

## Original article

## Coping styles and disability in patients with hand osteoarthritis

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## Abstract

**Objective.** Coping responses have been shown to determine health outcomes in chronic diseases. The aim of the study was to examine the role of joint-specific factors and coping styles on disability in patients with hand OA.

**Methods.** Primary hand OA patients who consulted secondary care, underwent physical examination to assess the number of joints with bony joint enlargements, pain upon palpation, soft tissue swelling, deformities and limitations in motion. Coping styles were assessed with Coping with Rheumatic Stressors. Disability (score  $\geq 5$ ) was assessed by the Functional Index for Hand OA (possible score 0–30) cross-sectionally and after 1 year. With multivariate logistic regression, joint-specific variables and coping styles were associated with disability cross-sectionally and after 1 year, adjusted for age, sex and BMI.

**Results.** A total of 314 patients (88% women, mean age 61.4 years) were included in the cross-sectional analyses; 68% were considered as disabled. Longitudinal data after 1 year were available in 173 patients (71% disabled). In multivariate analysis including all joint-specific factors, only painful joints and joints with limitations in motion were associated with disability. Disadvantageous scores for the coping scales (comforting cognitions, decreasing activity and pacing) were positively associated with disability cross-sectionally. Disability after 1 year was only associated with the coping scales decreasing activity and pacing. Joint-specific factors were also associated with disability, independent of coping styles.

**Conclusion.** In patients with hand OA, joint-specific factors and coping styles decreasing activity and pacing were both associated with disability. Our results suggest that interventions should aim at joint-specific complaints as well as changing coping styles to improve functional outcome.

**Key words:** osteoarthritis, hand, coping, CORS, disability.

## Rheumatology key messages

- Joint-specific factors and the coping styles decreasing activity and pacing are associated with disability in hand OA.
- Interventions may aim at joint-specific complaints and coping styles to improve functional outcome in hand OA.

## Introduction

Hand OA is a common disorder characterized by nodes and deformities of typically the DIP, PIP and the CMC-1

joints [1, 2]. The clinical burden of hand OA consists of pain and impaired functional ability [3]. It is unclear which factors contribute to these functional limitations, but earlier studies in OA, especially in patients with knee OA, showed that not only disease-specific factors, but also psychosocial factors are of importance [4–6].

According to Leventhal's common sense model (CSM), illness perceptions (cognitive and emotional) and coping responses are both determinants of health outcomes. Stimuli in the form of symptoms serve as a starting point in the CSM model, which are interpreted and elaborated

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Submitted 30 March 2014; revised version accepted 17 July 2015

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upon to form representations or illness perceptions and subsequently act as a guide to coping responses, which finally leads to appraisal of outcomes [7]. Since coping can be modified, it is interesting to further elucidate this hypothesis [8]. Studies investigating coping strategies of OA patients have been sparse [9–13], while even fewer studies have focused on hand OA in particular [10, 14].

According to a semi-structured interview study by Hill *et al.* [14], a variety of coping strategies are used by hand OA patients, particularly problem-based coping, whereby patients adapt and find a different way of doing things. However, from this study it remains unclear how these coping mechanisms may influence clinical outcome.

Coping with Rheumatic Stressors (CORS) is a reliable and validated arthritis-specific questionnaire that measures coping strategies directed at the most prominent chronic stressors of RA: pain, limitations and dependency [15]. The questionnaire has also been used to investigate coping strategies in patients with other rheumatic diseases, such as AS, but has not been used in OA [16]. The aim of the present study was to examine the role of joint-specific factors and coping styles on disability in patients with hand OA.

## Methods

### Study design

The present study is part of the Hand Osteoarthritis in Secondary Care (HOSTAS) study, an ongoing prospective follow-up study that has enrolled patients with hand OA consecutively since 2009. The HOSTAS study aims to investigate determinants of outcome in patients with hand OA. Patients were included when they consulted a rheumatologist at the outpatient clinic of the Leiden University Medical Center (LUMC) for hand complaints and when the treating rheumatologist diagnosed these hand complaints as primary hand OA. History, physical and radiographic examinations were used to make the diagnosis. Patients with hand complaints due to other disease causes or secondary OA due to other rheumatic diseases were excluded. Written informed consent was obtained from all participants according to the Declaration of Helsinki for the HOSTAS study. The HOSTAS study was approved by the LUMC Medical Ethical Committee and covers this analysis.

In the present study, patients who filled in a coping questionnaire (henceforth referred to as baseline) were included. In the follow-up study, patients who have 1 year of follow-up data were included.

### Demographics and clinical characteristics

Standardized questionnaires, which are completed every year, were used to collect demographic and clinical characteristics, including age, sex, BMI and symptom duration. At inclusion and once every 2 years thereafter, participants underwent standardized physical examination of their hands by a trained research nurse. The DIP, PIP, IP-1, MCP and CMC-1 joints were evaluated for the number of joints with bony joint enlargements

(0–30), pain upon palpation (total score range 0–90, range 0–3 for each joint, higher score = more pain) and soft tissue swelling (0–30). Joints with deformities (0–22) and limitations in motion (total range 0–66, range 0–3 for each joint, higher score = more limitations) were also assessed in the DIP, PIP, IP-1, MCP-1 and CMC-1 joints.

### Radiographs

At inclusion and once every 2 years thereafter conventional radiographs of the hands (dorso-volar) were obtained. The DIP, PIP, IP-1, MCP and CMC-1 joints were scored by W.D. using the Kellgren–Lawrence grading scale (0–4, maximum score 120). W.D. was blinded for clinical and demographic data. Intrareader reproducibility was assessed on a randomly selected sample ( $n = 31$ ) of radiographs and was high [intraclass correlation coefficient (ICC) 0.95 (95% CI 0.89, 0.97)].

### Disability

Since January 2011, disability was assessed at inclusion and at annual follow-up visits by the Functional Index for Hand OA (FIHOA), a 10-item questionnaire with items rated in terms of difficulty on a 4-point Likert scale (0 = possible without difficulty, 3 = impossible) [17]. The scale ranges from 0 to 30. A FIHOA score  $\geq 5$  was considered as disability [18].

### Coping

Coping was assessed with the CORS questionnaire, which measures eight coping strategies that are associated with pain (three strategies), limitations (three strategies) and dependence (two strategies). Three scales measure strategies of coping with pain: comforting cognitions (nine items), decreasing activities (eight items) and diverting attention (eight items). Three coping scales refer to limitations: optimism (five items), pacing (10 items) and creative solution seeking (eight items). Two scales measure dependency: making an effort to accept one's dependence (six items) and showing consideration (seven items). For each item the patients report how often they made use of that particular coping mechanism (range 1–4, higher score = more usage). Its metric properties for reliability are good (Cronbach's  $\alpha$  0.73–0.88, test-retest reliability 0.79–0.91 for all scales). Its correlation with variables such as sex, age, education and symptom duration was low [15].

Assessment of the CORS questionnaires occurred after January 2011 in all patients at the inclusion in the study and at biannual follow-up visits. In the current study, the first CORS that was completed was used. For the analyses, the CORS scales were divided into tertiles. The lowest tertile represented the most beneficial scores [19] and was used as a reference category.

### Data analysis

To investigate the determinants of the disability, odds ratios (ORs) with 95% CIs were calculated using multivariate logistic regression as measures of relative risk, while adjusting for age, sex and BMI. In addition, multivariate

analyses were performed adjusting for joint-specific variables when appropriate. In individual patients, data from questionnaires, physical examination and radiographs were acquired or assessed at the same time point. Multivariate analyses were also performed for reporting disability after 1 year, adjusting for age, sex, BMI, joint-specific variables and baseline FIHOA.

For the CORS, missing data were imputed according to the user manuals. Imputation for the missing data in the FIHOA was performed if two or fewer items were unanswered, by replacing missing data with the mean of answered items. If more than three items were missing, the FIHOA was considered as missing. All analyses were done using SPSS version 20 (SPSS, Chicago, IL, USA).

## Results

### Study population

Between May 2009 and April 2013, 354 patients were included in the HOSTAS study. 91% of the patients met the ACR criteria for hand OA. The FIHOA and CORS questionnaires were completed by 315 patients, of which 1 patient was excluded due to incomplete CORS data. Therefore 314 (89%) patients were included in the present study; of these, 197 patients participated in the HOSTAS study from 2011 and 117 patients started participation between 2009 and 2011 (Fig. 1). A standardized physical examination and radiographs of their hands were available at the time when the questionnaires were completed in 303 and 301 patients, respectively.

Longitudinal FIHOA data with 1 year follow-up were then obtained (range 0.8–1.6 years). Thirty-eight patients declined participation. The FIHOA was completed by 173 of the 211 (82%) eligible patients (follow-up after first available FIHOA was at least 1 year).

The patients' characteristics of those included in the cross-sectional study and of the subpopulation included in the longitudinal study are shown in Table 1. The patients' characteristics of the subpopulation are similar to the characteristics of the total population.

The median FIHOA score was 8 (range 0–24) at baseline and 9 (range 0–28) at follow-up. At baseline, 68% of the patients could be considered as disabled as defined by a FIHOA score  $\geq 5$ . After 1 year, 71% (122 of 173) of the patients had disability due to their hand OA.

### Disease-specific determinants and disability

We hypothesized that disease-specific features of hand OA could play a role in disability. Multivariate analyses on cross-sectional data were used to investigate the association of these features with disability (Table 2). These analyses demonstrated that joints painful upon palpation, joints with deformity and joints limited in motion were independently positively associated with disability. The objective features of joints with bony joint enlargement and soft tissue swelling were not associated with disability. The Kellgren–Lawrence score was also associated with disability, as was the elapsed time since diagnosis. In multivariate analysis including all joint-specific factors,

only painful joints and joints with limitations in motion remained associated.

In further analyses on the association between coping strategies and disability, we adjusted for the determinants joints painful upon palpation and limited in motion. The joint-specific factors were also associated with disability, independent of coping styles.

### Coping strategies and disability

Of the coping with pain strategies, the strategy comforting cognitions, with a median of 27 (range 9–36), was the most frequently used strategy. The other pain strategies were employed less often. Optimism was the most often used coping with limitations strategy, with a median of 16 (range 7–20). Patients used consideration more as a coping with dependency strategy than accepting (Table 1).

### Coping with pain strategies and disability

Cross-sectional multivariate analyses investigating the association between coping styles and disability are shown in Table 3. The lowest tertiles represent the most beneficial scores.

In cross-sectional analysis, the highest tertiles for the coping with pain scales comforting cognitions and decreasing activity were positively associated with disability. Lower scores on the comforting cognitions scale were disadvantageous and associated with more disability. A positive dose-response association between the CORS pain coping strategy decreasing activity and disability was also found (Table 3). The strategy diverting attention was not associated with disability. Longitudinal analyses showed that the strategy comforting cognitions was not associated with disability, while a significant dose-response relation still existed between the coping with pain strategy decreasing activity and disability after 1 year (Table 4).

### Coping with limitations strategies and disability

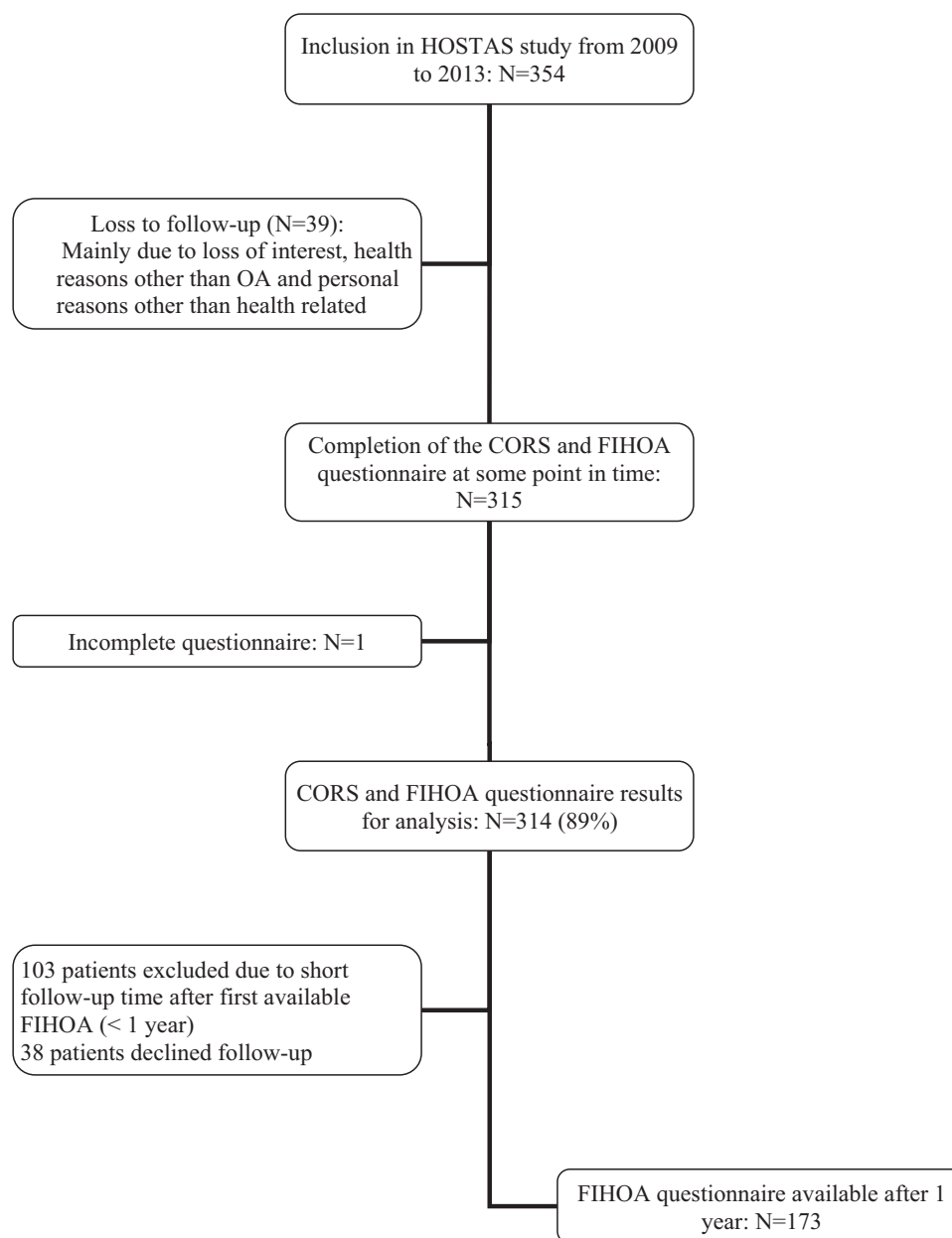
The coping with limitations strategy optimism was not associated with disability either cross-sectionally or longitudinally. Pacing as a strategy of coping with limitations showed a dose-response relation with disability in both the cross-sectional and longitudinal analyses. Cross-sectional and longitudinal analyses showed that creative solutions was also not associated with disability.

### Coping with dependence strategies and disability

Coping with dependency was measured using two scales: making an effort to accept one's dependence and showing consideration. No association was seen between these coping strategies and disability in either cross-sectional or longitudinal analyses.

## Discussion

In the present study we investigated the association between coping strategies and disability in patients with hand OA using validated questionnaires and longitudinal

**Fig. 1** Flow chart of the HOSTAS study showing the inclusion for this analysis

CORS: Coping with Rheumatic Stressors; FIHOA: Functional Index for Hand OA; HOSTAS: Hand Osteoarthritis in Secondary Care study.

data. We found that patients who cope with pain by employing the strategy comforting cognitions less often, experienced more disability. More employment of the strategy decreasing activity led to more disability. Patients who cope with the limitations due to their hand OA by pacing also experience more disability. Disability after 1 year was only associated with the coping scales decreasing activity and pacing, and provided further proof for a causal relationship between these factors and disability; these associations were independent

from joint-specific factors. The joint-specific factors painful joints and joints with limitations in motion were also associated with disability, independent of coping styles.

Comforting cognitions was associated with disability in our cross-sectional data, but no longer associated after 1 year. This suggests that comforting cognitions does not cause patients to experience disability. It is rather more likely that disability causes use of this strategy.

**TABLE 1** Baseline characteristics of 314 patients with clinical hand OA consulting a rheumatology outpatient clinic, of which 173 patients were followed prospectively

	Total population ( <i>n</i> = 314)	Population with follow-up ( <i>n</i> = 173)
Women, <i>n</i> (%)	275 (87.6)	149 (86.1)
Age, mean (s.d.), years	61.4 (8.9)	61.3 (8.6)
BMI, median (range) kg/m <sup>2</sup>	26.4 (17.6–48.4)	26.4 (17.6–39.0)
Hand OA according to ACR criteria, <i>n</i> (%)	91.1	92.5
Kellgren–Lawrence score (range 0–120), median (range)	21 (0–75)	21 (0–75)
Symptom duration, median (range), years	5.7 (0.1–58.7)	5.2 (0.1–58.7)
Time since diagnosis, median (range), years	2.0 (0.0–35.2)	2.0 (0.0–31.7)
FIHOA (range 0–30), median (range)	8 (0–24)	8 (0–24)
Patients with disability, <i>n</i> (%)	212 (68)	118 (68)
CORS scales		
Pain-comforting cognitions (range 9–36, median (range))	27 (9–36)	26 (9–36)
Pain-decreasing activity (range 8–32), median (range)	17 (8–28)	17 (8–28)
Pain-diverting attention (range 8–32), median (range)	19 (8–32)	19 (8–31)
Limitations -optimism (range 5–20), median (range)	16 (7–20)	16 (7–20)
Limitations-pacing (range 10–40), median (range)	25 (10–40)	25 (10–40)
Limitations-creative solutions (range 8–32), median (range)	20 (8–32)	20 (8–32)
Dependency-accepting (range 6–24), median (range)	13 (6–24)	13 (6–24)
Dependency-consideration (range 7–28), median (range)	20 (7–28)	20 (7–28)

CORS: Coping with Rheumatic Stressors; FIHOA: Functional Index for Hand OA.

**TABLE 2** Univariate and multivariate analyses for disease-specific determinants of disability in hand OA patients (*n* = 314)

	Prevalence (median (range))	Crude OR (95% CI)	Adjusted OR <sup>a</sup> (95% CI)	Adjusted OR <sup>b</sup> (95% CI)
Symptom duration	5.7 (0.1, 58.7)	1.02 (0.99, 1.05)	1.02 (0.99, 1.05)	0.98 (0.94, 1.02)
Time since diagnosis	2.0 (0.0, 35.2)	1.11 (1.03, 1.19)	1.11 (1.03, 1.20)	1.08 (0.99, 1.18)
Kellgren–Lawrence score (range 0–120)	21 (0, 75)	1.02 (1.003, 1.04)	1.02 (1.003, 1.04)	1.00 (0.98, 1.03)
Joints with bony enlargements (range 0–30), <i>n</i>	11 (0, 24)	1.01 (0.96, 1.05)	1.01 (0.96, 1.06)	
Joints painful upon palpation (range 0–90), <i>n</i>	3 (0, 53)	1.12 (1.06, 1.18)	1.11 (1.05, 1.18)	1.14 (1.06, 1.23)
Joints with soft tissue swelling (range 0–30), <i>n</i>	0 (0, 17)	1.08 (0.95, 1.23)	1.09 (0.96, 1.23)	
Deformed joints (range 0–22), <i>n</i>	5 (0, 17)	1.09 (1.01, 1.17)	1.10 (1.02, 1.19)	1.00 (0.90, 1.11)
Joints limited in motion (range 0–22), <i>n</i>	7 (0, 48)	1.07 (1.04, 1.11)	1.08 (1.04, 1.11)	1.06 (1.01, 1.11)

<sup>a</sup>Adjusted for sex, age and BMI. <sup>b</sup>Multivariate analyses with sex, age, BMI, symptom duration, time since diagnosis, Kellgren–Lawrence score, painful joints upon palpation, deformed joints and joints limited in motion.

Decreasing activity as a way of coping with pain and pacing as a way of coping with limitations were both associated with disability, both in cross-sectional and longitudinal data, suggesting a causal relationship. We considered these coping scales to be passive coping scales. The results are in line with our expectations. Limitation of activity may result in deterioration of muscular strength and endurance [20]. Thus it is likely that patients using limiting activity as a way of coping with pain are at more risk of developing disability independent of disease status.

Although studies investigating coping strategies in hand OA have been rare, studies have been conducted in diseases such as RA. Previous studies with RA patients

reported that decreasing activity was associated with psychological distress, a negative disease impact and a decrease in dexterity, which is in line with our results [21, 22].

However, in RA, pacing was not related to changes in dexterity, while we did find an association between pacing and disability in our study. It is possible that differences in underlying disease mechanisms of RA and OA may explain this difference in results. Also, in a study that investigated coping in knee and hip OA, the coping scores were different when compared with patients with RA and other chronic painful conditions [9].

In contrast to our findings, another cross-sectional study did not find an association between coping with pain strategies and disability in hand OA patients [10]. In



**TABLE 3** Association between disability, defined as FIHOA  $\geq 5$ , and tertiles of coping strategies in hand OA patients ( $n = 314$ )

CORS strategies tertiles <sup>a</sup>	No disability, <i>n</i>	Disability, <i>n</i>	Adjusted OR (95% CI) <sup>b</sup>
Pain-comforting cognitions			
>28	44	67	1.0
25–28	35	69	1.32 (0.71, 2.43)
9–24	23	74	2.14 (1.08, 4.22)
Pain-decreasing activity			
8–14	41	52	1.0
15–18	40	76	1.58 (0.85, 2.95)
>18	21	83	2.59 (1.28, 5.25)
Pain-diverting attention			
$\geq 21$	38	66	1.0
17 to <21	32	80	1.57 (0.82, 2.99)
8–16	32	64	1.38 (0.71, 2.66)
Limitations-optimism			
>17	32	60	1.0
15–17	44	80	0.95 (0.51, 1.79)
7–14	26	72	1.69 (0.86, 3.36)
Limitations-pacing			
10–22	50	65	1.0
23–27	30	61	1.68 (0.88, 3.21)
>27	22	86	3.07 (1.53, 6.16)
Limitations-creative solutions			
>22	25	67	1.0
19–22	26	79	1.42 (0.70, 2.88)
8–18	51	66	0.56 (0.29, 1.06)
Dependency-accepting			
6–11	32	58	1.0
12–15	33	76	0.99 (0.51, 1.90)
>15	33	78	1.10 (0.56, 2.15)
Dependency-consideration			
>21	35	66	1.0
>18–21	24	69	1.93 (0.96, 3.88)
7–18	39	76	1.16 (0.62, 2.16)

<sup>a</sup>Lowest tertile represents the most helpful illness representation and serves as a reference category. <sup>b</sup>Adjusted for sex, age, BMI, painful upon palpation and limited in motion. FIHOA: Functional Index for Hand Osteoarthritis.

the study by Stukstette *et al.* [10], the Pain Coping Inventory questionnaire was used, which measured a patient's strategies for dealing with pain. Although the Pain Coping Inventory is able to investigate an association between coping with pain strategies and daily activities, it does not measure a patient's strategies for dealing with limitations or dependency and thus our results could not be compared with theirs for these dimensions of coping. In their study, a univariate association was found between coping with pain strategies and limitations in daily activities, but no longer in the multivariate model, which also included OA disease-specific factors such as pain and joint stiffness. Whether these coping with pain strategies were also not associated with limitations in daily activities over time is unknown, due to a lack of longitudinal data. Aside from these differences in the measuring instrument,

**TABLE 4** Association between disability after 1 year, FIHOA  $\geq 5$ , and tertiles of coping strategies at baseline in hand OA patients ( $n = 173$ )

CORS strategies tertiles <sup>a</sup>	No disability, <i>n</i>	Disability, <i>n</i>	Adjusted OR (95% CI) <sup>b</sup>
Pain-comforting cognitions			
>28	17	42	1.0
25–28	18	43	0.57 (0.19, 1.76)
9–24	16	36	0.39 (0.11, 1.34)
Pain-decreasing activity			
8–14	21	31	1.0
15–18	21	40	1.19 (0.40, 3.56)
>18	9	50	5.68 (1.52, 21.19)
Pain-diverting attention			
$\geq 21$	17	44	1.0
17 to <21	15	45	0.77 (0.24, 2.42)
8–16	19	32	0.47 (0.15, 1.44)
Limitations-optimism			
>17	18	40	1.0
15–17	18	42	0.85 (0.28, 2.57)
7–14	15	40	0.60 (0.19, 1.92)
Limitations-pacing			
10–22	28	35	1.0
23–27	12	37	4.40 (1.32, 14.65)
>27	11	50	5.00 (1.45, 17.30)
Limitations-creative solutions			
>22	9	44	1.0
19–22	18	38	0.25 (0.07, 0.90)
8–18	24	40	0.43 (0.13, 1.37)
Dependency-accepting			
6–11	15	32	1.0
12–15	18	51	0.91 (0.29, 2.85)
>15	16	38	0.64 (0.19, 2.11)
Dependency-consideration			
>21	14	45	1.0
>18–21	12	35	0.52 (0.14, 1.88)
7–18	22	41	0.34 (0.11, 1.08)

<sup>a</sup>Lowest tertile represents the most beneficial illness representation and serves as a reference category. <sup>b</sup>Adjusted sex, age, BMI, painful upon palpation, limited in motion and FIHOA baseline. FIHOA: Functional Index for Hand OA.

our findings may differ due to differences in patient inclusion criteria and subsequent differences in patient characteristics.

In Stukstette's study [10], patients were only included if they scored at least 9 on the Australian Canadian Osteoarthritis Hand Index (range 0–36) and fulfilled the ACR hand OA criteria, while the HOSTAS study included all patients who sought care in the LUMC. This suggests that although coping with pain strategies may be independently associated with joint-specific factors, differences may still exist in the coping styles of more severely OA affected individuals vs those less severely affected.

Although studies in hand OA may be sparse, there have been studies investigating coping strategies and disability in OA located elsewhere. A study investigating the

relationship between coping with pain strategies and functional impairment in knee and hip OA found a good correlation for passive pain coping dimensions and function, with more impaired patients using more passive coping [9]. In another study investigating the use of various coping styles at baseline and pain and disability at follow-up in knee and hip OA patients, the passive coping style of resting predicted a higher level of disability, supporting our own findings that passive coping strategies were associated with more disability [23].

If passive coping strategies are associated with more disability, one would hypothesize that active coping strategies are associated with less disability. However, as was seen previously in a clinical study, active coping strategies are not associated with less disability [24]. It is therefore not surprising that we were also unable to find in our study an association between active coping strategies such as creative solutions and less disability. We suspect that the employment of creative solutions may be a result rather than a cause of disability. However, more research will be necessary to confirm this hypothesis.

Our study results also have limitations. The HOSTAS study is an observational study that included both patients with a recent diagnosis of OA and those who were diagnosed many years ago, with a wide variation in symptom duration. As patients did not all enter at the time when OA symptoms first began or when the diagnosis was made, we hypothesized that this may have influenced our results. Fortunately, our analyses showed that the duration of symptoms is not a determinant of disability. While the association between the elapsed time since diagnosis and disability may show a trend in multivariate analyses, its influence seemed to be very limited.

We have observed both a dose-response relationship and a temporal relationship in longitudinal analyses for the association between the coping strategies decreasing activity and pacing and disability. Causality is always difficult to investigate in an epidemiological study, but since these associations fulfil Hill's criteria for causality, it is likely that a causal relationship between these passive coping mechanisms and disability exists [25]. Therefore these negative coping skills could serve as a target for therapy.

In previous research it has been demonstrated that education on OA can improve clinical outcomes [26, 27]. Evidence for the efficacy of psychological interventions such as pain coping strategies training in OA patients is also increasing [8, 28, 29].

By better understanding which coping strategies may influence physical limitations, psychological interventions such as psychoeducation and cognitive restructuring can be employed to improve clinical outcome by addressing coping strategies [8, 28, 29]. Since coping mechanisms are considered to be influenced by illness perceptions, as suggested by the CSM, further research to elucidate their relationship is warranted.

## Acknowledgements

R.L. is funded by the Dutch Arthritis Association to conduct research in the HOSTAS study. The funding sources

had no role in the study design; collection, analysis and interpretation of data; writing of the manuscript or in the decision to submit the manuscript for publication.

**Funding:** No specific funding was received from any funding bodies in the public, commercial or not-for-profit sectors to carry out the work described in this article.

**Disclosure statement:** The Dutch Arthritis Foundation paid a research grant to the Leiden University Medical Center for M.K. to perform the research in this study. R.L. is funded by the Dutch Arthritis Association to conduct research in the HOSTAS study. All other authors have declared no conflicts of interest.

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