monte Carlo study to identify the most appropriate method. *Psychology & Health*, *22*, 123–142.
- Deary, V. (2008). A precarious balance: Using a self-regulation model to conceptualize and treat chronic fatigue syndrome. *British Journal of Health Psychology*, *13*, 231–236.
- Dieppe, P. A., & Lohmander, L. S. (2005). Pathogenesis and management of pain in osteoarthritis. *Lancet*, *365*, 965–973.
- Doyle, D. V., Dieppe, P. A., Scott, J., & Huskisson, E. C. (1981). An articular index for the assessment of osteoarthritis. *Annals of Rheumatic Diseases*, *40*, 75–78.
- Elder, R. G. (1973). Social class and lay explanations of the etiology of arthritis. *Journal of Health & Social Behavior*, *14*, 28–38.
- Ferreira, V. M., & Sherman, A. M. (2007). The relationship of optimism, pain and social support to well-being in older adults with osteoarthritis. *Aging and Mental Health*, *11*, 89–98.
- 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.
- Furze, G., Lewin, R. J. P., Murberg, T., Bull, P., & Thompson, D. R. (2005). Does it matter what patients think? The relationship between changes in patients' beliefs about angina and their psychological and functional status. *Journal of Psychosomatic Research*, *59*, 323–329.
- Gignac, M. A. M., Cott, C., & Badley, E. M. (2002). Adaptation to disability: Applying selective optimization with compensation to the behaviors of older adults with osteoarthritis. *Psychology and Aging*, *17*, 520–524.
- Goodman, D., Morrissey, S., Graham, D., & Bossingham, D. (2005). The application of cognitive-behaviour therapy in altering illness representations of systemic lupus erythematosus. *Behaviour Change*, *22*, 156–171.
- Hagger, M. S., & Orbell, S. (2003). A meta-analytic review of the common-sense model of illness representations. *Psychology & Health*, *18*, 141–184.
- Hall, S., Weinman, J., & Marteau, T. M. (2004). The motivating impact of informing women smokers of a link between smoking and cervical cancer: The role of coherence. *Health Psychology*, *23*, 419–424.
- Hampson, S. E., & Glasgow, R. E. (1996). Dimensional complexity of older patients' illness representations of arthritis and diabetes. *Basic and Applied Social Psychology*, *18*, 45–59.
- Hampson, S. E., Glasgow, R. E., & Zeiss, A. M. (1994). Personal models of osteoarthritis and their relation to self-management activities and quality of life. *Journal of Behavioral Medicine*, *17*, 143–158.
- 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*, *46*, 944–951.
- Hudak, P. L., Clark, J. P., Hawker, G. A., Coyte, P. C., Mahomed, N. N., Kreder, H. J., & Wright, J. G. (2002). "You're perfect for the procedure! Why don't you want it?" Elderly arthritis patients' unwillingness to consider total joint arthroplasty surgery: A qualitative study. *Medical Decision Making*, *22*, 272–278.
- Humphries, G., & Ozakinci, G. (2008). The AFTER intervention: A structured psychological approach to reduce fears of recurrence in patients with head and neck cancer. *British Journal of Health Psychology*, *13*, 223–230.
- Kaptein, A. A., van Korlaar, I. M., Cameron, L. D., Vossen, C. Y., van der Meer, F. J. M., & Rosendaal, F. R. (2007). Using the common-sense model to predict risk perception and disease-related worry in individuals at increased risk for venous thrombosis. *Health Psychology*, *26*, 807–812.
- Karamidou, C., Weinman, J., & Horne, R. (2008). Improving haemodialysis patients' understanding of phosphate-binding medication: A pilot study of a psycho-educational intervention designed to change patients' perceptions of the problem and treatment. *British Journal of Health Psychology*, *13*, 205–214.
- Kellgren, J. H. (1963). Atlas of standard radiographs of arthritis. In J. H. Kellgren (Ed.), *The epidemiology of chronic rheumatism* (Vol. 2, pp. 1–13). Oxford, England: Blackwell Scientific.
- Kellgren, J. H., & Moore, R. (1952). Generalized osteoarthritis and Heberden's nodes. *British Medical Journal*, *1952*, *1*, 181–187.
- Kratz, A. L., Davis, M. C., & Zautra, A. J. (2007). Pain acceptance moderates the relation between pain and negative affect in female osteoarthritis and fibromyalgic patients. *Annals of Behavioral Medicine*, *33*, 291–301.
- Lawrence, J. S. (1963). Generalized osteoarthritis in a population sample. *American Journal of Epidemiology*, *90*, 381–389.
- Leventhal, H., Brissette, I., & Leventhal, E. A. (2003). The common-sense model of self-regulation of health and illness. In L. D. Cameron & H. Leventhal (Eds.), *The self-regulation of health and illness behaviour* (pp. 42–65). London: Routledge.
- Leventhal, H., Weinman, J., Leventhal, E. A., & Phillips, L. A. (2008). Health psychology: The search for pathways between behavior and health. *Annual Review of Psychology*, *59*, 1–29.
- McAndrew, L. M., Musumeci-Szabó, T. J., Mora, P. A., Vileikyte, L., Burns, E., Halm, E. A., Leventhal, E. A., et al. (2008). Using the common sense model to design interventions for the prevention and management of chronic illness threats: From description to process. *British Journal of Health Psychology*, *13*, 195–204.
- 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.
- Newman, S., Steed, L., & Mulligan, K. (2004). Self-management interventions for chronic illness. *Lancet*, *364*, 1523–1537.
- Orbell, S., Johnston, M., Rowley, D., Easley, A., & Davey, P. (1998). Cognitive representations of illness and functional and affective adjustment following surgery for osteoarthritis. *Social Science & Medicine*, *47*, 93–102.
- Peat, G., Greig, J., Wood, L., Wilkie, R., Thomas, E., & Croft, P. (2005). Diagnostic discordance: We cannot agree when to call knee pain "osteoarthritis." *Family Practice*, *22*, 96–102.
- Petrie, K. P., Cameron, L. D., Ellis, C. J., Buick, D., & Weinman, J. (2002). Changing illness perceptions after myocardial infarction: An early intervention randomized controlled trial. *Psychosomatic Medicine*, *64*, 580–586.
- Riyazi, N., Meulenbelt, I., Kroon, H. M., Runday, K. H., Helliö le Graverand, M. P., Rosendaal, F. R., Breedveld, F. C., et al. (2005). Evidence for familial aggregation of hand, hip, and spine but not knee osteoarthritis in siblings with multiple joint involvement: The GARP study. *Annals of Rheumatic Diseases*, *64*, 438–443.
- Riyazi, N., Rosendaal, F. R., Slagboom, E., Kroon, H. M., Breedveld,

- F. C., & Kloppenburg, M. (2008). Risk factors in familial osteoarthritis: The GARP sibling study. *Osteoarthritis and Cartilage*, *16*, 654–659.
- Skinner, T. C., Carey, M. E., Craddock, S., Daly, H., Davies, M. J., Doherty, Y., Heller, K., et al. (2006). Diabetes education and self-management for ongoing and newly diagnosed (DESMOND): Process modeling of pilot study. *Patient Education and Counseling*, *64*, 369–377.
- Theis, K. A., Helmick, C. G., & Hootman, J. M. (2007). Arthritis burden and impact are greater among U.S. women than men: Intervention opportunities. *Journal of Women's Health*, *16*, 441–453.
- Toye, F. M., Barlow, J., Wright, C., & Lamb, S. E. (2006). Personal meanings in the construction of need for total knee replacement surgery. *Social Science & Medicine*, *63*, 43–53.
- Wearden, A., & Peters, S. (2008). Therapeutic techniques for interventions based on Leventhal's Common Sense Model. *British Journal of Health Psychology*, *13*, 189–193.

Call for Nominations: *Sport, Exercise, and Performance Psychology*

The Publications and Communications (P&C) Board of the American Psychological Association and Division 47 (Exercise and Sport Psychology) of the APA have opened nominations for the editorship of *Sport, Exercise, and Performance Psychology* for the years 2011–2016. The editor search committee is co-chaired by Ed Acevedo, PhD, and Robert Frank, PhD.

Sport, Exercise, and Performance Psychology, to begin publishing in 2011, will publish papers in all areas of sport, exercise, and performance psychology for applied scientists and practitioners. This journal is committed to publishing evidence that supports the application of psychological principles to facilitate peak sport performance, enhance physical activity participation, and achieve optimal human performance. Published papers include experimental studies, qualitative research, correlational studies, and evaluation studies. In addition, historical papers, critical reviews, case studies, brief reports, critical evaluations of policies and procedures, and position statements will be considered for publication.

Editorial candidates should be available to start receiving manuscripts in July 2010 to prepare for issues published in 2011. Please note that the P&C Board encourages participation by members of underrepresented groups in the publication process and would particularly welcome such nominees. Self-nominations are also encouraged.

Candidates should be nominated by accessing APA's EditorQuest site on the Web. Using your Web browser, go to <http://editorquest.apa.org>. On the Home menu on the left, find "Guests." Next, click on the link "Submit a Nomination," enter your nominee's information, and click "Submit."

Prepared statements of one page or less in support of a nominee can also be submitted by e-mail to Molly Douglas-Fujimoto, Managing Director, Educational Publishing Foundation, at mdouglas-fujimoto@apa.org.

The deadline for accepting nominations is January 31, 2010, when reviews will begin.