Familial osteorarthritis : risk factors and determinants of outcome

Riyazi, N.

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Discrepancies of disease and disability in hand osteoarthritis

Naghmeh Riyazi[1], MD, Stella Botha-Scheepers[1], MD, Margreet Scharloo[2], PhD, Herman M Kroon[3], MD, PhD, Frits R. Rosendaal[4], MD, PhD, Eline Slagboom[5], PhD, Ferdinand C. Breedveld[1], MD, PhD, Tanja Stamm, PhD[6] and Margreet Kloppenburg[1, 4], MD, PhD

Departments of [1]Rheumatology, [2]Medical Psychology, [3]Radiology, [4]Clinical Epidemiology and [5]Molecular Epidemiology, Leiden University Medical Center, The Netherlands and [6] Department of Internal Medicine III, Vienna Medical University, Vienna

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Abstract

Objective

To investigate which contextual factors modify the association of impairments in body structures and functions due to hand osteoarthritis (OA) to limitations in activity.

Methods

Self-reported limitation in activities was assessed by the function subscale of the Australian/Canadian Osteoarthritis Hand Index (AUSCAN LK 3.0) in 332 patients with structure abnormalities in the hands. Body structures and functions were evaluated during clinical and radiological assessments. Socio-demographic data were obtained with structured questionnaires. Illness perceptions and mental health were assessed with the revised illness perception questionnaire (IPQ-R) and RAND-36 mental component summary score, respectively. For each patient an expected AUSCAN function score was calculated, on the basis of a multivariate model resulting from the association of body structures and self-reported AUSCAN scores.

Results

Self-reported and expected median (range) AUSCAN function scores were 10 (0-36) and -3.7 (-17-21) respectively. 88 patients reported more and 167 patients reported less limitation in activity than expected from the model. Factors related to more self-reported limitation than expected were age, odds ratio (OR) (95% confidence intervals) OR: 2.4 (1.3-4.6), education, OR: 0.5 (0.2-0.9) and IPQ-R consequences, OR: 2.5 (1.2-5.2). Shoulder pain, OR:0.5 (0.3-0.9), pain at other joint sites, OR: 0.5 (0.3-0.9) and IPQ-R identity, OR: 0.4 (0.2-0.8) were related with less self-reported limitation than expected. No association was found with the RAND-36 mental score.

Conclusion

In patients with hand OA limitation of activity is under a substantial influence of personal factors, such as age, education and psychological factors. The identification of these factors provides possible targets for management of patients with hand OA.

Key words

Hand, osteoarthritis, AUSCAN, IPQ, disability, GARP

Introduction

The hand is a common site of peripheral joint involvement in osteoarthritis (OA) and preferentially affects different joint groups in the hands, being the distal and proximal interphalangeal (DIP and PIP) and first carpometacarpal (CMC1) joints. Degraded cartilage, the presence of osteophytes especially at joint margins and lateral deformities are the most prominent impairment of body structures in hand OA. These impaired body structures are associated with impaired body functions, like pain, stiffness, limited joint mobility, joint swelling and weakness. Several studies in hand OA have shown an association between impairments in body structures and functions with limitations in activity and participation (1-8).

The International Classification of Functioning, Disability and Health (ICF) describes the impact of a disease such as hand OA on the patients functioning, disability and health (9) and recognizes the modifying role of contextual factors on the association between impaired body structures and functions on the one side and limitations in activity and participation on the other side (10). In hand OA several modifying contextual factors on hand function have been investigated such as, age, sex and the effect of impairments of other joint sites in the upper and lower extremities (1-4, 11). These studies have rendered inconsistent results in terms of the impact of these factors on hand function. The more recent studies on hand OA limitation of activity have recognised the role of contextual factors involved in this multidimensional process, consisting of impaired body structures and functions with the modifying role of personal factors, such as age, sex, socio-demographic and psychological factors (7-8).

Psychological factors of interest, as shown in studies of OA in the lower extremities, are mood, helplessness, self-efficacy, catastrophizing, and pain coping abilities (7, 12- 19). Furthermore, attention has been directed to the role of patients' beliefs with regard to their illness (20-21). Research on mental representations of illness is guided by the Common Sense Self-Regulation Model (22), which postulates that patients' beliefs about the illness in terms of symptoms, duration, causes, consequences, and controllability/curability mediate between the experience of illness symptoms, subsequent health behaviour, and health outcomes. Support for this theory has come from studies on illness representations in patients with various chronic illnesses (23), including OA (20-21), and from intervention studies in patients with myocardial infarction (24), and chronic low back pain (25).

The main objective of the present study was to investigate disability in hand OA patients by determining the association between impairments in body structures and functions and limitations in activity using a validated instrument (AUSCAN LK 3.0) (26), taking into account the role of contextual factors. In the present study, we separately examined the modifying effect of contextual factors in patients reporting less and patients reporting more limitation in activity than what would be expected based on impairments in body structures and body functions. We presumed different modifying effects of contextual factors between the two groups of patients, as different mechanisms have been shown to underlie sustained levels of high as opposed to low physical functioning (27). We evaluated whether contextual factors, including personal and social factors, co-morbidities and illness perceptions, could explain these discrepancies.

Patients and Methods

The present study is part of the ongoing GARP study (Genetics, Arthrosis and Progression). The GARP study is aimed at the identification of determinants of OA susceptibility and progression. The study is based on Caucasian sibships of Dutch ancestry with predominantly symptomatic OA at multiple sites. Details of recruitment and selection of patients have been described in detail in a previous study (28).

Patients with secondary OA and familial syndromes with a Mendelian inheritance pattern were excluded. Considered as secondary OA were major congenital or developmental diseases and bone dysplasias, major local factors such as severe scoliosis and hypermobility, certain metabolic diseases associated with joint disease such as hemochromatosis and Wilson's disease, inflammatory joint diseases such as rheumatoid arthritis, other bone diseases such as morbus Paget and osteochondritis and intra-articular fractures. Patients with a very limited life expectancy were also excluded. Crystal deposition arthropathies (unless in the case of severe polyarticular gout), and diabetes mellitus or thyroid conditions were not considered as exclusion criteria.

OA diagnosis

Probands and siblings were included in the GARP study with OA at multiple joint sites in the hands or with OA in two or more of the following joint sites: hand, spine (cervical or lumbar), knee, or hip. Both subjects were included only when they had symptomatic OA in at least one joint site. Furthermore, subjects with symptomatic OA in just one joint site were included only when they had structural abnormalities in at least one other joint site defined by the presence of radiographic OA in either of the four joints or the presence of two or more Heberden nodes, Bouchard nodes or squaring of at least one CMC1 joint on physical examination. Symptomatic OA in hand joints was defined according to the ACR criteria (29) as pain or stiffness on most days of the prior month in addition to three of the following four criteria: bony swelling of 2 or more of the 10 selected joints (bilateral DIP joints 2 + 3, bilateral PIP joints 2 + 3 and CMC1 joints), bony swelling of 2 or more DIP joints, less than 3 swollen metacarpophalangeal (MCP) joints and deformity of at least 1 of the 10 selected joints. In the present analysis all patients were included with symptomatic hand OA or structural abnormalities in the hands.

Radiographs

Conventional radiographs of the hands (dorso-volar) and other joint sites were obtained from all participants. Conventional radiographs were scored by a single experienced musculoskeletal radiologist (HK) according to the Kellgren-Lawrence scale with the help of the original atlas (30). This is a five-point scoring system with ascending severity, based on the presence of osteophytes, joint space narrowing, sclerosis and degenerative cysts. A Kellgren-Lawrence score of ≥ 2 depicts OA in a particular joint. In the hands, the DIP, PIP and CMC 1 joints were scored, rendering a total Kellgren-Lawrence score of 80. The intra-reader variability as scored by the Kellgren-Lawrence method, depicted by the intra-class correlation coefficient (ICC) (95% confidence interval) for the hands

was 0.95 (0.92-0.96). The intra-reader variability was based on the examination of radiographs of 40 subjects, which were selected randomly throughout the duration of the study period and were blinded for any patient characteristics.

Clinical Assessments

Standardised questionnaires were used to record socio-demographic data like age, sex, married status, level of formal education (categorised as low: up to and including lower technical and vocational training; medium: up to and including secondary technical and vocational training; high: up to and including higher technical and vocational training and university) and additional data including body mass index (BMI) (weight (kg)/height $(m)^2$), the presence of co-morbidities, including diabetes mellitus, hypertension, cardiovascular disease, cerebrovascular disease and peripheral vascular disease.

During a physical examination, the following was recorded: the presence of pain upon lateral pressure and limitation on movement in the DIPs, PIPs, CMC1s and MCPs graded on a three point scale for intensity; the presence of bony swellings (Heberden or Bouchard nodes or squaring of CMC1) and deformities; and pain upon movement in the wrists, elbows and shoulders.

Activities assessment

Hand function was assessed by a self-administered questionnaire, the Australian/ Canadian Osteoarthritis Hand Index (AUSCAN LK 3.0) (26). The AUSCAN questionnaire contains nine items relating to difficulty with hand functions (taps, doorknobs or handles, buttons, jewellery, jars, carrying pots, peeling vegetables or fruit, picking up large heavy objects and wringing out washing clothes). This hand index uses a 48 h time frame, response being scaled on a five-point Likert scale (0=none, 1=mild, 2=moderate, 3=severe, 4=extreme). The possible range of scores is 0-36 for function. An asymptomatic population would be expected to score zero on the AUSCAN.

Psychological assessment

Mental health was assessed with the mental component summary score (MCS) of the Dutch validated SF-36 Health Survey, including the subscales social functioning, role limitations (emotional), mental health and vitality (31-32). A higher score indicates better mental health. The revised version of the Illness Perception Questionnaire (IPQ-R) (33) was completed by 301 of the patients. The IPQ-R is a multiple-choice questionnaire developed to provide information about the components that have been found to underlie the cognitive and emotional representation of illness. The first section, the identity component, is concerned with the symptoms the patient associates with OA. Patients were asked whether they were experiencing 14 commonly occurring symptoms and also if they believed their symptoms were related to their OA (yes/no). The sum of the yes-rated items formed the identity subscale. The second section of the IPQ-R consists of statements rated on a five-point Likert scale and provides separate scores for the subscales: consequences (an individual's beliefs about illness severity and impact on physical, social and physical functioning), chronic timeline (perceptions of likely chronic duration of their health problems), cyclical timeline

(perceptions of likely variability of their health problems), illness coherence (how much patients feel they comprehend their illness), personal control (belief in personal control over illness), treatment control (belief in cure through treatment) and emotional dimensions (negative emotions generated by the illness). High scores represent strong beliefs on the particular dimension.

Statistical analysis

Data concerning body structures and functions in association with AUSCAN function were analysed using SPSS, version 11.0. Linear mixed models, with a random intercept to adjust for the familial effect within the sib pairs, were used for modelling. Univariate analyses were performed initially to examine the associations between the independent disease variables and AUSCAN function scores as dependent variables. Estimates of fixed effects were reported with 95% confidence intervals. The estimates represent the magnitude of the impact of the variables on the AUSCAN function scores. Subsequently for each patient expected AUSCAN function scores were calculated using a function based on the multivariate model for the association of body structures and functions due to OA and limitations in activity as measured by AUSCAN function. The amount of discrepancy was defined as the difference between self-reported AUSCAN function and expected AUSCAN function scores.

To understand the discrepancies between self-reported and expected AUSCAN function scores the potential modifying effects of personal and environmental factors were investigated. The modifying effect of contextual factors were investigated separately in the patients who had a higher self-reported than expected AUSCAN function score and in the patients that a lower self-reported than expected AUSCAN function score. Both groups were compared with patients who had a self-reported AUSCAN function score that was similar to the expected AUSCAN function score. A 10% change (within a range of 3.6 points) on the AUSCAN scale was regarded indicating equivalence. This cut-off point was chosen synonymous to a 10 % cut-off point found to represent minimal perceptible clinical changes for the Western Ontario and McMaster University Osteoarthritis Index (WOMAC) in patients with hip and knee OA (34).

Contextual factors were dichotomised according to their presence or absence or divided in two groups based on the median score. Odds ratios (OR), as measures of relative risk, were calculated using logistic regression. OR are presented with a 95% confidence interval (CI95). All OR have been adjusted for age, sex and BMI. To take into account the intra-family effect, robust standard errors were computed using the statistical programme STATA 7.0.

Results

Population description

Of the 382 patients (191 sib pairs) included in the GARP study, the AUSCAN questionnaire was unavailable in 32 patients and invalid in 2 patients due to missing values. Of the remaining 348 patients, 332 had structural abnormalities due to OA in the hands and were included in the present study. The patient characteristics are shown in Table 1. The median age of the patients was 60 years old and 80% were women. DIP joints were mostly (65%) affected. The majority (52%) of the patients had concomitantly cervical spine degeneration. Physical examination of the joints in the upper extremities showed that the shoulders (39%) were most painful followed by the wrists (8%) and elbows (5%). Of the 332 patients 75% met the ACR criteria for hand OA. The median AUSCAN function score was 10 out of a maximum score of 36. The mean AUSCAN function scores were higher in patients that met the ACR criteria of the hands at 13.1 (range 0-33) than in patients with just structural abnormalities in the hands, at 6.4 (range 0-26); mean difference of 7.1 (CI95 1.1-5.0).

Table 1. Characteristics of 332 patients with structural abnormalities in the hands in addition to osteoarthritis (OA) at multiple sites[1].

Age, yrs	60 (43-79)
Women, no. (%)	267 (80)
Hand OA according to ACR[2] criteria, no. (%)	250 (75)
Hand joints with radiological OA[3], no. (%)	
Distal interphalangeal (DIP)	214 (65)
Proximal interphalangeal (PIP)	177 (53)
First carpometacarpal (CMC1)	158 (48)
AUSCAN[4] function (0-36)	10 (0-33)
Cervical spine degeneration, no. (%)	172 (52)
Pain at physical examination, no. (%)	
Shoulders	130 (39)
Elbows	16 (5)
Wrists	28 (8)
OA in ≥ 2 other joint sites (hip, knee, spine)	145 (44)
Pain at ≥ 2 other joint sites (hip, knee, spine)	235 (71)

[1]Median (range) unless otherwise stated

[2]ACR=American College of Rheumatology

[3] Radiological OA is defined as at least Kellgren or Lawrence grade 2, in 1 joint

[4] AUSCAN=Australian/ Canadian Hand Osteoarthritis Index

Association between impairments in body structures and functions due to hand OA and limitations in activity assessed by AUSCAN function.

In Table 2 the association between impairments in body structures and functions due to hand OA and AUSCAN function is shown. In univariate analyses, Kellgren/Lawrence total score, the presence of bony swellings, deformities, limited mobility and joint pain total score were associated with AUSCAN functions scores. The presence of bony swellings and joint pain total score were independently associated with AUSCAN functions scores in multivariate analyses. Based on the multivariate model the following function was defined to calculate AUSCAN function scores for each patient: Expected AUSCAN function = 6.9 + (-0.04 * Kellgren-Lawrence total score + 2.3 * limited mobility + 1.6 *presence of deformities + 0.25 * presence of bony swellings + 0.64 * joint pain total score).

Table 2. Impairments in body structures and functions due to osteoarthritis (OA) in 332 patients with OA at multiple sites including the hands and the association with function scores assessed by the Australian/ Canadian Hand Osteoarthritis Index (AUSCAN).

Variable	Prevalence[1]	Univariate association with AUSCAN function	Multivariate association with AUSCAN function
		Effect (CI95)	Effect (CI95)
K/L total score (0-80)	14 (0-69)	0.2 (0.1-0.2)	-0.04(-0.1-0.05)
Bony swellings[2] (0-20)	7 (0-19)	0.5 (0.4-0.7)	0.3 (0.04-0.5)
Deformities, no. (%)	89 (27)	6.2 (4.1-8.3)	1.6 (-0.9-4.9)
Limited mobility, no. (%)	60 (18)	5.6 (3.1-8.1)	2.3 (-0.3-4.9)
Joint pain total score (0-66)	2 (0-40)	0.8 (0.6-0.9)	0.6 (0.5-0.8)

Abbreviations: K/L = Kellgren/Lawrence, CI95 = 95% confidence interval.

[1]Values are median (range) unless otherwise stated.

[2]Bony swellings include Heberden´s/Bouchard´s noduli and 1st Carpal metacarpal joint squaring.

Discrepancies between self-reported AUSCAN function and expected AUSCAN function scores.

The median (range) for the expected AUSCAN function was -3.7 (-17-21). When self-reported and expected AUSCAN function scores were compared, 77(23%) patients had self-reported and expected AUSCAN scores that were equivalent (the difference between self-reported and expected AUSCAN scores less than 3.6 units). 88(27%) patients had a self-reported AUSCAN function score that was at least 3.6 units higher than the expected AUSCAN function score, and 167 (50%) patients had a lower self-reported AUSCAN function score than expected.

Modifying effects of contextual factors on limited activities as measured by AUSCAN function.

To understand the discrepancies between self-reported and calculated AUSCAN function scores the potential modifying effects of contextual factors were investigated. The prevalence of the personal and environmental contextual factors in the study population is depicted in Table 3.

Table 3. Presence of personal and environmental factors in 332 patients with osteoarthritis (OA) at multiple sites including the hands.

	Prevalence[1]
Co-morbidity, no. (%)	112 (34)
Body mass index, kg/m^2	26 (19-46)
Use of pain medication, no. (%)	147 (44)
Living alone, no. (%)	86 (26)
Low educational level, no. (%)	132 (40)
RAND-36 mental scale (0-100)	83 (4-100)
IPQ-R subscales[2]	
Identity (0-14)	5 (0-14)
Consequences (0-30)	17 (6-30)
Chronic timeline (0-30)	26 (11-30)
Cyclical timeline (0-20)	15 (4-20)
Personal control (0-30)	19 (10-28)
Treatment control (0-25)	14 (5-20)
Illness coherence (0-25)	18 (6-25)
Emotional representations (0-30)	14 (6-30)

[1]Values are the median (range) unless otherwise stated.

[2]The revised version of the Illness Perceptions Questionnaire (IPQ-R) was completed by 301 of the patients.

Tables 4 and 5 show the relative risk of the modifying effect of contextual factors in patients reporting AUSCAN function scores that were higher or lower than the expected AUSCAN function scores, adjusted for age, sex and BMI. Older age and use of pain medication were associated with a two-fold increased risk of a higher self-reported than expected AUSCAN function scores. A low education was associated with a two-fold decreased risk of a higher self-reported than expected AUSCAN function scores. Furthermore a higher IPQ-R identity, OR=1.8 (CI95 1.0-3.5) and consequences, OR=2.5 (CI95 1.2-5.2) scores were associated with self-reported AUSCAN function scores higher than the expected AUSCAN function scores. Lower AUSCAN function scores than expected, were associated with a two-fold less often reporting of pain at other joint sites, pain in the shoulders at physical examination, and a low IPQ-R identity, OR=0.4 (CI95 0.2-0.8) score than patients with the expected AUSCAN function scores. Other factors associated with lower AUSCAN function scores than expected were: living alone, a lower educational level and a high IPQ-R treatment control.

Table 4. Age, sex and Body mass Index (BMI) adjusted relative risk of patients with personal or environmental risk factors having a discrepancy between self-reported and expected AUSCAN function scores.

Variable	More limitation [1] OR (CI95) (n=88)	Less limitation[1] OR (CI95) (n=167)
Age > 60 years	2.4 (1.3-4.6)	1.6 (0.9-2.8)
Female sex	1.6 (0.6-4.1)	0.6 (0.3-1.2)
Cervical spine degeneration	1.1 (0.6-2.0)	0.7 (0.4-1.2)
OA in ≥ 2 other sites (spine, hip, knee)	1.6 (0.8-3.2)	1.6 (0.9-2.9)
Pain at ≥ 2 other sites (spine, hip, knee)	1.0 (0.5-1.9)	0.5 (0.3-0.9)
Use of pain medication	1.9 (1.0-3.7)	0.7 (0.4-1.3)
Pain on movement		
shoulders	1.0 (0.5-1.9)	0.5 (0.3-0.9)
elbows	1.8 (0.5-6.7)	0.7 (0.2-2.7)
wrists	0.8 (0.6-1.1)	0.7 (0.5-1.2)
Co-morbidity	1.0 (0.4-2.8)	1.1 (0.5-2.5)
BMI>30	1.7 (0.8-3.9)	0.7 (0.4-1.3)
Living alone	1.7 (0.8-3.9)	2.0 (1.0-4.1)
Low educational level	0.5 (0.2-0.9)	0.6 (0.3-1.0)

[1]The relative risk of having a self-reported AUSCAN function score that was higher or lower than the expected AUSCAN function score in comparison to patients with an equivalent score, given specific personal or environmental risk factors, expressed as adjusted odds ratio's (OR) with 95% confidence intervals (CI95).
[2]Scores were divided in two groups based on the median values.

Table 5. Age, sex and Body mass Index (BMI) adjusted relative risk of patients with psychological risk factors having a discrepancy between self-reported and expected AUSCAN function scores.

Psychological factor	More limitation [1] OR (CI95) (n=88)	Less limitation [1] OR (CI95) (n=167)
High RAND-36 mental component summary score [2]	0.7 (0.3-1.2)	1.7 (0.9-3.0)
IPQ-R subscales [2]		
High identity	1.8 (1.0-3.5)	0.4 (0.2-0.8)
High consequences	2.5 (1.2-5.2)	0.7 (0.3-1.3)
High chronic timeline	1.6 (0.8-3.3)	1.0 (0.6-2.0)
High cyclical timeline	1.6 (0.8-3.4)	1.5 (0.8-2.8)
High personal control	0.9 (0.5-1.9)	1.3 (0.7-2.4)
High treatment control	1.4 (0.7-2.9)	1.9 (1.0-3.6)
High illness coherence	1.1 (0.6-2.3)	1.4 (0.8-2.6)
High emotional representations	1.3 (0.6-2.6)	0.7 (0.4-1.3)

[1]The relative risk of having a self-reported AUSCAN function score that was higher or lower than the expected AUSCAN function score in comparison to patients with an equivalent score, given specific personal or environmental risk factors, expressed as adjusted odds ratio's (OR) with 95% confidence intervals (CI95).
[2]Scores were divided in two groups based on the median values.

Discussion

In this analysis of 332 patients with predominantly symptomatic OA in the hands, in the presence of pain in other joint groups, personal, environmental and psychological factors were shown to affect the limitations in activity, as assessed by a validated instrument (AUSCAN LK 3.0).

Of the 332 patients, 88 reported more limitation in activity than expected. Age strongly determined the outcome in these patients. This result is in accordance with findings from a study by Dominick et al (8), showing that age was associated with grip strength, a parameter of limited activity, in a multivariate analysis. However, in their study, grip strength was also associated with female sex. Since we mainly studied women our study may have had limited power to detect sex differences. Patients who reported more limitation than expected also used more pain medication than other patients. One would expect this to attenuate the differences, at least on AUSCAN items related to pain, and therefore our findings are likely to be an underestimation of the true associations.

Of the 332, 167 patients reported less limitation in activities than expected. These patients reported less often pain at other joint sites, including the shoulders as compared to patients with the same self-reported limitation in activity as expected. This may be due to an altered pain perception as suggested by Kosek et al (35), who found deficient centrally mediated responses involved in the pain modulation pathways in osteoarthritic pain. The lack of shoulder pain may also directly lead to less disability in the hands as demonstrated in a study by Hirsch et al (3) that showed upper extremity joint impairment contributes significantly to reduced hand performance.

A higher education level was in the present study associated with reporting less limitation than expected, in line with earlier studies. In a study in OA of the knee a negative association was reported between education (years) and self-reported disability as measured using the WOMAC function score (15). However, a higher education level was also associated with more self-reported limitation in activity than expected. This paradoxical finding may have different underlying mechanisms which further future studies may help elucidate. Possibly, the reporting of more limitations than expected in patients with higher education levels may be due to the nature of activities in higher educated patients, and even minimal osteoarthritic structural changes may have a great impact on these activities and perceived limitation.

In the present study a number of illness perceptions were shown to influence hand functions. We observed that a belief in strong consequences of the disease (beliefs about the illness severity and its likely impact on physical, social and psychological functioning), and a high illness identity (beliefs about the number of symptoms associated with OA) were associated with reporting a worse functioning score than expected, while reporting a low IPQ-R identity score and strong beliefs in treatment control were associated with a better functioning score than expected. These findings are remarkably consistent with results from other studies that have also adopted the self-regulation approach to investigate activity limitation in rheumatoid arthritis and osteoarthritis (20-21, 36-38), and also closely resemble the results on the pervasive effect of catastrophizing in rheumatic diseases (18).

Although mental health is reported to be a contextual factor of WOMAC functioning in knee OA (27), our results do not support the role of mental health as a psychological factor in AUSCAN functioning. This may be due to the fact that we examined the mental health component summary score that also includes the subscales social functioning, role limitations (emotional), and vitality (32). Results by Sharma et al. (27), show that good mental health scores increase the likelihood of a good WOMAC outcome, whereas increased likelihood of chair-stand outcome is related to role-functioning emotional scores but not to mental health scores. Also, a low mental health score may be a more important determinant of functioning in patients with mobility problems associated with involvement of the lower extremities.

The modifying effects of contextual factors on limited activities as measured by AUSCAN function, were evaluated separately in patients that reported less and patients that reported more limitations in activity than would be calculated based on impairments in body structures and body functions. We chose to investigate these relationships separately in the two patient groups because we presumed that different mechanisms could underlie these discrepancies, which was confirmed by the results. For instance, the absence of a relationship between educational level and self-reported disability may be due to the separated analysis of the two patient groups in this fashion; when both groups would have been analyzed in one heap, in comparison to the group of patients reporting the same amount of limitation in activity as calculated, we would have find no association with education. Age was only a contextual factor in patients reporting more limitation in activity than calculated and the absence of pain in the shoulders or pain in at least 2 other OA joint sites were only contextual factors in patients reporting less limitation in activity than calculated.

The investigated impairments in body structure and functions included the Kellgren/Lawrence total score, the presence of bony swellings, deformities, limited mobility and joint total pain score. Similar to the present study, Jones et al (2) and Dominick et al (8), found radiographic features of hand OA to be associated with limitations in activity using the same instrument (AUSCAN LK 3.0). In the present study, we found in a multivariate analysis of the individual impairments in body structures, that the association between these radiographic characteristics and hand function are partially mediated through pain and tenderness in the hands upon physical examination and the presence of bony swelling.

The present study has several potential limitations. The relationship between limitation in activity and impairments in body structures and functions was based on a questionnaire-based measurement and not on performance-based measurements, such as measurements of grip strength. However, in the study by Jones et al, the AUSCAN LK 3.0 function score demonstrated comparable sensitivity to grip strength for severity of hand OA (2). The present study did not include the MCP joints. However, radiological assessment of a proportion of the hand radiographs revealed that MCPs had signs of radiological OA in less than 5%. So, it is very unlikely that the presence of MCP joints in the analyses would have influenced the results. Further, similar to the studies by Jones et al. (2) and Dominick et al. (8), the current study consisted of individuals with familial OA. It is debatable whether the results can be extrapolated to patients with non-familial OA.

In conclusion, impairments in body structures and functions in hand OA were associated with limitations in activity using a validated instrument (AUSCAN LK 3.0). We found different modifying factors, i.e., personal and environmental, to play a role in patients reporting less or more limitations in activity as measured by AUSCAN function than would be calculated based on impairments in body structures and body functions. This suggests that different mechanisms underlie the discrepancies in the effects of modifying factors in these two groups of patients. Further, the findings of the present study support previous investigations that have demonstrated a consistent association between illness perceptions and psychological and functional adjustment in a variety of illnesses. Our study advocates that future rehabilitation programs for preserving hand function may benefit from targeting appropriate cognitive factors rather than from focusing on improvement in medical status alone.

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