Arthritis & Rheumatism (Arthritis Care & Research)
Vol. 61, No. 8, August 15, 2009, pp 1054–1061
DOI 10.1002/art.24674
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ORIGINAL ARTICLE

Illness Perceptions in Patients With Osteoarthritis: Change Over Time and Association With Disability

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Objective. **To investigate changes 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 revised Illness Perception Questionnaire (IPQ-R) and the 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 (with 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 the 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 with 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 changed over time, and these changes were related to outcome. Moreover, illness perceptions were predictive of disability. This may imply that interventions aimed 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 a burden not only for the individual but also for society, increasing in relevance with an aging population (1,2). Therefore, reducing disability is an important treatment goal in patients with OA (3).

It is well recognized 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 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 body structures and body functions. Personal and environmental factors are recognized as modifying factors for the association between these 2 components.

An aspect of the personal factors that modify the association is the perceptions that patients have regarding their disease. Research on these illness perceptions is guided by the common-sense model, which hypothesizes that patients create mental representations of their disease in order to make sense of and manage their 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

Supported by the Dutch Arthritis Association and Pfizer Groton, Connecticut.

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Submitted for publication November 27, 2008; accepted in revised form April 29, 2009.

on the relationship between disease processes and disability, interventions aimed 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 followup 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-characterized 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 whether 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 aimed 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, which is aimed at identifying determinants of OA susceptibility and progression. The population comprises 192 white sibships with symptomatic OA at multiple sites recruited from rheumatologists, orthopedic 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 followup visit were examined. Patients were eligible for the present study if baseline and followup measures of their illness perceptions and disability were available.

OA diagnosis. Patients were included in the GARP study if they had symptomatic OA in ≥2 joint sites in the hands or in ≥2 of the following joint sites: hand, knee, hip, or spine. Patients with 1 joint site involved were required to have structural abnormalities in at least 1 of the other joint sites, defined by the presence of radiographic OA or the presence of ≥2 of Heberden's nodes, Bouchard's nodes, or the squaring of ≥1 first carpometacarpal (CMC) joint on physical examination.

Symptomatic OA in the knee and hip was defined following the criteria of the American College of Rheumatology (ACR) (17,18). Knee OA was defined as pain or stiffness on most days of the prior month and osteophytes at the 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 3 of the following criteria: bony swelling of ≥2 of the 10 selected joints (bilateral distal interphalangeal joints 2 and 3, bilateral proximal interphalangeal joints 2 and 3, and the bilateral first CMC joints), bony swelling of ≥2 distal interphalangeal joints, <3 swollen metacarpal 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 (K/L) score of 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 followup using standardized questionnaires.

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

Radiographs. Conventional radiographs of the hands (dorsovolar), knees (posteroanterior [PA] weight bearing/semiflexed), hips (PA), lumbar spine (PA and lateral), and cervical spine (anteroposterior, lateral, and transbuccal) were obtained by a single radiographer employing a standard protocol with a fixed film focus distance. Radiologic OA was scored by a single experienced musculoskeletal radiologist using the K/L grading scale (21) in the hands (distal and proximal interphalangeal joints and first CMC 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 Health Assessment Questionnaire (HAQ), which consists of 24 items in 8 categories concerning activities of daily living and mobility (22). Responses are scored from 0 (indicating that the item can be accomplished without any difficulty) to 3 (indicating that the patient is unable to do the item). If patients use aids, they automatically score 2 on that item. The highest scores in each of the 8 categories are summed and divided by 8 to produce a disability score (range 0–3).

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 that patients associate with OA. Patients were asked whether or not they had experienced 14 commonly occurring symptoms since the onset of their illness and whether they believe these symptoms were 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 7 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 individual's perceptions of the likely chronic duration of their health problems. The cyclical timeline represents the individual's perceptions of the likely variability of their disease. Illness coherence reflects the individual's understanding of OA. Personal control represents the individual's perceptions of personal control, and treatment control represents their beliefs in cure through treatment. The emotional representations dimension reflects the individual's negative emotions experienced due to OA. Each item is rated on a 5-point Likert scale, ranging from strongly disagree to strongly agree. High scores represent strong beliefs on that particular dimension.

The third section of the IPQ-R comprises 18 possible causes that patients might attribute to OA, grouped in 4 dimensions: psychological attributions (n = 6), risk factors (n = 7), immunity (n = 3), and chance (n = 2).

Statistical analysis. Data were analyzed using SPSS, version 14.0 (SPSS, Chicago, IL). For each IPQ-R dimension, means and SDs were calculated. The mean change for each dimension with the 95% confidence interval (95% CI) was calculated by subtracting the baseline scores from the followup scores. In order to relate these changes to the progression of disability, patients were classified as progressed or not progressed based on the minimum clinically important difference (MCID) of 0.22 on the HAQ (25). Patients with a change on HAQ score $\geq$0.22 were classified as progressed, and those with a change on 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, sex, body mass index (BMI), K/L score, pain intensity score, baseline HAQ score, baseline IPQ-R score, and with a random intercept to adjust for family effects within sibpairs. The adjustment for family effects is based on the hypothesis from the common-sense model that illness perceptions are influenced by a patient's social environment. This implies that illness perceptions within a sibpair could be more alike than illness perceptions between sibpairs. The estimates represent the difference in change of illness perceptions between patients with and without progression of disability and are reported with 95% CIs.

At baseline, the association between illness perceptions and disability was assessed using linear mixed models adjusting for age, sex, BMI, K/L 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 followup, IPQ-R baseline scores were categorized in tertiles and HAQ scores at followup were categorized in quartiles, both based on the distribution in this population. The highest quartile of HAQ followup scores was regarded as high disability, and the other 3 quartiles as low disability. Logistic regression analyses were used to estimate crude and adjusted odds ratios (ORs) with 95% CIs. Adjustments were made for age category (40–49, 50–59, 60–69, and 70–79 years), sex, BMI category ($<$20, 20–25, 25–30, and $>$30 kg/m^2), K/L score (binary, using the median as the cutoff), pain intensity score (binary, using the median as the cutoff), and baseline HAQ score quartile. To take into account intrafamily effect, robust SEs were computed using Stata, version 8.0 (Stata, College Station, TX). The crude and adjusted ORs and 95% CIs were subsequently transformed to risk ratios (RRs) using the approximation formula described by Zhang and Yu (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 followup study, of whom 260 patients completed questionnaires and visited the outpatient clinic and 57 patients completed questionnaires only. Consent was not given by 50 patients (13.0%), 15 (3.9%) were deceased, and 2 (0.5%) were lost to followup. Of the 317 eligible patients, 241 had completed the IPQ-R at baseline and followup at the time of the present study and were included. The mean followup time was 6.0 years (range 5.0–7.4 years).

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

The median (interquartile range) HAQ score was 0.50 (0.13–0.94) at baseline and 0.75 (0.38–1.13) at followup. The mean change was 0.17 (95% CI 0.12, 0.23). Patients with progression on the HAQ (n = 110) had a mean ± SD change in HAQ score of 0.53 ± 0.29. Patients without progression on the HAQ (n = 131) had a mean ± SD 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 changes with 95% CIs 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 that patients perceived their OA as more chronic and less controllable, that they believed that they had a

Table 1. Baseline demographic characteristics, HAQ, K/L, and pain intensity scores of 241 patients with OA at multiple sites*

Patient characteristics	Value
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)
Sites with symptomatic OA, no. (%)	
Hand	172 (71.4)
Knee	83 (34.4)
Hip	61 (25.3)
Spine	192 (79.7)
HAQ score, range 0–3	0.50 (0.13–0.94)
K/L score, range 0–180	41.0 (29.0–55.0)
Pain intensity score, range 0–145	5.0 (2.0–10.0)

* Values are median (interquartile range) unless otherwise stated. HAQ = Health Assessment Questionnaire; K/L = Kellgren/Lawrence; OA = osteoarthritis.

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 score were found, with β coefficients (95% CIs) derived from linear mixed model analysis of 0.03 (0.01, 0.06) and 0.04 (0.02, 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).

Change of perceptions about OA in relation to progression of disability. To investigate the relationship between changes of illness perceptions over 6 years and the progression of disability, change on the IPQ-R dimensions was compared between patients with progression (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 of timeline acute/chronic, increased less on the dimension of illness coherence, and decreased less on the dimension of emotional representations than patients without progression did. 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 the 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 with patients without progression of disability. Patients with progression of disability showed a decrease in perceived control and understanding of OA compared with 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

Table 2. Baseline scores on the IPQ-R and mean change after 6 years in 241 patients with OA at multiple sites*

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

* IPQ-R = revised Illness Perception Questionnaire; OA = osteoarthritis; 95% CI = 95% confidence interval.

Table 3. Mean ± SD change 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 HAQ*

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

* Progression on the Health Assessment Questionnaire (HAQ) was defined as the highest quartile of HAQ score change after 6 years. The lower quartiles of HAQ change after 6 years were regarded as no progression. IPQ-R = revised Illness Perception Questionnaire; 95% CI = 95% confidence interval.
† Adjusted for age, sex, body mass index, Kellgren/Lawrence score, pain intensity score, baseline HAQ score, baseline IPQ-R score, and family effects.

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 toward 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 showed 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 of OA 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 their 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, the chronicity of the disease, and immunity as causal factor, and an increase in negative emotions experienced due to OA compared with patients without progression of disability. Patients with progression of disability also showed a decrease in perceived control of OA and understanding of OA compared with patients without progression of disability. A higher number of symptoms attributed to OA, lower perceived control, and stronger perceived consequences of OA at baseline were predictive of high disability after 6 years. These findings imply that illness perceptions do change over time, and 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 have investigated illness perceptions in OA, and all of them have been cross-sectional. In our study it was found that at baseline, more disability was associated with more symptoms attributed to OA and stronger perceived consequences of OA. These results are in line with earlier studies in patients with OA (6,10,11). Earlier cross-sectional results from the GARP study showed that patients with high scores on the identity, consequences, and chronic timeline subscales 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, 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 followup 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 with 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, in which 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, and perceive less control of their disease and more negative emotions due to their disease compared with patients with good outcome. This shows that over both short- and long-term followup peri-

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

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

* The cause dimension did not show an association with high disability and was therefore omitted from the table. HAQ = Health Assessment Questionnaire; IPQ-R = revised Illness Perception Questionnaire; RR = risk ratio; 95% CI = 95% confidence interval.
† The reference tertile represents the most helpful illness representation and is regarded as the reference category.
‡ Adjusted for age (40–49, 50–59, 60–69, 70–79 years), sex, body mass index (<20, 20–25, 25–30, >30 kg/m^2), Kellgren/Lawrence score (≤41, >41), pain intensity score (≤5, >5), baseline HAQ score quartiles, and family effects.

ods illness perceptions change, and that this change is related to changes in 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, lower 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 been shown to also 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 followup 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 2 other studies, we found that in addition to the number of associated symptoms, strong perceived consequences, and weak beliefs about 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 optimized, not necessarily meaning that they should be maximized.

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 followup study. However, demographic and disease characteristics were similar between consenters and nonconsenters, 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 cutoff 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. The HAQ was used as the outcome for disability after 6 years because 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 that may exist with the use of a self-reported measure is also present if a performance-based measure is used because performance is related to self-efficacy (29,30). The MCID for RA was used as the cutoff 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 followup 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 that 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.

ACKNOWLEDGMENTS

The authors acknowledge the support of the cooperating hospitals and referring rheumatologists, orthopedic surgeons, and general practitioners.

AUTHOR CONTRIBUTIONS

All authors were involved in drafting the article or revising it critically for important intellectual content, and all authors approved the final version to be submitted for publication. Dr. Bijsterbosch had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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Acquisition of data. Bijsterbosch, Scharloo, Visser, Watt, Meulenbelt, Huizinga, Kaptein, Kloppenburg.

Analysis and interpretation of data. Bijsterbosch, Scharloo, Visser, Watt, Meulenbelt, Huizinga, Kaptein, Kloppenburg.

ROLE OF THE STUDY SPONSOR

Pfizer and the Dutch Arthritis Association provided financial support for this work. However, they did not contribute to the study design, data collection, data analysis, and writing of the manuscript. Publication was not contingent on the approval of the sponsors.

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