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ILLNESS PERCEPTIONS IN PATIENTS WITH OSTEOARTHRITIS CHANGE OVER TIME AND ARE ASSOCIATED WITH DISABILITY

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ABSTRACT

Objective. To investigate change in illness perceptions in patients with osteoarthritis (OA) and the association of those changes with disability, and to determine the predictive value of illness perceptions in disability.

Methods. Illness perceptions and disability were measured at baseline and after 6 years in 241 patients with OA at multiple sites (mean age 59.0 years, 82.2% women) using the Illness Perception Questionnaire (IPQ-R) and Health Assessment Questionnaire (HAQ), respectively. Mean changes for each IPQ-R dimension were reported and related to progression of disability, defined as the highest quartile of HAQ score change. The predictive value of baseline illness perceptions in disability at 6 years (high disability defined as the highest quartile of HAQ score) was assessed using logistic regression.

Results. Illness perceptions changed over time and these changes were related to progression of disability. Patients with progression of disability had an increase in symptoms attributed to OA, perceived consequences, perceived disease chronicity, negative emotions associated with OA and beliefs about immunity as causal factor, and a decrease in perceived control and understanding of OA compared to patients without progression of disability. Moreover, a higher number of symptoms attributed to OA, less perceived control and more perceived consequences of OA at baseline were predictive of high disability after 6 years.

Conclusion. Illness perceptions in patients with OA change over time and these changes were related to outcome. Moreover, illness perceptions were predictive of disability. This may imply that interventions aiming at changing illness perceptions can contribute to better functional outcome.

INTRODUCTION

Osteoarthritis (OA) is the most common musculoskeletal disorder and a major cause of disability. It is therefore a burden not only for the individual but also for society, increasing in relevance with an aging population.[1,2] Hence, reducing disability is an important treatment goal in patients with OA.[3]

It is well recognised that disability in OA is not only associated with the disease process itself, but also with other factors. This multifactorial character of the disease is illustrated by the International Classification of Functioning, Disability and Health (ICF) developed by the World Health Organization.[4] This classification describes the impact of a disease on a patient as a dynamic interaction between disease, personal and environmental factors. Functioning is classified in the activity and participation component. The health related component consists of the dimensions body structures and body functions. Personal and environmental factors are recognised as modifying factors for the association between these two components.

An aspect of the personal factors that modify the association are the perceptions patients have regarding their disease. Research on these illness perceptions is guided by the Common-Sense Model, which hypothesises that patients create mental representations of their disease in order to make sense of and manage the health problem.[5] These illness perceptions influence health behavior and outcome. Support for this theory was found in studies on the relationship between illness perceptions and clinical outcome, including disability, in various diseases including OA.[6-14]

Because of the modifying effects of illness perceptions on the relationship between disease processes and disability, interventions aiming at these illness perceptions may reduce disability. One of the few intervention studies on illness perceptions suggests that actively changing illness perceptions can improve outcome.[15] In order to establish a causal relationship between illness perceptions and outcome, longitudinal data are needed. Most of the studies on illness perceptions are cross-sectional and the few longitudinal studies that have been performed, had short term follow-up periods varying from 6 months to 2 years. To our knowledge, there have been no longitudinal studies on illness perceptions performed in OA.

For the present study, longitudinal data concerning illness perceptions over the relatively long period of 6 years were available in a well-characterised cohort of patients with OA at multiple sites. This made it possible to investigate whether illness perceptions changed over time and if these changes were associated with progression of disability. Furthermore, we determined if illness perceptions at baseline were predictive of disability after 6 years, which could be of importance with a view to illness perceptions as potential targets for therapy aiming at better functional outcome.

PATIENTS AND METHODS

Study design and patient population

The present study is part of the Genetics ARthrosis and Progression (GARP) study, aimed at identifying determinants of OA susceptibility and progression. The population comprises 192 Caucasian sibships with symptomatic OA at multiple sites, recruited from rheumatologists, orthopaedic surgeons and general practitioners. Details about the recruitment and selection have been published elsewhere.[16] The GARP study was approved by the medical ethics committee of the Leiden University Medical Center.

Patients were included for baseline assessment between August 2000 and March 2003. From April 2007 to June 2008 participants that consented to a follow-up visit were examined. Patients were eligible for the present study if baseline and follow-up measures of illness perceptions and disability were available.

OA diagnosis

Patients were included in the GARP study with symptomatic OA in at least two joint sites in the hands or in two or more of the following joint sites: hand, knee, hip or spine. Patients with one joint site involved, were required to have structural abnormalities in at least one of the other joint sites defined by the presence of radiographic OA or the presence of two or more Heberden's nodes, Bouchard's nodes or squaring of at least one first carpometacarpal (CMC-1) joint on physical examination.

Symptomatic OA in the knee and hip was defined following the American College of Rheumatology (ACR) criteria.[17,18] Knee OA was defined as pain or stiffness on most days of the prior 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 prior month in addition to femoral or acetabular osteophytes or joint space narrowing. Prostheses in the hip or knee for end-stage OA were included as OA in that joint.

Symptomatic hand OA was defined according to the ACR criteria as pain or stiffness on most days of the prior month in addition to three of the following criteria: bony swelling of ≥2 of the 10 selected joints (bilateral distal interphalangeal (DIP) joints II and III, bilateral proximal interphalangeal (PIP) joints II and III, and bilateral CMC-1 joints), bony swelling of ≥2 distal joints, <3 swollen metacarpophalangeal (MCP) joints and deformity of ≥1 of the 10 selected joints.[19]

Symptomatic OA of the spine was defined as pain or stiffness on most days of the prior month in the spine in addition to a Kellgren-Lawrence score ≥2 in ≥1 disc or apophyseal joint.

Clinical assessment

Demographic characteristics, data on symptoms and signs of OA and medical history were collected at baseline and follow-up using standardised questionnaires.

During physical examination pain upon lateral pressure or passive movement of the joint was graded 0-3 (0=no pain, 1=complaining of pain, 2=complaining of pain and wincing, 3=complaining of pain and joint withdrawal) in the hands, knees, hips and spine. It was graded on a dichotomous scale (0=no pain, 1=pain) in the acromioclavicular joints, sternoclavicular joints, shoulders, elbows, ankles and metatarsalphalangeal joints. This pain intensity score (range 0 to 145) is a modification of the articular index for the assessment of OA described by Doyle et al.[20]

Radiographs

Conventional radiographs of the hands (dorso-volar), knees (posterior-anterior (PA) weight bearing/semi-flexed), hips (PA), lumbar spine (PA and lateral) and cervical spine (anterior-posterior, lateral and transbuccal) were obtained by a single radiographer, employing a standard protocol with a fixed film focus distance. Radiographic OA was scored by a single experienced musculoskeletal radiologist using the Kellgren-Lawrence grading scale[21] in the hands (DIP, PIP, CMC-1 joints), tibiofemoral joints of the knee, hips and discs and apophyseal joints of the spine. Intrareader reproducibility was high.[16]

Disability

Functional status was assessed with the Dutch version of the Health Assessment Questionnaire (HAQ), which consists of 24 items in 8 categories concerning activities of daily living and mobility.[22] Responses are scaled from 0 (without any difficulty) to 3 (unable to do). If patients use aids they automatically score 2 on that item. The highest score in each of the 8 categories is summed and divided by 8 to produce a disability score (range 0 to 3).

Illness perceptions

Illness perceptions were assessed using the revised version of the Illness Perception Questionnaire (IPQ-R).[23,24] The questionnaire consists of 3 sections, with 9 subscales that provide information about the components that underlie both cognitive and emotional representation of illness.

The first section, the identity component, is concerned with symptoms patients associate with OA. Patients were asked whether or not they experienced 14 commonly occurring symptoms since the onset of their illness and if they believe these symptoms are related to OA. The sum of the yes-rated items on the second question forms the identity subscale.

The second section of the IPQ-R consists of 38 items arranged in seven subscales. The consequences subscale represents the individual's perceptions about the impact of OA on physical, social and psychological functioning. The acute/chronic timeline represents the perceptions of likely chronic duration of the health problems. The cyclical timeline represents the perceptions of likely variability of the disease. Illness coherence reflects the patients' understanding of OA. Personal control represents the perceptions of personal control and treatment control represents the beliefs in cure through treatment. The emotional representations dimension reflects the negative emotions experienced due to OA. Each item is rated on a five-point Likert scale, ranging from strongly disagree to strongly agree. High scores represent strong beliefs on that particular dimension.

The third section comprises of 18 possible causes that patients attribute OA to, grouped in four dimensions: psychological attributions (n=6), risk factors (n=7), immunity (n=3) and chance (n=2).

Statistical analysis

Data were analysed using SPSS, version 14.0 (SPSS, Chicago, Illinois, USA). For each IPQ-R dimension means and standard deviations (SD) were calculated. The mean change for each dimension with 95% confidence interval (95%CI) was calculated by subtracting the baseline scores from follow-up scores. In order to relate these changes to progression of disability, patients were classified as progressed or not progressed based on the minimal clinical important difference (MCID) of 0.22 on the HAQ.[25] Patients with change in HAQ score >0.22 were classified as progressed and those with a change in HAQ score <0.22 were classified as not progressed. Mean differences of change on each IPQ-R dimension between patients with and without progression were calculated with linear mixed models correcting for age, gender, body mass index (BMI), Kellgren-Lawrence score, pain intensity score, baseline HAQ score, baseline IPQ-R score and with a random intercept to adjust for family effects within sibling pairs. The adjustment for family effects is based on the hypothesis from the CSM that illness perceptions are influenced by a patient's social environment. This implies that illness perceptions within a sibling pair could be more alike then illness perceptions between sibling pairs. The estimates represent the difference in change of illness perceptions between patients with and without progression of disability and are reported with 95%CI.

At baseline the association between illness perceptions and disability was assessed using linear mixed models adjusting for age, gender, BMI, Kellgren-Lawrence score, pain intensity score, family effects and mutual IPQ-R dimensions.

In order to investigate the predictive value of illness perceptions at baseline for disability at follow-up, IPQ-R baseline scores were categorised in tertiles and HAQ scores at follow-up were categorised in quartiles, both based on the distribution in this population. The highest quartile of HAQ follow-up scores was regarded as high disability and the other quartiles as low disability. Logistic regression analyses were used to estimate crude and adjusted odds ratios (OR) with 95%CI. Adjustments were made for age category (40-49 yrs, 50-59 yrs, 60-69 yrs, 70-79 yrs), gender, BMI category (<20, 20-25, 25-30, >30), Kellgren-Lawrence score (binary using median as cut-off), pain intensity score (binary using median as cut-off) and baseline HAQ score quartile. To take into account intrafamily effect, robust standard errors were computed using Stata, version 8.0 (Stata, College Station, TX). The crude and adjusted ORs were subsequently transformed to risk ratios (RRs) using the approximation formula described by Zhang, et al.[26], because ORs for common outcomes in a cohort are not good approximations of RRs.

RESULTS

Patient demographics and disease characteristics

Of the 384 patients included at baseline 317 (82.6%) consented to participate in the follow-up study of whom 260 patients completed questionnaires and visited the outpatient clinic, and 57 patients completed questionnaires only. Consent was not given by 50 (13.0%) patients, 15 (3.9%) were deceased and 2 (0.5%) were lost to follow-up. Of the 317 eligible patients 241 completed the IPQ-R at baseline and follow-up at time of the present study and were included. The mean follow-up time was 6.0 years (range 5.0-7.4 years).

Baseline characteristics are shown in table 1. The mean age was 59.0 years and 82.2% were women. Symptomatic OA of the spine and hand were most prevalent with 80% and 71%, respectively. The knee was involved in 34% of the patients and the hip in 25%.

The median (IQR) HAQ score was 0.50 (0.13-0.94) at baseline and 0.75 (0.38-1.13) at follow-up. The mean change was 0.17 (95%CI 0.12 to 0.23). Patients with

Table 1. Baseline demographic characteristics, Health Assessment Questionnaire (HAQ), Kellgren-Lawrence and pain intensity scores of 241 patients with osteoarthritis (OA) at multiple sites.

Age, mean (SD), years	59.0 (7.5)
Women, no (%)	198 (82.2)
Postmenopausal, no (%)	175 (88.4)
Body mass index, kg/m^2	25.8 (23.6-29.1)
Years of formal education, no (%)	
0-6	27 (11.2)
6-12	139 (57.7)
>12	75 (31.1)
Affected sites with symptomatic OA, no (%)	
Hand	172 (71.4)
Knee	83 (34.4)
Hip	61 (25.3)
Spine	192 (79.7)
HAQ (range 0-3)	0.50 (0.13-0.94)
Kellgren-Lawrence score (range 0-180)	41.0 (29.0-55.0)
Pain intensity score (range 0-145)	5.0 (2.0-10.0)

Values are medians (IQR) unless stated otherwise

progression on the HAQ (n=110) had a mean change (SD) in HAQ score of 0.53 (0.29). Patients without progression (n=131) on the HAQ had a mean change of -0.13 (0.25).

Perceptions about OA at baseline and after 6 years

Mean baseline scores on all IPQ-R dimensions and the mean change with 95%CI after 6 years are shown in table 2. Although changes were small, ranging from -1.0 to 0.8, significant differences over 6 years were found for the dimensions timeline acute/chronic, personal control, illness coherence and emotional representations. This means patients perceived their OA as more chronic and less controllable, that they believed to have better understanding of their disease and that they experienced less negative emotions due to OA after 6 years.

The most commonly reported symptoms on the identity dimension at baseline were stiff joints (98%), pain (97%), fatigue (86%), loss of strength (77%) and sleeping difficulties (75%), which were perceived as related to OA in 97%, 97%, 72%, 77% and 61% of patients, respectively.

Relationship at baseline between perceptions about OA and disability

At baseline positive associations between the IPQ-R dimensions identity and consequences and HAQ were found, with β-coefficients (95%CI) derived from linear mixed model analysis of 0.03 (0.01 to 0.06) and 0.04 (0.02 to 0.06), respectively. This means that at baseline higher disability was associated with more symptoms attributed to OA and perceiving more consequences due to OA. For the other IPQ-R dimensions no association was found (data not shown).

Table 2. Mean (SD) baseline scores on IPQ-R and mean change (SD) with 95%CI after 6 years in 241 patients with osteoarthritis at multiple sites.

IPQ-R dimension	Range	Baseline	Mean change	95%CI
Identity	0-14	5.3 (2.5)	-0.2 (2.4)	(-0.5 to 0.1)
Consequences	6-30	16.8 (4.6)	-0.4 (4.6)	(-0.9 to 0.2)
Timeline acute/chronic	6-30	25.4 (3.7)	0.8 (3.9)	(0.3 to 1.3)
Timeline cyclical	4-20	14.3 (3.1)	-0.5 (3.4)	(-0.9 to 0.0)
Personal control	6-30	18.8 (3.5)	-0.8 (3.9)	(-1.3 to -0.3)
Treatment control	5-25	13.9 (2.8)	-0.3 (3.2)	(-0.7 to 0.1)
Illness coherence	5-25	17.9 (4.1)	0.7 (3.4)	(0.3 to 1.2)
Emotional representations	6-30	14.3 (5.2)	-1.0 (4.7)	(-1.6 to -0.4)
Cause - psychological	6-30	12.6 (4.3)	-0.2 (4.0)	(-0.7 to 0.3)
Cause - risk factor	7-35	17.8 (3.3)	0.2 (3.7)	(-0.2 to 0.7)
Cause - immunity	3-15	6.7 (2.0)	-0.2 (2.1)	(-0.5 to 0.0)
Cause - chance	2-10	4.9 (1.6)	-0.0 (1.8)	(-0.3 to 0.2)

Change of perceptions about OA in relation to progression of disability

To investigate the relationship between changes of illness perceptions over 6 years and progression of disability, change on the IPQ-R dimensions was compared between patients with (n=110) and without progression (n=131) of disability (table 3). Baseline IPQ-R scores did not differ between the groups. Patients with progression of disability increased more on the dimension timeline acute/chronic, increased less on the dimensions illness coherence and decreased less on the dimension emotional representations than patients without progression. Scores on identity, consequences and the immune function attribution increased in patients with progression of disability but decreased in patients without progression. The opposite was found for treatment control, in which patients with progression of disability decreased and patients without progression increased. This means that patients with progression of disability had an increase in the number of symptoms they associated with OA, increasingly stronger perceptions about consequences of OA, the chronicity of the disease and immunity as a causal factor, and an increase in negative emotions experienced due to OA compared to patients without progression of disability. Patients with progression of disability showed a decrease in perceived control and understanding of OA compared to patients without progression of disability.

Prediction of disability

The association between high disability after 6 years and tertiles of the IPQ-R dimensions at baseline is shown in table 4. The lowest tertiles represent the most helpful perceptions. Significant relationships between high disability after 6 years and the IPQ-R dimensions identity, consequences, personal control and treatment control were found, meaning that high disability after 6 years was associated with a higher number of symptoms attributed to OA at baseline, less perceived control at baseline and perceptions of stronger consequences due to OA at baseline. There was a trend

Table 3. Mean change (SD) in IPQ-R scores and adjusted mean difference in change of IPQ-R scores after 6 years for patients with progression (n=110) versus patients without progression (n=131) on the Health Assessment Questionnaire (HAQ)*.

IPQ-R dimension	Progression	No progression	Mean difference (95%CI)**
Identity	0.1 (2.4)	-0.4 (2.4)	0.87 (0.40 to 1.34)
Consequences	0.2 (4.6)	-0.9 (4.6)	1.38 (0.37 to 2.39)
Timeline acute/chronic	1.4 (4.0)	0.2 (3.8)	1.33 (0.51 to 2.14)
Timeline cyclical	-0.5 (3.5)	-0.4 (3.3)	-0.02 (-0.79 to 0.74)
Personal control	-1.0 (3.8)	-0.6 (3.9)	-0.44 (-1.34 to 0.46)
Treatment control	-0.8 (3.8)	0.1 (3.1)	-1.00 (-1.70 to -0.29)
Illness coherence	0.4 (3.7)	1.0 (3.1)	-0.86 (-1.66 to -0.06)
Emotional representations	-0.1 (4.3)	-1.8 (4.8)	2.04 (0.93 to 3.15)
Cause - psychological	0.0 (4.3)	-0.4 (3.6)	0.69 (-0.25 to 1.63)
Cause - risk factor	0.3 (3.9)	0.1 (3.5)	0.60 (-0.26 to 1.47)
Cause - immunity	0.0 (2.2)	-0.4 (2.0)	0.56 (0.07 to 1.06)
Cause - chance	0.0 (1.8)	0.0 (1.7)	0.00 (-0.40 to 0.40)

*Progression on the HAQ was defined as the highest quartile of the HAQ change after 6 years. The lower quartiles of HAQ change after 6 years were regarded as no progression.
**Adjusted for age, sex, BMI, Kellgren-Lawrence score, pain intensity score, baseline HAQ score, baseline IPQ-R score and family effects.

towards an association between high disability after 6 years and more perceived chronicity and more negative emotions experienced due to OA at baseline.

DISCUSSION

This study in patients with OA at multiple sites shows that illness perceptions change over time and that these changes are related to disability. Moreover, illness perceptions regarding the number of symptoms attributed to OA, the level of perceived control and perceived consequences are predictive of disability. Over a period of 6 years patients in general perceived their OA as more chronic and less controllable, their understanding of OA increased and emotions associated with OA were less negative. Patients with progression of disability had an increase in the number of symptoms attributed to OA, stronger beliefs about the negative impact of OA, chronicity of the disease, immunity as causal factor and an increase in negative emotions experienced due to OA compared to patients without progression of disability. They also showed a decrease in perceived control of OA and understanding of OA compared to patients without progression of disability. A higher number of symptoms attributed to OA, lower perceived control, and stronger perceived consequences at baseline were predictive of high disability after 6 years. These findings imply that illness perceptions do change over time, that they are related to and, most importantly, predictive of disability. Therefore, interventions aimed at changing illness perceptions may influence clinical outcome.

To our knowledge, few studies investigated illness perceptions in OA and all of them were cross-sectional. In our study it was found that at baseline more disability

Table 4. Association between high disability after 6 years, defined as the highest quartile of Health Assessment Questionnaire (HAQ) score after 6 years, and tertiles of IPQ-R dimensions at baseline.

IPQ-R dimension tertiles*	Crude risk ratio (95%CI)	Adjusted risk ratio (95%CI)**
Identity		
<4	1	1
4-6	12.8 (2.1 to 39.7)	11.5 (1.6 to 39.7)
>6	17.7 (3.2 to 44.6)	12.6 (2.1 to 39.4)
Consequences		
<15	1	1
15-18	3.0 (0.8 to 9.2)	2.5 (0.5 to 9.8)
>18	9.4 (3.7 to 17.0)	6.2 (1.7 to 15.2)
Timeline acute/chronic		
<24	1	1
24-28	2.6 (1.2 to 4.9)	3.1 (1.1 to 6.5)
>28	2.5 (1.1 to 4.8)	2.5 (0.8 to 5.6)
Timeline cyclical		
<13	1	
13-16	0.9 (0.4 to 1.7)	1.2 (0.3 to 2.6)
>16	1.3 (0.7 to 2.2)	1.4 (0.6 to 2.7)
Personal control		
>21	1	1
17-21	1.7 (0.9 to 3.1)	2.9 (1.3 to 5.0)
<17	2.5 (1.3 to 4.1)	2.8 (1.1 to 5.3)
Treatment control		
>15	1	1
13-15	2.1 (1.1 to 3.6)	3.7 (1.4 to 6.5)
<13	2.7 (1.5 to 4.2)	3.2 (1.3 to 5.8)
Illness coherence		
>20	1	1
16-20	1.0 (0.5 to 1.9)	1.5 (0.5 to 3.1)
<16	1.6 (0.9 to 2.6)	1.5 (0.6 to 2.8)
Emotional representations		
<12	1	1
12-16	2.3 (0.9 to 4.7)	2.8 (1.2 to 5.5)
>16	3.1 (1.4 to 5.9)	2.1 (0.7 to 4.9)

*The lowest tertile represents the most helpful illness representation and is regarded as reference category.

**Risk ratios (RR) are adjusted for age, sex, BMI, Kellgren-Lawrence score, pain intensity score, baseline HAQ score quartiles and family effects.

The cause dimension did not show an association with high disability and was therefore omitted from the table.

was associated with more symptoms attributed to OA and stronger perceived consequences. These results are in line with earlier studies in OA patients.[6,10,11] Earlier cross-sectional results from the GARP study showed that patients with high scores on identity, consequences and chronic timeline had an increased risk of reporting more activity limitation of the lower extremities than expected based on disease characteristics.[6] Hill et al. found that in patients with self-reported hand OA, worse hand function was related to reporting more symptoms and more serious consequences.[11] Hampson et al. found an association between reporting more symptoms and perceiving OA as more serious and a greater use of health services and poorer quality of life.[10]

Few longitudinal studies reporting on changes of illness perceptions have been conducted, none of which included patients with OA. Our study is the only one with a long-term follow-up period (6 years) during which some illness perceptions changed, although the changes were small. Patients with progression of disability had increasingly negative illness perceptions compared to patients without progression of disability. These results are in line with a study by Foster et al. in primary care patients with low back pain, where illness perceptions showed the same small range of change over a period of 6 months.[7] After stratification of the population in their study according to clinical outcome, patients with poor outcome were found also to attribute more symptoms to their disease, experience more serious consequences, perceive less control of their disease and more negative emotions due to their disease compared to patients with good outcome. This shows that over both short- and long-term follow-up periods illness perceptions change and that this change is related to change of clinical outcome.

The predictive value of illness perceptions in disability in OA has not been previously investigated. It was found that a higher number of symptoms attributed to OA, low perceived control and more serious perceived consequences at baseline were predictive of high disability after 6 years. The number of symptoms attributed to the disease was the strongest predictor. In other chronic conditions the number of symptoms attributed to disease has shown also to be a strong predictor of clinical outcome. In rheumatoid arthritis (RA) it was found that more perceived symptoms was associated with higher levels of pain after 1 year.[13] Better outcome on physical functioning, social functioning and mental health after 1 year in patients with psoriasis was associated with fewer perceived symptoms.[14] In a 2-year follow-up study by Frostholm et al. in primary care patients, the number of reported symptoms was the strongest predictor of future mental health.[8] A possible explanation for the strong predictive value of the number of disease attributed symptoms for clinical outcome is the direct influence of perceived symptoms on the level of disability that patients experience. It might be that other illness perceptions influence the experience of disability less directly.

In accordance with two other studies we found that in addition to the number of associated symptoms, strong perceived consequences and weak beliefs in the controllability of the disease were predictive of outcome. Foster et al. found that in low back pain patients strong perceived consequences and low perceived control were related to poor outcome at 6 months.[7] In RA patients perceiving strong consequences was associated with more hospital visits and more tiredness after 1 year.[13]

In predicting high disability after 6 years a dose-response relationship was seen for the number of symptoms attributed to OA and perceived consequences, but not for beliefs concerning the controllability of OA. This may reflect that for certain illness perceptions maximum scores may not be the optimal situation. For instance, very strong beliefs in the controllability of OA, meaning cure, are not clinically realistic or desirable. This should be kept in mind when interventions influencing illness perceptions are considered. Therefore perceptions should be optimised, not necessarily meaning they should be maximised.

There are a number of potential limitations of this study. The possibility of bias exists due to differences between those who did and those who did not participate in the follow-up study. However, demographic and disease characteristics were similar between consenter and non-consenters, except for a lower age of the consenters. We expect that this age difference will have no effect on the study outcome. Moreover, adjustment for age was made in all analyses. As noted earlier only small changes in illness perceptions were found. It is unclear whether these changes are clinically significant because no cut-off points for illness perceptions have been determined as of yet. By relating the changes to outcome, an alternative way of giving a clinical meaning to the result was created. As outcome for disability after 6 years the HAQ was used, since it reflects functioning of the whole body. A limitation could be that the HAQ, which is self-reported, does not reflect actual performance of subjects.[27,28] Ideally, a combined score of self-reported and performance-based measures should be used to assess disability. However, no such score exists. Potential bias which may exist with the use of a self-reported measure is also present if a performance-based measure is used, since performance is related to self-efficacy.[29,30] The MCID for RA was used as the cut-off for HAQ progression, because no MCID on the HAQ is established for OA. It may be that the MCID for OA differs from that for RA. Finally, limited information is available about interventions during the follow-up period. In the future, intervention studies should be carried out to assess the effect on illness perceptions.

This study showed that illness perceptions in patients with OA change over time and that they are related to and predictive of disability. This implies that interventions aimed at changing illness perceptions might contribute to improving clinical outcome. Evidence to support this hypothesis is scarce, but promising.[15,31] For clinical practice it is important to bear in mind that illness perceptions influence clinical outcome and it might be useful to explore and discuss a patient's illness perceptions as part of patient evaluation. Further research on the influence of illness perceptions on clinical outcome in OA and other chronic disorders is needed to support this premise, as well as research on the role of possible interventions aimed at altering illness perceptions.

REFERENCES

1. Peat G, McCarney R, Croft P. Knee pain and osteoarthritis in older adults: a review of community burden and current use of primary health care. Ann Rheum Dis 2001;60(2):91-97.
2. Zhang Y, Niu J, Kelly-Hayes M et al. Prevalence of symptomatic hand osteoarthritis and its impact on functional status among the elderly: The Framingham Study. Am J Epidemiol 2002;156(11):1021-1027.
3. Zhang W, Moskowitz RW, Nuki G et al. OARSI recommendations for the management of hip and knee osteoarthritis, Part II: OARSI evidence-based, expert consensus guidelines. Osteoarthritis Cartilage 2008;16(2):137-162.
4. World Health Organization. International Classification of Functioning, Disability and Health: ICF. Geneva, WHO 2001.
5. Leventhal H, Meyer D, Nerenz D. The common sense representations of illness danger. In: Rachman S, editor. Medical Psychology. New York: Pergamon, 1980: 7-30.
6. Botha-Scheepers S, Riyazi N, Kroon HM et al. Activity limitations in the lower extremities in patients with osteoarthritis: the modifying effects of illness perceptions and mental health. Osteoarthritis Cartilage 2006;14(11):1104-1110.
7. Foster NE, Bishop A, Thomas E et al. Illness perceptions of low back pain patients in primary care: What are they, do they change and are they associated with outcome? Pain 2008;136(1-2):177-187.
8. Frostholm L, Oernboel E, Christensen KS et al. Do illness perceptions predict health outcomes in primary care patients? A 2-year follow-up study. J Psychosom Res 2007;62(2):129-138.
9. Hagger MS, Orbell S. A meta-analytic review of the common-sense model of illness representations. Psychol Health 2003;18(2):141-184.
10. Hampson SE, Glasgow RE, Zeiss AM. Personal models of osteoarthritis and their relation to self-management activities and quality of life. J Behav Med 1994;17(2):143-158.
11. Hill S, Dziedzic K, Thomas E et al. The illness perceptions associated with health and behavioral outcomes in people with musculoskeletal hand problems: findings from the North Staffordshire Osteoarthritis Project (NorStOP). Rheumatology (Oxford) 2007;46(6):944-951.
12. Scharloo M, Kaptein AA, Weinman J et al. Illness perceptions, coping and functioning in patients with rheumatoid arthritis, chronic obstructive pulmonary disease and psoriasis. J Psychosom Res 1998;44(5):573-585.
13. Scharloo M, Kaptein AA, Weinman JA et al. Predicting functional status in patients with rheumatoid arthritis. J Rheumatol 1999;26(8):1686-1693.
14. Scharloo M, Kaptein AA, Weinman J et al. Patients' illness perceptions and coping as predictors of functional status in psoriasis: a 1-year follow-up. Br J Dermatol 2000;142(5):899-907.
15. Petrie KJ, Cameron LD, Ellis CJ et al. Changing illness perceptions after myocardial infarction: an early intervention randomized controlled trial. Psychosom Med 2002;64(4):580-586.
16. Riyazi N, Meulenbelt I, Kroon HM et al. Evidence for familial aggregation of hand, hip, and spine but not knee osteoarthritis in siblings with multiple joint involvement: the GARP study. Ann Rheum Dis 2005;64(3):438-443.
17. Altman R, Asch E, Bloch D et al. Development of criteria for the classification and reporting of osteoarthritis. Classification of osteoarthritis of the knee. Diagnostic and Therapeutic Criteria Committee of the American Rheumatism Association. Arthritis Rheum 1986;29(8):1039-1049.
18. Altman R, Alarcon G, Appelrouth D et al. The American College of Rheumatology criteria for the classification and reporting of osteoarthritis of the hip. Arthritis Rheum 1991;34(5):505-514.
19. Altman R, Alarcon G, Appelrouth D et al. The American College of Rheumatology criteria for the classification and reporting of osteoarthritis of the hand. Arthritis Rheum 1990; 33(11):1601-1610.
20. Doyle DV, Dieppe PA, Scott J et al. An articular index for the assessment of osteoarthritis. Ann Rheum Dis 1981;40(1):75-78.
21. Kellgren J. The Epidemiology of chronic rheumatism. Atlas of standard radiographs of arthritis. Philadelphia: FA Davis, 1963:1-13.
22. Siegert CE, Vleming LJ, Vandenbroucke JP et al. Measurement of disability in

Dutch rheumatoid arthritis patients. Clin Rheumatol 1984;3(3):305-309.

23. Weinman J, Petrie KJ, Moss-Morris R et al. The illness perception questionnaire: a new method for assessing the cognitive representation of illness. Psychol Health 1996;11:431-445.
24. Moss-Morris R, Weinman J, Petrie KJ et al. The revised Illness Perception Questionnaire (IPQ-R). Psychol Health 2002;17:1-16.
25. Kosinski M, Zhao SZ, Dedhiya S et al. Determining minimally important changes in generic and disease-specific health-related quality of life questionnaires in clinical trials of rheumatoid arthritis. Arthritis Rheum 2000;43(7):1478-1487.
26. Zhang J, Yu KF. What's the relative risk? A method of correcting the odds ratio in cohort studies of common outcomes. JAMA 1998;280(19):1690-1691.
27. Gandhi R, Tsvetkov D, Davey JR et al. Relationship between self-reported and performance-based tests in a hip and knee joint replacement population. Clin Rheumatol 2009;28(3):253-257.
28. van den Ende CH, Hazes JM, le Cessie S et al. Discordance between objective and subjective assessment of functional ability of patients with rheumatoid arthritis. Br J Rheumatol 1995;34(10):951-955.
29. Lau-Walker M. A conceptual care model for individualized care approach in cardiac rehabilitation--combining both illness representation and self-efficacy. Br J Health Psychol 2006;11(Pt 1):103-117.
30. Maly MR, Costigan PA, Olney SJ. Contribution of psychosocial and mechanical variables to physical performance measures in knee osteoarthritis. Phys Ther 2005;85(12):1318-1328.
31. Buchbinder R, Jolley D, Wyatt M. Population based intervention to change back pain beliefs and disability: three part evaluation. BMJ 2001;322(7301):1516-1520.