

## Construct Validity of the Canadian Occupational Performance Measure in Participants With Tendon Injury and Dupuytren Disease

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[van de Ven-Stevens LAW, Graff MJL, Peters MAM, et al. Construct validity of the Canadian Occupational Performance Measure in participants with tendon injury and Dupuytren disease. *Phys Ther*. 2015;95:750-757.]

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Published Ahead of Print:

December 18, 2014

Accepted: November 30, 2014

Submitted: December 1, 2013

**Background.** In patient-centered practice, instruments need to assess outcomes that are meaningful to patients with hand conditions. It is unclear which assessment tools address these subjective perspectives best.

**Objective.** The aim of this study was to establish the construct validity of the Canadian Occupational Performance Measure (COPM) in relation to the Disabilities of Arm, Shoulder, and Hand (DASH) questionnaire and the Michigan Hand Outcomes Questionnaire (MHQ) in people with hand conditions. It was hypothesized that COPM scores would correlate with DASH and MHQ total scores only to a moderate degree and that the COPM, DASH questionnaire, and MHQ would all correlate weakly with measures of hand impairments.

**Design.** This was a validation study.

**Methods.** The COPM, DASH questionnaire, and MHQ were scored, and then hand impairments were measured (pain [numerical rating scale], active range of motion [goniometer], grip strength [dynamometer], and pinch grip strength [pinch meter]). People who had received postsurgery rehabilitation for flexor tendon injuries, extensor tendon injuries, or Dupuytren disease were eligible.

**Results.** Seventy-two participants were included. For all diagnosis groups, the Pearson coefficient of correlation between the DASH questionnaire and the MHQ was higher than .60, whereas the correlation between the performance scale of the COPM and either the DASH questionnaire or the MHQ was lower than .51. Correlations of these assessment tools with measures of hand impairments were lower than .46.

**Limitations.** The small sample sizes may limit the generalization of the results.

**Conclusions.** The results supported the hypotheses and, thus, the construct validity of the COPM after surgery in people with hand conditions.



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Hand injuries and diseases (hand conditions), such as tendon injury or Dupuytren disease, may affect a person's ability to successfully engage in day-to-day self-care, work, and leisure activities. Although impaired hand function can cause limitations in activities and participation, this relationship is not linear.<sup>1-8</sup> Therefore, assessment of activity limitations and evaluation of impairments are fundamental for clinical decision making, monitoring progress, and determining effectiveness of treatment in patients with hand conditions.<sup>9-12</sup> Although many tools for assessing activity limitations in patients with hand conditions are available, there is no consensus on the most appropriate instruments to use.<sup>13-20</sup>

Instruments that measure activity limitations can be classified as either performance tests or subjective assessment tools, such as questionnaires.<sup>19</sup> The current study focused on the latter category. In client-centered practice, instruments need to assess outcomes that are meaningful to patients; therefore, it is important that these assessments reflect patients' perspectives, including their values, judgments, and preferences regarding occupational performance. At present, it is unclear which assessment tools address these subjective perspectives best in patients with hand conditions.<sup>21-23</sup>

Recent clinimetric reviews showed that the Canadian Occupational Performance Measure (COPM),<sup>24,25</sup> the Disabilities of Arm, Shoulder, and Hand (DASH) questionnaire,<sup>26,27</sup> and the Michigan Hand Outcomes Questionnaire (MHQ)<sup>28,29</sup> are the most widely used and probably the best available assessment tools for measuring activity limitations in patients with hand conditions on the basis of their psychometric properties.<sup>2,11,17-19,26,28-39</sup> Although the MHQ and DASH questionnaire assess

a combination of impairments (eg, pain, sensibility, joint mobility, strength) and predefined activity limitations in patients with hand and upper-limb conditions, respectively, the COPM is a patient-specific instrument for evaluating self-reported activity limitations in the areas of self-care, occupational and household activities, and leisure.<sup>32,40</sup>

The reproducibility of the performance and satisfaction scores on the COPM was found to be moderate to high for scores averaged over all problems identified by an individual patient.<sup>34</sup> Supportive evidence for the content, convergent, and divergent validity of the COPM was found in several studies.<sup>11,24,33,41,42</sup> The responsiveness of the COPM indicated good discriminatory power for detecting improvement.<sup>6-8,35,42,43</sup> However, the psychometric properties of this instrument in patients with tendon injury or Dupuytren disease have not yet been sufficiently established.<sup>19,32-35</sup> The DASH questionnaire is generally considered to be valid and reliable for measuring activity limitations.<sup>2,19,26,37-39</sup> However, the responsiveness of the DASH questionnaire<sup>18,19,30,31,36,37</sup> has not yet been established according to the quality criteria for measurement properties.<sup>44</sup> The MHQ is generally considered to be valid for measuring activity limitations. However, its reliability and responsiveness have not yet been sufficiently established<sup>2,18,19,28,29,37</sup> according to the quality criteria.<sup>44</sup> Although the clinimetric properties of all 3 assessment tools (COPM, DASH questionnaire, and MHQ) have been investigated, few data comparing these instruments are available.<sup>2,11,17-19,26,28-39</sup>

Thus, the aim of this study was to establish the construct validity of the COPM in relation to the DASH questionnaire and the MHQ. We hypothesized that the COPM scores would correlate positively with the DASH

and MHQ total scores (convergent validity), but only to a moderate degree ( $.4 < r < .7$ ).<sup>45</sup> In other words, we expected the positive correlation between the DASH and MHQ total scores to be stronger than their respective correlations with the COPM scores because the DASH questionnaire and MHQ are more similar in content and structure. Furthermore, we hypothesized that the COPM, DASH questionnaire, and MHQ would all correlate positively, but weakly ( $.2 < r < .4$ ),<sup>45</sup> with measures of hand impairments (pain, active range of motion [AROM], and grip and pinch grip strength) because they focus, to a large degree, on limitations in activity and participation, which constitute a different domain of the *International Classification of Functioning, Disability and Health*<sup>46</sup> (divergent validity).

## Method

### Participants

People who had received postsurgery rehabilitation at our university hospital between 2005 and 2011 and who had flexor tendon injuries in any of the 5 anatomical flexor tendon zones, extensor tendon injuries in any of the 5 anatomical extensor tendon zones, or Dupuytren disease were eligible. Only those who responded to an open-ended question that they experienced activity limitations were included. Exclusion criteria were as follows: age of less than 16 years, injury of the contralateral hand, other injuries or surgeries limiting the performance of daily activities, diagnosis of severe cognitive or mental retardation, or inadequate understanding of the Dutch language. Potential participants received a written description of the study, and invitations to participate were extended by postal mail and by telephone. Upon inclusion, written informed consent was obtained.

### Procedure

Participants were approached beginning 3 months after surgery. Demographic and clinical information about age, sex, profession, date of injury, and date of surgery was extracted from electronic patient files. Participants were asked to complete the COPM, DASH questionnaire, and MHQ. The order of administration was systematically balanced across participants on the basis of the order of inclusion. Next, measurements of hand impairments were obtained at the end of each measurement session to avoid the possibility of results influencing the outcomes of the subjective assessments. Pain was scored first, and then AROM (only the flexor tendon injury group) and grip and pinch grip strength were measured. All assessments were carried out by 5 investigators who were trained by education and by comparison of each other's results during practice.

### Outcome Measures

The conceptual basis of the COPM is derived from the Canadian Model of Occupational Performance and Engagement.<sup>47,48</sup> The COPM is frequently used to identify limitations experienced in the performance of activities (and satisfaction with this performance) in the areas of self-care, household and occupational activities, and leisure.<sup>47</sup> This outcome measure is administered through a semistructured interview that has been designed to help patients identify, prioritize, and evaluate important problems that they encounter in daily life.<sup>47</sup> The importance of each activity limitation, as perceived by the patient, is first rated on a scale ranging from 1 (not important at all) to 10 (extremely important). In the next step, the patient prioritizes a maximum of 5 activity limitations. Consecutively, the patient has to evaluate his or her performance on the activities and satisfaction with this performance.

The performance and satisfaction scores range from 1 to 10, with higher values indicating better performance and greater satisfaction, respectively. A structured approach is used for the COPM, and there are specific instructions and methods for administering and scoring.<sup>25</sup>

The DASH questionnaire was developed by the American Academy of Orthopaedic Surgeons and the Institute for Work and Health.<sup>27</sup> It is a standardized questionnaire that measures the degree of disability resulting from a disorder of the upper extremity by assessing the severity of symptoms and difficulty in completing specific tasks. The DASH questionnaire contains 30 questions that are scored on a 5-point scale. Part A contains 21 "physical function" items, 6 "symptom" items (including pain, sensibility, strength, and mobility), and 3 "social" or "role function" items. Part B is optional and contains 4 questions about the impact of arm or hand problems on work performance and playing an instrument or sports. All items refer to the situation in the preceding week. The DASH questionnaire is a self-report questionnaire designed to be completed by patients. It does not distinguish between disabilities of the left upper extremity and those of the right upper extremity. The scores are converted into an overall score ranging from 0 to 100, with higher values reflecting greater disability.

The MHQ<sup>29</sup> is a self-report questionnaire that assesses hand-specific outcomes, including pain and activities of daily living, as a result of hand disorders. It consists of 37 items reflecting 6 domains: general functioning of the hand, activities of daily living, pain, work performance, esthetics, and patient satisfaction with functioning. For every domain except pain and work performance, patients evaluate either their right hand or their left hand. In the pres-

ent study, all items had to be scored for one hand (the affected side) in addition to the bimanual items. The scores on all items (ranging from 1 to 5) were converted into a single total score ranging from 0 to 100, with lower values reflecting greater disability.

Several measures of impairments were used to assess pain, AROM, and grip and pinch grip strength. The overall pain intensity that a participant had experienced during the preceding week was scored on a numerical rating scale<sup>15,49</sup> from 0 to 10 (0=no pain, 10=maximum pain). The AROM<sup>3,15</sup> of the metacarpophalangeal, proximal interphalangeal, and distal interphalangeal joints was determined with a finger goniometer (Smith and Nephew Rolyan Inc, Germantown, Wisconsin).<sup>15</sup> The values for the different joints were converted into one value per finger.<sup>3</sup> Grip strength was measured with a calibrated Jamar dynamometer (JA Preston Corp, Jackson, Mississippi)<sup>15,50</sup> in the second handle position.<sup>15,51</sup> Pinch grip strength was measured with a B&L pinch meter (B&L Engineering, Santa Fe Springs, California),<sup>15,51,52</sup> testing the strength of lateral and tripod pinches. All measurements of grip and pinch grip strength were obtained 3 times for each participant, and the individual average was calculated. For AROM (only the flexor tendon injury group) and grip and pinch grip strength, the mean score for the injured hand was expressed as a percentage of the score for the contralateral (sound) hand.

### Data Analysis

Floor and ceiling effects were considered to be present when more than 15% of the participants achieved the lowest and highest possible scores on each of the assessment tools, respectively.<sup>44</sup>

**Table 1.**

Scores on the 3 Assessment Tools for Participants With Activity Limitations (n=72)<sup>a</sup>

Diagnosis Group	COPM Performance Scale			COPM Satisfaction Scale			DASH Questionnaire			MHQ		
	n	Score		n	Score		n	Score		n	Score	
		$\bar{X}$	SD		$\bar{X}$	SD		$\bar{X}$	SD		$\bar{X}$	SD
Flexor tendon injury	41	6.1	1.7	41	6.7	2.0	43	7.7	8.4	43	84.8	11.3
Extensor tendon injury	6	7.0	0.7	6	6.9	2.0	8	8.6	8.3	8	80.1	11.8
Dupuytren disease	16	5.2	1.1	16	5.1	0.8	21	20.1	9.1	21	68.8	12.7
Total	63	6.0	1.6	63	6.3	1.9	72	11.4	10.2	72	79.6	13.6

<sup>a</sup> COPM=Canadian Occupational Performance Measure (1=not able to do or not satisfied, 10=able to do well or extremely satisfied); DASH=Disabilities of Arm, Shoulder, and Hand (0=no disability, 100=maximum disability); MHQ=Michigan Hand Outcomes Questionnaire (0=maximum disability, 100=no disability).

Convergent validity was determined by calculating Pearson product moment correlation coefficients ( $r_p$ ) for performance scores on the COPM, overall DASH scores, and total MHQ scores. Divergent validity was determined by calculating Pearson correlation coefficients ( $r_p$ ) for these assessment tools and measures of hand impairments.

All statistical analyses were performed with SPSS version 18.0 for Windows (IBM SPSS Statistics, Chicago, Illinois).<sup>53</sup> The critical level for statistical significance was set at a *P* value of less than .05.

**Results Participants**

Of a total of 113 participants, 72 (64%) indicated, in a response to an open-ended question, that they experienced activity limitations: 43 participants with flexor tendon injury, 8 participants with extensor tendon injury, and 21 participants with Dupuytren disease. Forty-one participants (36%) answered that they did not experience any activity limitations: 4 participants with flexor tendon injury, 7 participants with extensor tendon injury, and 30 participants with Dupuytren disease. For further analysis, only the data from the 72 participants who experienced activity limitations were used. Their mean scores on the

3 assessment tools are shown in Table 1.

**Floor and Ceiling Effects**

No floor or ceiling effects were observed for the COPM, DASH questionnaire, or MHQ. The maximum score was recorded on the satisfaction scale of the COPM for 4 participants (6.3%), on the DASH questionnaire for 5 participants (6.9%), and on the MHQ for 1 participant (1.4%). On the performance scale of the COPM, no maximum score was recorded. No participant recorded a minimum score on any of the 3 assessment tools.

**Convergent and Divergent Validity**

The Pearson product moment correlation coefficients for the performance and satisfaction scores on the COPM, the overall DASH scores, and the total MHQ scores are shown in Table 2. For all groups together, the coefficient of correlation between the DASH questionnaire and the MHQ was higher ( $r_p = -.744, P < .01$ ) than that between the COPM performance scale and either the DASH questionnaire or the MHQ ( $r_p = -.447$  and  $r_p = .419$ , respectively;  $P < .01$ ). The coefficient of correlation between the COPM satisfaction scale and either the DASH questionnaire or the MHQ also was lower than that between the DASH ques-

tionnaire and the MHQ ( $r_p = -.579$  and  $r_p = .593$ , respectively;  $P < .01$ ).

The Pearson coefficients of correlation of the COPM, DASH questionnaire, and MHQ with measures of hand impairments (pain, AROM, and strength) are shown in Table 3. For all groups together, 10 of 16 correlation coefficients were significant. All  $r_p$  values were lower than .46, and 6 of the significant  $r_p$  values were lower than .40. Of these, 5 were correlations between the COPM and measures of hand impairments.

**Discussion**

The aim of the present study was to establish the construct validity of the COPM in relation to the DASH questionnaire and the MHQ in people with hand conditions (flexor or extensor tendon injury or Dupuytren disease) at least 3 months after surgery. As hypothesized, the correlation of the COPM with either the DASH questionnaire or the MHQ was only moderate and was lower than the correlation between the DASH questionnaire and the MHQ. The finding that the lowest correlations of the 3 assessment tools with hand impairments were observed for the COPM further underscores the construct (divergent) validity of this measure in relation to the DASH questionnaire and the MHQ. Indeed, both the DASH questionnaire and

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**Table 2.**

Pearson Product Moment Correlations Between Assessments per Diagnosis and Overall<sup>a</sup>

Population	COPM Performance Scale-DASH Questionnaire		COPM Performance Scale-MHQ		COPM Satisfaction Scale-DASH Questionnaire		COPM Satisfaction Scale-MHQ		DASH Questionnaire-MHQ	
	n	Correlation	n	Correlation	n	Correlation	n	Correlation	n	Correlation
Flexor tendon injury	41	-.506 <sup>b</sup>	41	.496 <sup>b</sup>	41	-.621 <sup>b</sup>	41	.602 <sup>b</sup>	43	-.625 <sup>b</sup>
Extensor tendon injury	6	.084	6	-.251	6	.064	6	.083	8	-.831 <sup>c</sup>
Dupuytren disease	16	-.137	16	.169	16	-.352	16	.606 <sup>c</sup>	21	-.621 <sup>b</sup>
Total	63	-.447 <sup>b</sup>	63	.419 <sup>b</sup>	63	-.579 <sup>b</sup>	63	.593 <sup>b</sup>	72	-.744 <sup>b</sup>

<sup>a</sup> COPM=Canadian Occupational Performance Measure; DASH=Disabilities of Arm, Shoulder, and Hand; MHQ=Michigan Hand Outcomes Questionnaire.

<sup>b</sup> Correlation was significant at the .01 level (2-tailed).

<sup>c</sup> Correlation was significant at the .05 level (2-tailed).

the MHQ integrate the subjective assessment of impairments and predefined activity limitations, whereas the COPM assesses self-reported activity limitations on the basis of people's experiences. As a consequence, the COPM may reveal important activity limitations that are not identified with either the DASH questionnaire or the MHQ, such as problems with shaking hands, nail clipping, making vegetable mash, or knotting shoelaces.

Taken together, the results support the notion that the COPM provides patient-specific information that is not obtained with standardized measures that have predefined items, such as the DASH questionnaire and MHQ, or with measures of hand impairments. This information is related to what people value as their most important daily life activities. The large variation in problems identified with the COPM in other studies<sup>33,34,54,55</sup> confirms the notion that values with regard to occupational performance differ greatly among people, depending on their physical, cultural, and social environments.<sup>47,48</sup> Because rehabilitation is aimed at improving a person's functioning in his or her natural environment (ie, reducing disability), it is crucial that functional assessments identify activity limitations as experienced by a person.<sup>56</sup> The focus on

a person's priorities helps both the therapist and the person to formulate goals and expectations of treatment, a valuable addition to the evaluation of outcomes of hand surgery and hand therapy.<sup>8</sup> From this perspective, the COPM may be a useful addition to standardized questionnaires in client-centered rehabilitation of people with hand conditions.

We found that the correlations of the performance scores on the COPM with the DASH and MHQ scores were even lower than those of the satisfaction scores, at least for the participants with flexor tendon injury. An explanation for this result might be that the COPM performance scale assesses self-reported activity limitations, whereas the DASH questionnaire and MHQ evaluate more global performance on predefined activities. It is possible that the COPM satisfaction scale is more strongly influenced by general functioning, as assessed with the DASH questionnaire and MHQ, than the COPM performance scale. It is also possible that general functioning is determined more by people's abilities than by their disabilities. This notion is supported by the finding that the satisfaction scores were higher than the performance scores for all groups together in the present study.

The *International Classification of Functioning, Disability and Health* has 2 main components: one is body functions and structures (impairments), and the other is activities (limitations) and participation (restrictions). It is well known that bodily functions are not unambiguously related to functional activities,<sup>1,2,21</sup> partly because a relatively small percentage of the AROM of the hand is necessary for the satisfactory completion of most functional tasks.<sup>57</sup> On the other hand, even minor impairments can have a severe impact on the performance of daily activities and societal participation,<sup>4,5</sup> for instance, in musicians or surgeons. From this perspective, Jansen and Watson<sup>3</sup> already argued that functional assessments as well as goniometric assessments of the hand joints should be performed for optimal understanding of the capacity and use of the upper extremity after flexor tendon injury. In addition, for nerve disorders, it has been found that questionnaires on activity limitations are poorly related to objective measures of sensibility and the widely used carpal tunnel syndrome symptom score.<sup>2</sup> Furthermore, Michener et al<sup>4</sup> reported that the recovery of grip strength predicts merely 37% of the performance of daily activities. In the same vein, we found relatively low correlations between the subjective assessment

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**Table 3.**  
Pearson Product Moment Correlations Between Subjective Assessments and Measures of Hand Impairments per Diagnosis and Overall<sup>a</sup>

Correlation (n) for:	Population (n)			
	Flexor Tendon Injury (43)	Extensor Tendon Injury (8)	Dupuytren Disease (21)	Total (72)
Pain				
COPM performance scale	-.278 (41)	.509 (6)	-.177 (16)	-.155 (63)
COPM satisfaction scale	-.454 <sup>b</sup> (41)	.246 (6)	-.002 (16)	-.243 (72)
DASH questionnaire	.412 <sup>b</sup> (43)	.416 (8)	.098 (21)	.295 <sup>c</sup> (72)
MHQ	-.550 <sup>b</sup> (43)	-.562 (8)	-.367 (21)	-.457 <sup>b</sup> (72)
% grip strength				
COPM performance scale	.387 <sup>c</sup> (41)	.344 (6)	.187 (16)	.367 <sup>b</sup> (63)
COPM satisfaction scale	.500 <sup>b</sup> (41)	-.436 (6)	.410 (16)	.402 <sup>b</sup> (63)
DASH questionnaire	-.455 <sup>b</sup> (43)	-.620 (8)	-.378 (21)	-.425 <sup>b</sup> (51)
MHQ	.522 <sup>b</sup> (43)	.431 (8)	.311 (21)	.426 <sup>b</sup> (72)
% pinch strength for key				
COPM performance scale	.242 (40)	.923 <sup>b</sup> (6)	.331 (16)	.266 <sup>c</sup> (62)
COPM satisfaction scale	.332 <sup>c</sup> (40)	.258 (6)	.316 (16)	.282 <sup>c</sup> (62)
DASH questionnaire	-.092 (42)	.134 (8)	.143 (21)	-.031 (71)
MHQ	.323 <sup>c</sup> (42)	-.126 (8)	-.061 (21)	.154 (71)
% pinch strength for tripod				
COPM performance scale	.432 <sup>b</sup> (40)	.952 <sup>b</sup> (6)	-.111 (16)	.336 <sup>b</sup> (62)
COPM satisfaction scale	.479 <sup>b</sup> (40)	-.202 (6)	-.014 (16)	.290 <sup>c</sup> (62)
DASH questionnaire	-.195 (42)	.113 (8)	-.061 (21)	-.110 (71)
MHQ	.390 <sup>c</sup> (42)	-.159 (8)	-.183 (21)	.111 (71)
% AROM				
COPM performance scale	.324 (31)			
COPM satisfaction scale	.371 <sup>c</sup> (31)			
DASH questionnaire	-.152 (32)			
MHQ	.369 <sup>c</sup> (32)			

<sup>a</sup> AROM=active range of motion (obtained only for flexor tendon injury group); COPM=Canadian Occupational Performance Measure; DASH=Disabilities of Arm, Shoulder, and Hand; MHQ=Michigan Hand Outcomes Questionnaire.

<sup>b</sup> Correlation was significant at the .01 level (2-tailed).

<sup>c</sup> Correlation was significant at the .05 level (2-tailed).

tools and the measures of hand impairments in the present study. This result emphasizes the necessity to assess activity limitations in addition to impairments, such as contracture, reduced hand strength, and pain, in people with hand conditions.

For identification of the most suitable instrument for assessing activity limitations in people with hand conditions, the feasibility of the COPM,

DASH questionnaire, and MHQ should also be considered. Overall, the COPM is more time-consuming (administration time, ~20 minutes) than the DASH questionnaire or the MHQ (~10 minutes).<sup>2,42</sup> In particular, in people who have not experienced activity limitations, the application of the DASH questionnaire or the MHQ will save time and costs. On the other hand, it could be argued that, even in people with minimal activity limitations, the

COPM offers the advantage of evaluating a wide range of possible (otherwise perhaps neglected) problems. Because the COPM is primarily based on people's perspectives, including their values, judgments, and preferences regarding occupational performance, it can facilitate both clinical decision making and monitoring of functional progress. With the COPM, people also can be effectively engaged in problem identification and goal setting<sup>32</sup> to increase the efficacy of individually tailored interventions.

### Limitations

The present study was conducted at only one university hospital and included 72 participants who had hand conditions and experienced daily life activity limitations after surgery; these aspects of the study may limit the generalizability of the results. In particular, the sample sizes of the extensor tendon injury (n=6 or 8) and Dupuytren disease (n=16 or 21) groups were relatively small. Intrarater reliability and interrater reliability were not addressed in the present study. However, possible differences between assessors might have influenced the results of the COPM and the measures of hand impairments.

As hypothesized, the correlation of the COPM with either the DASH questionnaire or the MHQ was only moderate and was lower than the correlation between the DASH questionnaire and the MHQ. The correlations of the 3 assessment tools with measures of hand impairments further support the construct validity of the COPM in relation to the DASH questionnaire and the MHQ. The value of the COPM lies in the structured self-report of experienced importance of activity limitations on the basis of an open dialogue between the patient and the hand therapist. Therefore, along with standardized measures, such as the

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DASH questionnaire and MHQ, the COPM seems to be a suitable instrument for indicating and evaluating individually tailored interventions in patients with hand conditions.

All authors provided concept/idea/research design. Mrs van de Ven-Stevens, Dr Graff, Dr van der Linde, and Dr Geurts provided writing. Miss Peters provided data collection. Mrs van de Ven-Stevens and Miss Peters provided data analysis. Dr Graff and Dr Geurts provided project management and consultation (including review of manuscript before submission). Dr Graff provided fund procurement. Mrs van de Ven-Stevens provided participants. Mrs van de Ven-Stevens and Dr Geurts provided facilities/equipment. The authors thank Petra Bulkens, Niek Koenders, and Carolien Kokkelink for their contribution in collecting data.

The study design was approved by the Medical-Ethical Committee of Radboud University Medical Centre, Nijmegen.

DOI: 10.2522/ptj.20130590

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