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AMERICAN CONGRESS OF REHABILITATION MEDICINE

Archives of Physical Medicine and Rehabilitation

journal homepage: www.archives-pmr.org

Archives of Physical Medicine and Rehabilitation 2023;000: 1−12

ORIGINAL RESEARCH

Explaining Personalized Activity Limitations in Patients With Hand and Wrist Disorders: Insights from Sociodemographic, Clinical, and Mindset Characteristics

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Abstract

Objectives: To investigate the association of sociodemographic, clinical, and mindset characteristics on outcomes measured with a patient-specific patient-reported outcome measure (PROM); the Patient Specific Functional Scale (PSFS). Secondly, we examined whether these factors differ when a fixed-item PROM, the Michigan Hand Outcome Questionnaire (MHQ), is used as an outcome.

Design: Cohort study, using the aforementioned groups of factors in a hierarchical linear regression.

Setting: Twenty-six clinics for hand and wrist conditions in the Netherlands.

Participants: Two samples of patients with various hand and wrist conditions and treatments: n=7111 (PSFS) and n=5872 (MHQ).

Interventions: NA.

Main Outcome Measures: The PSFS and MHQ at 3 months.

Results: The PSFS exhibited greater between-subject variability in baseline, follow-up, and change scores than the MHQ. Better PSFS outcomes were associated with: no involvement in litigation (β[95% confidence interval=-0.40[-0.54;-0.25]), better treatment expectations (0.09 [0.06;0.13]), light workload (0.08[0.03;0.14]), not smoking (-0.07[-0.13;-0.01]), men sex (0.07[0.02;0.12]), better quality of life (0.07[0.05;0.10]), moderate workload (0.06[0.00;0.13]), better hand satisfaction (0.05[0.02; 0.07]), less concern (-0.05[-0.08;-0.02]), less pain at rest (-0.04[-0.08;-0.00]), younger age (-0.04[-0.07;-0.01]), better comprehensibility (0.03[0.01;0.06]), better timeline perception (-0.03[-0.06;-0.01]), and better control (-0.02[-0.04;-0.00]). The MHQ model was highly similar but showed a higher R^2 than the PSFS model (0.41 vs 0.15), largely due to the R^2 of the baseline scores (0.23 for MHQ vs 0.01 for PSFS).

Conclusions: Health care professionals can improve personalized activity limitations by addressing treatment expectations and illness perceptions, which affect PSFS outcomes. Similar factors affect the MHQ, but the baseline MHQ score has a stronger association with the outcome score than the PSFS. While the PSFS is better for individual patient evaluation, we found that it is difficult to explain PSFS outcomes based on baseline characteristics compared with the MHQ. Using both patient-specific and fixed-item instruments helps health care professionals develop personalized treatment plans that meet individual needs and goals.

Archives of Physical Medicine and Rehabilitation 2023;000:1−12

Disclosures: None of the authors have a conflict of interest.

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https://doi.org/10.1016/j.apmr.2023.08.003

Patient-centered care is a health care approach that prioritizes the patient's needs, preferences, and values with the aim of improving their health care outcomes.[1,2] This approach acknowledges that each patient is unique and that their health care should be tailored to their individual needs. Patients with hand and wrist conditions experience a broad spectrum of functional limitations in their daily life (hereafter referred to as "activity limitations") that depend on these individual needs and circumstances.[3-5]

While fixed-item patient-reported outcome measures (PROMs) provide valuable information about a patient's overall function, they may not capture these specific activity limitations of an individual patient.[6-9] Therefore, patient-specific measures have been introduced, such as the Patient Specific Functional Scale (PSFS), to evaluate the functional status in the activities relevant to the individual patient.[10] The PSFS is a content-valid questionnaire and is more responsive to change than fixed-item PROMs in patients with hand disorders.[8,11] Other studies demonstrated that the PSFS measures a different construct than fixed-item PROMs (Y.E. van Kooij, unpublished data, 2023),[12−14] because the activities evaluated in fixed-item PROMs may not be those that are relevant to the individual patient.

As each patient has their personal activity limitations, it is imperative to understand to what extent the outcomes can be explained of these personalized activity limitations and which factors influence outcomes in personalized activity limitations. Previous studies have shown that activity limitations assessed by a fixed item PROM, such as the Michigan Hand Outcome Questionnaire (MHQ), can be fairly well explained in hand and wrist conditions.[15−20] It is unknown whether outcomes on a patient-specific PROM such as the PSFS can be explained, as every individual patient has their personal goals. Therefore, we hypothesize that it might be more difficult to explain outcomes of the PSFS. Identifying specific determinants (eg, mental health and mindset characteristics) of PSFS outcomes can inform personalized treatment strategies, for example, by targeting mental health and mindset characteristics, ultimately leading to better outcomes and enhanced patient-centered care. Also, it enables clinicians to better inform patients about the influence of these factors on their treatment success, allowing better expectation management and shared decision-making.

We investigated the contribution of sociodemographic, clinical, and mindset characteristics to PSFS outcomes, as well as examined whether these factors differ from those obtained from a fixed-item PROM like the MHQ.

Methods

Study design

This cohort study used routine outcome measurements collected as part of the regular health care process.[21,22] Study findings are reported following the Strengthening the Reporting of Observational Studies in Epidemiology statement.[23]

List of abbreviations:

CEQ	**Credibility/Expectancy Questionnaire**
MHQ	**Michigan Hand Outcome Questionnaire**
PROM	**Patient-Reported Outcome Measure**
PSFS	**The Patient Specific Functional Scale**
SRM	**standardized response mean**
VAS	**Visual Analog Scale**

Setting

Data were collected between 2017 and 2021 at Xpert Clinics which currently comprises 26 hand surgery and hand therapy locations in the Netherlands, with 23 Federation of European Societies for Surgery of the Hand certified surgeons and over 150 hand therapists. All patients participate in routine outcome measurements at fixed timepoints, based on the measurement track (a wrist, finger, thumb, Dupuytren's, and a compression neuropathy track).[21,22] Data were collected digitally using GemsTracker electronic data capture tools.[24] Our local medical ethical review board approved the anonymous use of the data (application number MEC-2018-1088). Additionally, they declared that this study was not subject to the Dutch Medical Research Involving Human Subjects Act (WMO).[25] All participants provided informed consent.

Participants

We used 2 samples. Patients were eligible for inclusion in the first sample if they completed the PSFS at baseline and 3 months. Patients were eligible for the second sample if they completed the MHQ, at baseline and 3 months. Patients had to be adults, with any type of diagnosis-treatment combination (provided that it occurred ≥20 times in the data), and with no missing data for 1 of the explanatory variables.

Variables, data sources, and measurements

Primary outcome

We used the total PSFS score at 3 months as a primary measure for personalized activity limitations. The PSFS is a patient-specific PROM and is a valid, reliable, and responsive outcome measure for patients with hand and wrist disorders.[11] At baseline, the digital form states: "Please identify up to 3 important activities that you are unable to do or are having difficulty with as a result of the current problem with your hand and/or wrist." The patient scores the activities on a 0-10 scale (0 unable to perform; 10 able to perform at the original level). The total score was the mean of the chosen activities. At 3 months, the patient is asked to score the same activities again. The minimal important change varies from 1.4 to 2.7 points.[26]

Secondary outcome

We used the total MHQ score at 3 months as a measure for general hand function and activity limitations. The MHQ has a high internal consistency and validity in patients with various hand disorders.[27] The MHQ is a fixed-item PROM and has 6 domains: overall hand function, activities of daily living, pain, work performance, aesthetics, and satisfaction with hand function[28] (range 0-100, higher scores indicate better performance, except for pain). The total MHQ score is the mean score of all domains after conversion of the pain domain. The minimal important change for the total MHQ score is 9.3 points.[29]

Explanatory variables

Patient characteristics were classified into (1) sociodemographic, (2) clinical, and (3) mental health and mindset characteristics.

Sociodemographic characteristics included age, symptom duration in months, sex, whether the dominant side was treated, smoking status, body mass index, workload, second opinion, comorbidities not hand or wrist-related, daily alcohol consumption, and whether there was a simultaneous litigation case.

Clinical characteristics included pain (at rest, during physical load, and average last week), hand function, and hand satisfaction (exact question, "how satisfied are you with your hand at this moment?"), all measured using a 0-100 Visual Analog Scale (VAS).[30,31] Higher scores indicate more pain, better hand satisfaction, and better hand function. We measured health-related quality of life (HRQoL) using the European Quality of Life Five Dimension VAS (VAS), on which the patient rates their health on a 0-100 scale (higher scores indicate better HRQoL).[32–34]

Mental health and mindset characteristics included treatment credibility, treatment expectations, illness perception, pain catastrophizing, anxiety, and depression. The treatment credibility and expectations were measured with the Credibility/Expectancy Questionnaire (CEQ, subscales range 0-27, higher scores indicate higher credibility/expectations).[35,36] Illness perceptions were measured using the Brief Illness Perception Questionnaire[37] items (range 0-10, higher scores indicate worse illness perception except for personal control and comprehensibility). The item treatment control was omitted because of overlap with the CEQ. We measured pain catastrophizing using the Pain Catastrophizing Scale (range 0-52, higher scores indicate more catastrophizing). Anxiety and depression were measured with the four-item Patient Health Questionnaire (PHQ, range 0-12, higher scores indicate worse symptoms).[38–41]

Confounding variables

Because of the variety of treatments in our samples, we considered the type of treatment a potential confounder. Also, the baseline PSFS score and baseline MHQ score were considered potential confounders, as we expected these variables to be associated with the outcome.[42] We adjusted for these by adding them first in the models.

Study size

Power analysis for multiple regression analysis, with a power of 0.80 (α=0.05), a conventional medium effect size of 0.15,[43] and 30 explanatory variables showed that >187 participants were required. We included all eligible participants, to increase the generalizability and accuracy of the model estimates.

Statistical methods

Hierarchical multivariable linear regression

We performed hierarchical linear regression analyses to evaluate the contribution of the aforementioned grouped variables to PSFS and MHQ scores at 3 months. The variables were added to the models in 3 steps to illustrate the added amount of explained variance of each group of variables: (1) sociodemographics, (2) clinical, and (3) mental health and mindset characteristics. We compared the explained variance (multiple R^2) of both models and used standardized beta coefficients to compare the significant variables. Residual plots and Q-Q plots were used to check linear regression's homoscedasticity and normality assumptions. We considered a Variance Inflation Factor>10 to indicate multicollinearity.[44] Values of $P<.05$ were considered statistically significant.

Non-responder analysis

We performed a non-responder analysis to investigate whether patients with a response at 3 months (responders) systematically differed from patients without a response (non-responders). We compared the groups using standardized mean differences as we expected that small, clinically irrelevant differences would be statistically significant due to our expected high statistical power.[45] We considered a standardized mean difference<0.2 a negligible difference between groups.[43]

Results

We included 7111 participants in the primary sample (PSFS) and 5872 participants in the second sample (MHQ, fig 1), with an

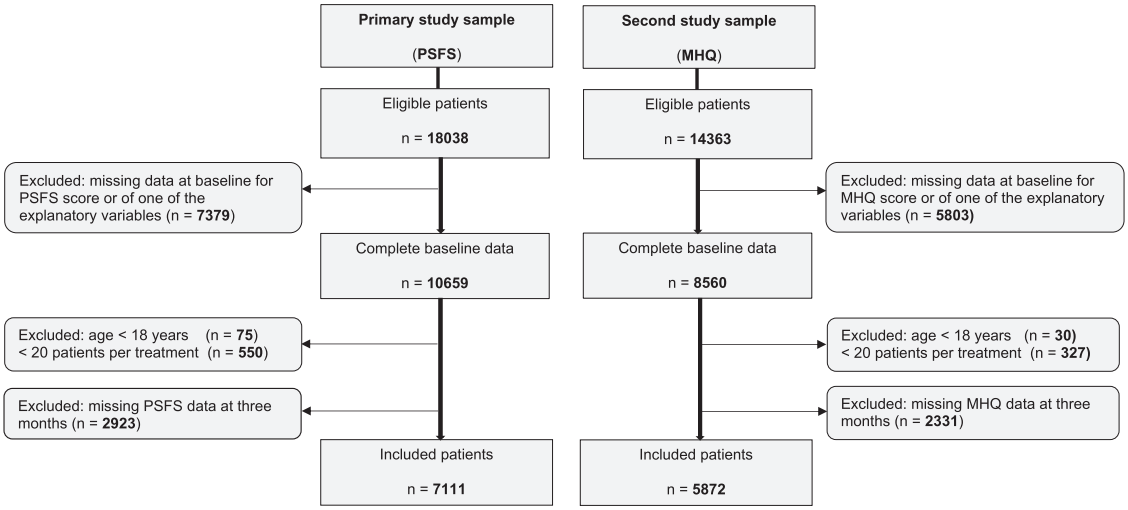

Fig 1 This flowchart illustrates the selection process

Table 1 Baseline patient characteristics

	Primary Sample (PSFS)	Second Sample (MHQ)	SMD
N	7111	5872	
Age (mean ± SD)	55 (14)	60 (12)	0.30*
Men	36%	40%	0.10
Symptom duration (mean ± SD)	18 (36)	19 (36)	0.03
Workload;			0.12
Unemployed	36%	41%	
Light physical work	29%	29%	
Moderate physical work	26%	22%	
Heavy physical work	9%	8%	
Second opinion=No	97%	98%	0.05
Dominant side treated=Yes	47%	47%	0.01
BMI (mean ± SD)	27 (5)	27 (5)	0.05
Smoking = No	84%	86%	0.05
Alcohol = No	73%	55%	0.38*
Comorbidity = No	75%	74%	0.04
Litigation = No	98%	99%	0.05
VAS pain last week (mean ± SD)	47 (26)	42 (28)	0.17
VAS EQ5D (mean ± SD)	77 (19)	79 (18)	0.13
PHQ score (mean ± SD)	1 (2)	1 (2)	0.17
PCS score (mean ± SD)	11 (10)	10 (9)	0.19
Credibility score (mean ± SD)	23 (4)	23 (4)	0.04
Expectations score (mean ± SD)	22 (4)	22 (4)	0.04

Abbreviations: BMI, body mass index; EQ5D, European Quality of Life Five Dimension; PCS, Pain Catastrophizing Scale (0-52); PHQ, Patient Health Questionnaire (0-12); SMD, standardized mean difference.

* Systematic differences between groups at SMD>0.2.

overlap of 3220 participants. Samples differed only on 2 variables (age and alcohol consumption, table 1). The PSFS non-responder analysis showed that responders were somewhat older (55±14 vs 52±16) and had higher treatment credibility (23±4 vs 22±4) than non-responders (supplemental appendix 1; available online only at http://www.archives-pmr.org/).

The PSFS score (0-10 scale) was 4.4±2.4 at baseline and 6.6±2.6 at follow-up. The MHQ (0-100 scale) score was 66.0±16.9 at baseline and 75.5±16.8 at follow-up. The relatively larger standard deviations of the PSFS at baseline (24% for the PSFS vs 17% for the MHQ) and at follow-up (26% for the PSFS vs 17% for the MHQ) indicate higher between-subject variability at baseline and follow-up in PSFS scores compared with the MHQ (fig 2).

The PSFS showed a significant change score (mean difference [95% confidence interval]=2.2[2.1;2.2], $P<.001$,) with a standardized response mean (SRM) of 0.7[0.6;0.8]. The MHQ also showed

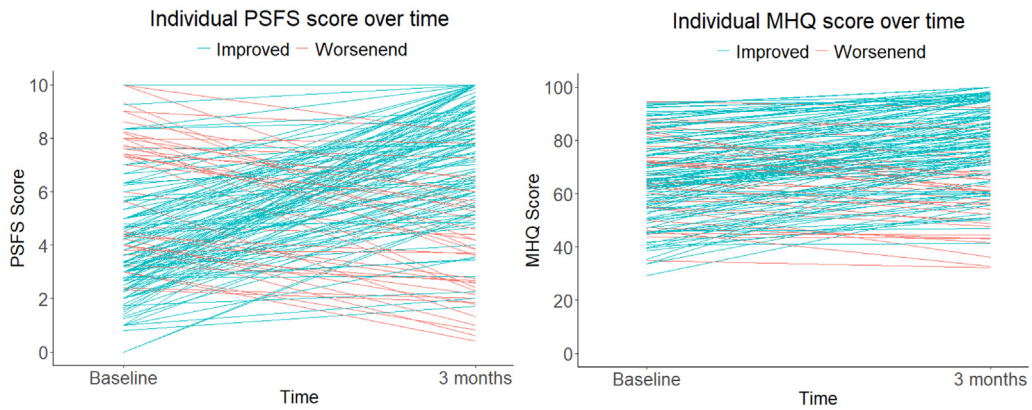

Fig 2 The spaghetti plots (random samples of n=150) show that the PSFS score changes more over time and has more variability at baseline and at 3 months compared with the MHQ.

Table 2 Significant variables and associated interpretation from the final PSFS model of the hierarchical regression analysis

Significant Variable	*B* (95% CI)	*P* Value	Interpretation
Age	−0.01 (−0.01; −0.00)	.007	Every year older decreases PSFS score at 3 months by 0.01 points
Sex = men	0.19 (0.06; 0.33)	.004	Being men increases PSFS score at 3 months by 0.19 points
Light physical labor	0.22 (0.07; 0.37)	.005	Workload of light physical labor increases PSFS score at 3 months by 0.22 points compared with unemployment.
Moderate physical labor	0.17 (0.01; 0.33)	.040	Workload of moderate physical labor increases PSFS score at 3 months by 0.17 points compared with unemployment.
Alcohol = Yes	0.23 (0.10; 0.37)	<.001	Alcohol consumptions increases PSFS score at 3 months by 0.23 points
Smoking = Yes	−0.19 (−0.35; −0.03)	.021	Smoking decreases PSFS score at 3 months by 0.19 points
Litigation	−1.04 (−1.43; −0.65)	<.001	Involvement in litigation decreases PSFS score at 3 months by 1.04 points
Pain at rest	−0.00 (−0.01; −0.00)	.030	Intensity of pain at rest neither increases nor decreases PSFS score at 3 months
Satisfaction with hand	0.00 (0.00; 0.01)	.002	Degree of satisfaction with the hand neither increases nor decreases PSFS score at 3 months
Health-related quality of life	0.01 (0.01; 0.01)	<.001	Every point increase on the VAS-EQ5D increases PSFS score at 3 months by 0.01 points
Treatment expectations	0.06 (0.04; 0.07)	<.001	Every point increase in expectation score on the CEQ increases PSFS score at 3 months by 0.06 points
BIPQ Timeline	−0.03 (−0.06; −0.01)	.017	Every point increase in BIPQ Timeline decreases PSFS score at 3 months by 0.03 points
BIPQ Control	−0.02 (−0.05; −0.00)	.049	Every point increase in BIPQ Control decreases PSFS score at 3 months by 0.02 points
BIPQ Concern	−0.04 (−0.07; −0.02)	.002	Every point increase in BIPQ Concern decreases PSFS score at 3 months by 0.04 points
BIPQ Comprehensibility	0.04 (0.01; 0.07)	.004	Every point increase in BIPQ Comprehensibility increases PSFS score at 3 months by 0.04 points

Abbreviations: *B*, unstandardized beta coefficient; BIPQ, Brief Illness Perception Questionnaire (0-10); CI, confidence interval; EQ5D, European Quality of Life Five Dimension (0-100).

a significant change score (9.5[9.1;9.9], $P<.001$) with a slightly lower SRM of 0.6[0.6;0.6]. The much wider SRM 95% confidence interval of the PSFS indicates more variability in the change score compared with the MHQ.

Hierarchical multivariable linear regression

The first step of the PSFS model showed that sociodemographics yielded an R^2 of only 0.02. After adding clinical characteristics, the R^2 increased slightly to 0.05. By adding the mental health and mindset characteristics, the R^2 increased to 0.07, indicating that these characteristics have limited influence on the PSFS score at follow-up. Together with the confounding variables (ie, type of treatment and the baseline PSFS score), the full PSFS model yielded an R^2 of 0.15. The MHQ model showed a much higher R^2 (0.41 vs 0.15), which was mainly due to the patients' baseline score explaining notably more in the MHQ model (R^2=0.23) than in the PSFS model (R^2=0.01).

Better PSFS scores at follow-up were associated with no involvement in litigation (*B*[95% confidence interval]=-1.04 [-1.43;-0.65]), daily alcohol consumption (0.23[0.10;0.37]), light physical labor (0.22[0.07;0.37]), not smoking (-0.19[-0.35;-0.03]), men sex (0.19[0.06;0.33]), moderate physical labor (0.17 [0.01;0.33]), higher treatment expectations (0.06[0.04;0.07]), better comprehensibility (0.04[0.01;0.07]), less concern (-0.04 [-0.07;-0.02]), better timeline perception (-0.03[-0.06;-0.01]), better control (-0.02[-0.05;-0.00]), higher EQ5D-VAS score (0.01 [0.01;0.01]), younger age (-0.01[-0.01;-0.00]), lower VAS pain at rest (-0.00[-0.01;-0.00]), and higher VAS satisfaction with the hand (0.00[0.00;0.01]) (table 2).

We found similar explanatory variables for the MHQ model, with standardized beta coefficients of both models overlapping for all variables except for the baseline scores; 0.41[0.37;0.44] for the MHQ vs 0.07[0.05;0.09] for the PSFS

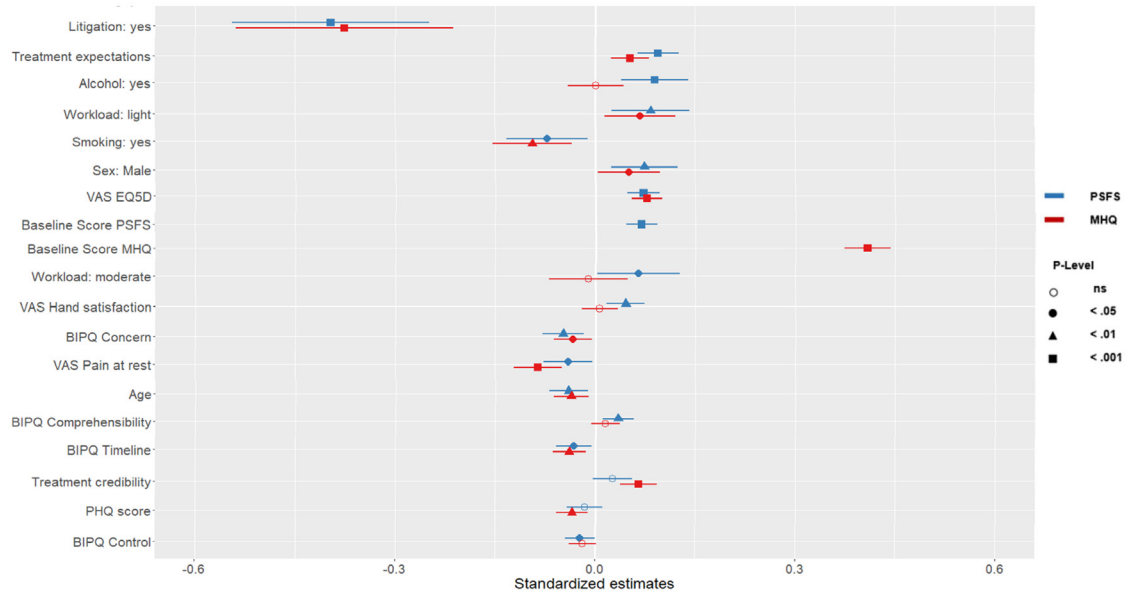

Fig 3 Significant variables for either the PSFS model or the MHQ model (arranged from the largest to smallest beta coefficient of the PSFS model). Note that the standardized beta coefficients overlapped for all variables, except for the PSFS/MHQ baseline scores.

(fig 3). Furthermore, we found that moderate physical labor, alcohol consumption, VAS hand satisfaction, and the Brief Illness Perception Questionnaire items control and comprehensibility were associated with the PSFS score but not with the MHQ score at follow-up, although their confidence intervals overlapped. The PHQ score and the CEQ score for treatment credibility were only associated with the MHQ score and not with the PSFS score. There were no indications of multicollinearity. See supplemental appendices 2 and 3 (available online only at http://www.archives-pmr.org/) for the univariable beta coefficients and the full hierarchical models.

Discussion

The PSFS exhibited greater between-subject variability in baseline, change, and follow-up scores, with similar explanatory variables found for the MHQ. Better PSFS score at follow-up is explained by younger age, men sex, no litigation, light to moderate workload, not smoking, less pain, more hand satisfaction, better quality of life, better illness perceptions, and more positive treatment expectations. The baseline score contributes notably more to MHQ score at follow-up compared with the PSFS at follow-up. We could explain only a small proportion of the variation in PSFS scores at follow-up. Of all factors associated with PSFS outcomes, patients' treatment expectations and illness perceptions are influenceable, thus these can be targeted to improve personalized activity limitation outcomes.

Our findings that older age, women sex, litigation, worse illness perceptions, and lower treatment expectations are associated with worse outcomes, are consistent with studies investigating other functional outcome domains.[46–53] Litigation was the strongest contributor in both models, indicating that patients involved in litigation (eg, a third-party claim) because of their hand or wrist condition have worse outcomes compared with patients who are not. Several factors (eg, anxiety and depression, treatment credibility, or pain catastrophizing) were not independently associated with PSFS outcomes in our multivariable model, while they did have a univariable association with PSFS outcomes. This indicates a shared variance of these and other variables in the multivariable model explaining PSFS outcomes. For, for example, anxiety and depression, treatment credibility, or pain catastrophizing, it is likely that other variables from the mental health and mindset characteristics step of the hierarchical model accounted for these univariable associations, such as illness perception or expectations. Future research may further investigate these associations with PSFS outcomes.

A noteworthy finding was that the baseline MHQ score contributes notably more to the MHQ score at follow-up compared with the contribution of the baseline PSFS score to PSFS score at follow-up. Despite the higher between-subject variability at baseline, follow-up, and change scores of the PSFS, we found a weaker relation between baseline and outcome scores compared with the MHQ with less between-subject variability. An explanation could be the trade-off between variability and predictability; it is conceivable that if all subjects have the same baseline and follow-up score, then the follow-up score is 100% predictable from the baseline score. In contrast, the greater the between-subject variability, the harder it is to predict. Thus, the higher between-subject variability of the PSFS at baseline makes it more difficult to predict outcomes. In contrast, less between-subject variability at baseline (ie, the MHQ baseline scores) may contribute to a higher association between the baseline score and the outcome score. This

may explain why the baseline MHQ score contributes stronger to the outcome at follow-up compared with the baseline PSFS score.

Although the higher between-subject variability in change scores of the PSFS indicates better responsiveness, the 95% confidence intervals of the SRMs of both measures overlapped. This can be explained by the SRM correcting for this between-subject variability in change scores,[54] making the SRMs of the MHQ and the PSFS comparable. This finding is consistent with another study demonstrating greater between-subject variability for the PSFS compared with the MHQ. It appears that the PSFS is a more responsive measure for individual-patient evaluation but is similarly responsive to the MHQ for group-level evaluation.

The higher between-subject variability in baseline, follow-up, and change scores may be explained by the patient-specific character of the PSFS compared with the MHQ. The PSFS may have greater between-subject variability in baseline scores because there is a variety of activities that are reported. In contrast, there is no variation in items on the MHQ because of its fixed-item character. Furthermore, the PSFS may exhibit more between-subject variability in change score because it allows the patient to choose items that are affected by their condition and are expected to change with the treatment. In comparison, some fixed items of the MHQ may not be relevant to an individual patient in relation to their hand or wrist condition.[6,7] Therefore, some items are expected not to change with the treatment, resulting in less between-subject variability in change scores.

Study limitations

This study has several limitations that may have left most of the variation in PSFS scores at follow-up unexplained. Other socioeconomic characteristics not yet included, such as income, postcode, and education level, may have been associated as they do with functional outcomes.[55,56] Also, performance-based measurements such as grip strength and range of motion were not included, although these are associated with functional outcomes.[57,58] Furthermore, we only used baseline variables to explain outcomes and did not use variables over time, such as treatment adherence or the use of an orthosis. It is likely that patients with better treatment adherence over time and those who used an orthosis, had better outcomes than patients with worse treatment adherence or who did not use an orthosis, as these factors may improve pain and function.[59,60] Additionally, we did not take into account the type and load of the activities that patients reported on the PSFS. Theoretically, the type and load of the activity may influence the PSFS follow-up score. Furthermore, we used 2 different samples, which differed systematically in age and alcohol consumption. This may have influenced the finding that the variable alcohol consumption was significantly associated with the PSFS outcomes and not with MHQ outcomes. Lastly, non-responders differed from responders by younger age and lower treatment credibility which may have influenced our results.

Clinical implications

Our findings show which factors influence PSFS outcomes, allowing health care professionals to better inform patients about their expected treatment success, shared decision-making, and expectation management. Health care professionals may consider a more thorough evaluation of patients' treatment expectations and illness perceptions. Addressing these factors through, for example, comprehensive patient education as part of the treatment, may improve personalized activity limitation outcomes. By incorporating both patient-specific and fixed-item instruments, health care professionals can better understand the unique needs and goals of each patient, and develop a personalized health care plan that addresses their specific concerns. Future studies should investigate other factors that may contribute to personalized activity limitation outcomes.

Conclusions

The PSFS exhibited greater variability in baseline, change, and follow-up scores compared with the fixed-item MHQ. Multiple factors were associated with PSFS outcomes, of which treatment expectations and illness perceptions are influenceable. These can be targeted by health professionals to improve personalized activity limitations outcomes. Similar factors play a role in the MHQ, the only difference being that the baseline score had a stronger association with the outcome compared with the PSFS. The PSFS seems more valuable for individual-patient evaluation than a fixed-item PROM, but its patient-specific nature makes it harder to explain outcome variability.

Keywords

Hand; Outcome assessment; Patient-centered care; Patient Reported Outcome Measures

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Acknowledgments

The authors thank all patients who participated and allowed their data to be anonymously used for the present study. The collaborators of the Hand-Wrist Study Group are Richard Arjen Michiel Blomme, MD, Jeronimus (Jeroen) Maria Smit, MD, PhD, Kennard Harmsen, MD, Gert-jan Halbesma, MD, Guus Maarten Vermeulen, MD, PhD, Johannes (Hans) Pieter de Schipper, MD, Jeroen Hein van Uchelen, MD, PhD, Oliver Theodor Zöphel, MD, PhD, John Sebastiaan Souer, MD, PhD, Lisa Esteban Lopez, PT, CHT-NL, Alexandra Fink, PT, CHT-NL, MSc, Rob van Huis, PT, CHT-NL, Pierre-Yves Alain Adriaan Pennehouat, PT, CHT-NL, Karin Schoneveld, PT,

CHT-NL, MSc, Grada Danée Arends, PT, CHT-NL, Reinier Feitz, MD, PhD, Lisa Hoogendam, BSc, Steven Eric Ruden Hovius, MD, PhD, Yara Eline van Kooij, PT, CHT-NL, MSc, Jaimy Emerentiana Koopman, MD, Mark Johannes Willem van der Oest, PhD, Willemijn Anna de Ridder, PT, CHT-NL, MSc, Ruud Willem Selles, PhD, Liz-Tipper Sikking, Harm Pieter Slijper, PhD, Marloes Hendrina Paulina ter Stege, MSc, Joris Sebastiaan Teunissen, BSc, Robbert Maarten Wouters, PhD, PT, CHT-NL, Nina Louisa Loos, BSc, Nienke Helena Adriana Mendelaar, MD, Lyse van Wijk, BSc, Ward Rogier Bijlsma, MD, PhD, Joost W. Colaris, MD, PhD, Liron S. Duraku, MD, PhD, E. P. A. (Brigitte) van der Heijden, MD, PhD, Caroline Anna Hundepool, MD, PhD, and Jelle Michiel Zuidam, MD, PhD.

Appendix A. Non-Responder Analyse

	PSFS			MHQ		
	Non-responder	Responder	SMD	Non-responder	Responder	SMD
N	2923	7111		2331	5872	
Age (mean (SD))	52 (16)	55 (14)	0.22*	57 (14)	59 (12)	0.20*
Male	36%	36%	0.00	40%	40%	0.03
Symptom duration (mean (SD))	17(32)	18 (36)	0.02	18 (34)	19 (36)	0.05
Workload			0.09			0.13
Unemployed	33%	36%		36%	41%	
Light physical work	29%	29%		28%	29%	
Moderate physical work	28%	26%		25%	22%	
Heavy physical work	11%	9%		11%	8%	
Dominant side treated = Yes	46%	47%	0.02	52%	47	0.08
Second opinion = No	97%	97%	0.01	97%	97%	0.05
BMI (mean (SD))	27 (5)	27 (5)	0.08	27 (5)	27 (5)	0.02
Smoking = No	78%	84%	0.17	82%	86%	0.12
Alcohol = No	74%	73%	0.01	57%	55%	0.03
Comorbidity = No	78%	75%	0.05	76%	74%	0.06
Litigation = No	98%	98%	0.01	98%	98%	0.03
VAS pain last week (mean (SD))	47 (25)	47 (26)	0.01	42 (28)	42 (28)	0.02
VAS pain at rest (mean (SD))	36 (27)	36 (27)	0.00	31 (27)	32 (27)	0.02
VAS pain activity (mean (SD))	57 (28)	55 (29)	0.05	50 (30)	51 (30)	0.01
VAS function (mean (SD))	53 (25)	53 (26)	0.02	55 (27)	54 (27)	0.06
VAS hand satisfaction (mean (SD))	39 (25)	39 (26)	0.01	42 (27)	41 (26)	0.05
VAS EQ5D (mean (SD))	76 (19)	77 (19)	0.04	79 (19)	79 (18)	0.01
PHQ score (mean (SD))	1 (2)	1 (2)	0.05	1 (2)	1 (2)	0.07
PCS score (mean (SD))	12 (10)	11 (10)	0.05	10 (9)	10 (9)	0.03
Credibility score (mean (SD))	22 (4)	23 (4)	0.22*	23 (4)	24 (4)	0.21*
Expectations score (mean (SD))	21 (5)	22 (4)	0.19	21 (5)	22 (5)	0.17
BIPQ item:						
Consequences (mean (SD))	6 (3)	6 (3)	0.01	6 (3)	6 (3)	0.00
Timeline (mean (SD))	6 (3)	6 (3)	0.00	6 (3)	6 (3)	0.02
Personal control (mean (SD))	4 (3)	5 (3)	0.02	5 (3)	5 (3)	0.00
Identity (mean (SD))	6 (3)	6 (3)	0.04	5 (3)	5 (3)	0.02
Concern (mean (SD))	5 (3)	5 (3)	0.03	5 (3)	5 (3)	0.02
Comprehensibility (mean (SD))	8 (2)	8 (2)	0.11	8 (2)	8 (2)	0.10
Emotions (mean (SD))	4 (3)	4 (3)	0.04	3 (3)	3 (3)	0.02
Baseline PSFS/MHQ score (mean (SD))	5 (2)	4 (2)	0.04	66 (17)	66 (17)	0.01

PSFS, Patient Specific Functional Scale (0-10); MHQ, Michigan Hand outcome Questionnaire (0-100); SMD, Standardized Mean Difference; BMI, Body Mass Index; VAS, Visual Analogue Scale (0-100); EQ5D, European Quality of Life Five Dimension; PHQ, Patient Health Questionnaire (0-12); PCS, Pain Catastrophizing Scale (0-52); BIPQ, Brief Illness Perception Questionnaire (0-10).

* Systematic differences between groups at SMD > 0.2.

Appendix B Full Hierarchical PSFS Model

	Univariable β[95% CI]	*P* Value	Step 0 β[95% CI]	Step 0 *P* Value	Step 1 β[95% CI]	Step 1 *P* Value	Step 2 β[95% CI]	Step 2 *P* Value	Step 3 β[95% CI]	Step 3 *P* Value	R^2
Step 0: Controlling variables											0.084
Type of treatment	-	-	-	-	-	-	-	-	-	-	
Baseline PSFS score	0.14 [0.11; 0.16]	<0.001	0.12 [0.09; 0.14]	0.0000	0.11 [0.09; 0.13]	<0.001	0.07 [0.04; 0.09]	<0.001	0.07 [0.05; 0.09]	<0.001	
Step 1: Sociodemographics											0.017
Age	0.05 [0.02; 0.07]	<0.001	-	-	0.00 [−0.03; 0.03]	0.960	−0.02 [−0.05; 0.01]	0.1221	−0.04 [−0.07; −0.01]	0.007	
Male	0.17 [0.12; 0.22]	<0.001	-	-	0.11 [0.06; 0.16]	<0.001	0.07 [0.02; 0.12]	0.009	0.07 [0.02; 0.12]	0.004	
Symptom duration	−0.02 [−0.04; 0.00]	0.071	-	-	−0.01 [−0.04; 0.01]	0.218	−0.02 [−0.04; 0.00]	0.111	−0.01 [−0.03; 0.01]	0.381	
Light physical work	0.10 [0.05; 0.16]	<0.001	-	-	0.14 [0.08; 0.20]	<0.001	0.10 [0.04; 0.16]	0.001	0.08 [0.03; 0.14]	0.005	
Moderate physical work	0.01 [−0.05; 0.07]	0.637	-	-	0.09 [0.03; 0.16]	0.004	0.06 [0.00; 0.13]	0.048	0.06 [0.00; 0.13]	0.040	
Heavy physical work	−0.03 [−0.12; 0.05]	0.473	-	-	0.04 [−0.04; 0.13]	0.339	0.02 [−0.07; 0.10]	0.708	0.02 [−0.07; 0.10]	0.719	
Dominant side treated (Yes)	0.04 [−0.01; 0.09]	0.104	-	-	0.00 [−0.04; 0.05]	0.947	−0.00 [−0.05; 0.04]	0.838	0.00 [−0.04; 0.04]	0.970	
Second Opinion (Yes)	−0.28 [−0.41; −0.15]	<0.001	-	-	−0.14 [−0.27; −0.01]	0.032	−0.10 [−0.23; 0.03]	0.119	−0.07 [−0.20; 0.05]	0.238	
BMI	−0.02 [−0.04; 0.01]	0.198	-	-	−0.02 [−0.04; 0.00]	0.113	0.01 [−0.02; 0.03]	0.506	0.00 [−0.02; 0.02]	0.839	
Alcohol (Yes)	0.14 [0.09; 0.19]	<0.001	-	-	0.10 [0.05; 0.16]	<0.001	0.09 [0.04; 0.14]	<0.001	0.09 [0.04; 0.14]	<0.001	
Smoking (Yes)	−0.14 [−0.21; −0.08]	<0.001	-	-	−0.12 [−0.19; −0.06]	<0.001	−0.07 [−0.13; −0.01]	0.025	−0.07 [−0.13; −0.01]	0.021	
Comorbidities(Yes)	−0.08 [−0.13; −0.02]	0.006	-	-	−0.05 [−0.11; 0.00]	0.051	−0.00 [−0.05; 0.05]	0.930	−0.00 [−0.05; 0.05]	0.961	
Litigation (Yes)	−0.61 [−0.76; −0.45]	<0.001	-	-	−0.49 [−0.64; −0.34]	<0.001	−0.43 [−0.58; −0.28]	<0.001	−0.40 [−0.54; −0.25]	<0.001	
Step 2: Clinical characteristics											0.032
VAS pain average last week	−0.20 [−0.22; −0.17]	<0.001	-	-	-	-	−0.03 [−0.08; 0.03]	0.307	−0.02 [−0.08; 0.03]	0.363	
VAS pain at rest	−0.17 [−0.19; −0.14]	<0.001	-	-	-	-	−0.05 [−0.09; −0.02]	0.004	−0.04 [−0.08; −0.00]	0.030	
VAS pain during physical load	−0.20 [−0.22; −0.18]	<0.001	-	-	-	-	−0.04 [−0.08; 0.00]	0.081	−0.03 [−0.08; 0.01]	0.149	
VAS hand function	0.13 [0.11; 0.16]	<0.001	-	-	-	-	0.01 [−0.02; 0.04]	0.417	0.01 [−0.02; 0.03]	0.721	
VAS hand satisfaction	0.16 [0.14; 0.19]	<0.001	-	-	-	-	0.06 [0.03; 0.09]	<0.001	0.05 [0.02; 0.07]	0.002	
VAS EQ-5D	0.17 [0.15; 0.19]	<0.001	-	-	-	-	0.11 [0.08; 0.13]	<0.001	0.07 [0.05; 0.10]	<0.001	
Step 3: Mental health and mindset characteristics											0.021
PHQ score	−0.14 [−0.16; −0.12]	<0.001	-	-	-	-	-	-	−0.02 [−0.04; 0.01]	0.237	
PCS score	−0.16 [−0.18; −0.14]	<0.001	-	-	-	-	-	-	−0.01 [−0.04; 0.02]	0.543	
CEQ credibility score	0.18 [0.16; 0.21]	<0.001	-	-	-	-	-	-	0.03 [−0.00; 0.06]	0.086	
CEQ expectations score	0.22 [0.20; 0.25]	<0.001	-	-	-	-	-	-	0.09 [0.06; 0.13]	<0.001	
BIPQ consequences	−0.15 [−0.18; −0.13]	<0.001	-	-	-	-	-	-	−0.00 [−0.03; 0.03]	0.869	
BIPQ timeline	−0.16 [−0.19; −0.14]	<0.001	-	-	-	-	-	-	−0.03 [−0.06; −0.01]	0.017	
BIPQ control	−0.01 [−0.03; 0.01]	0.482	-	-	-	-	-	-	−0.02 [−0.04; −0.00]	0.050	
BIPQ identity	−0.13 [−0.15; −0.11]	<0.001	-	-	-	-	-	-	0.02 [−0.01; 0.05]	0.215	
BIPQ concern	−0.20 [−0.22; −0.18]	<0.001	-	-	-	-	-	-	−0.05 [−0.08; −0.02]	0.002	
BIPQ comprehensibility	0.10 [0.08; 0.13]	<0.001	-	-	-	-	-	-	0.03 [0.01; 0.06]	0.004	
BIPQ emotions	−0.18 [−0.20; −0.16]	<0.001	-	-	-	-	-	-	−0.02 [−0.05; 0.01]	0.223	

β, Standardized Beta Coefficient; CI, Confidence Interval; R^2, Increase in explained variance (Multiple R^2) of PSFS outcome at 3 months for each group of variables; PSFS, Patient Specific Functional Scale (0-10); BMI, Body Mass Index; VAS, Visual Analogue Scale (0-100); EQ-5D, European Quality of Life Five Dimension; PHQ, Patient Health Questionnaire (0-12); PCS, Pain Catastrophizing Scale (0-52); CEQ, Credibility and Expectancy Questionnaire (3-27), BIPQ, Brief Illness Perception Questionnaire (0-10).

Appendix C Full Hierarchical MHQ model

	Univariable β[95% CI]	*P* Value	Step 0 β[95% CI]	Step 0 *P* Value	Step 1 β[95% CI]	Step 1 *P* Value	Step 2 β[95% CI]	Step 2 *P* Value	Step 3 β[95% CI]	Step 3 *P* Value	R^2
Step 0: Controlling variables											0.365
Type of treatment*	-	-	-	-	-	-	-	-	-	-	
Baseline MHQ score*	0.57 [0.55; 0.59]	<0.001	0.54 [0.52; 0.57]	<0.001	0.53 [0.50; 0.55]	<0.001	0.48 [0.44; 0.51]	<0.001	0.41 [0.37; 0.44]	<0.001	
Step 1: Sociodemograpics											0.007
Age	0.02 [−0.01; 0.05]	0.117	-	-	−0.01 [−0.03; 0.02]	0.534	−0.02 [−0.05; 0.01]	0.125	−0.04 [−0.06; −0.01]	0.006	
Male	0.39 [0.34; 0.44]	<0.001	-	-	0.03 [−0.02; 0.08]	0.231	0.04 [−0.01; 0.08]	0.123	0.05 [0.00; 0.10]	0.033	
Symptom duration	−0.05 [−0.07; −0.02]	<0.001	-	-	−0.02 [−0.04; 0.00]	0.100	−0.02 [−0.04; 0.00]	0.126	−0.01 [−0.03; 0.01]	0.271	
Light physical work	0.23 [0.17; 0.29]	<0.001	-	-	0.08 [0.02; 0.13]	0.006	0.06 [0.01; 0.12]	0.020	0.07 [0.01; 0.12]	0.013	
Moderate physical work	−0.05 [−0.11; 0.02]	0.173	-	-	0.01 [−0.05; 0.07]	0.833	−0.02 [−0.08; 0.04]	0.468	−0.01 [−0.07; 0.05]	0.734	
Heavy physical work	−0.12 [−0.21; −0.02]	0.021	-	-	−0.06 [−0.15; 0.02]	0.160	−0.09 [−0.17; −0.01]	0.036	−0.07 [−0.16; 0.01]	0.085	
Dominant side treated (Yes)	0.02 [−0.03; 0.07]	0.430	-	-	−0.02 [−0.06; 0.02]	0.433	−0.02 [−0.06; 0.02]	0.364	−0.01 [−0.05; 0.03]	0.646	
Second Opinion (Yes)	−0.26 [−0.43; −0.10]	0.002	-	-	0.01 [−0.12; 0.15]	0.857	0.00 [−0.13; 0.13]	0.967	0.03 [−0.10; 0.16]	0.622	
BMI	−0.04 [−0.07; −0.02]	0.001	-	-	0.01 [−0.02; 0.03]	0.621	0.02 [−0.00; 0.04]	0.090	0.01 [−0.01; 0.03]	0.305	
Alcohol (Yes)	0.14 [0.08; 0.19]	<0.001	-	-	0.00 [−0.04; 0.04]	0.969	−0.00 [−0.05; 0.04]	0.859	0.00 [−0.04; 0.04]	0.964	
Smoking (Yes)	−0.27 [−0.35; −0.20]	<0.001	-	-	−0.11 [−0.17; −0.05]	<0.001	−0.09 [−0.15; −0.03]	0.002	−0.09 [−0.15; −0.04]	0.002	
Comorbidities(Yes)	−0.13 [−0.19; −0.07]	<0.001	-	-	−0.02 [−0.07; 0.02]	0.326	0.01 [−0.04; 0.06]	0.641	0.01 [−0.04; 0.06]	0.631	
Litigation (Yes)	−0.59 [−0.79; −0.38]	<0.001	-	-	−0.43 [−0.60; −0.27]	<0.001	−0.40 [−0.57; −0.24]	<0.001	−0.38 [−0.54; −0.21]	<0.001	
Step 2: Clinical characteristics											0.013
VAS pain average last week	−0.38 [−0.40; −0.35]	<0.001	-	-	-	-	0.04 [−0.02; 0.09]	0.171	0.04 [−0.01; 0.09]	0.139	
VAS pain at rest	−0.37 [−0.39; −0.35]	<0.001	-	-	-	-	−0.10 [−0.13; −0.06]	<0.001	−0.09 [−0.12; −0.05]	<0.001	
VAS pain during physical load	−0.36 [−0.39; −0.34]	<0.001	-	-	-	-	0.03 [−0.02; 0.07]	0.278	0.02 [−0.03; 0.07]	0.404	
VAS hand function	0.29 [0.27; 0.32]	<0.001	-	-	-	-	−0.02 [−0.05; 0.01]	0.166	−0.01 [−0.03; 0.02]	0.623	
VAS hand satisfaction	0.30 [0.28; 0.32]	<0.001	-	-	-	-	0.02 [−0.01; 0.05]	0.136	0.01 [−0.02; 0.03]	0.643	
VAS EQ-5D	0.30 [0.27; 0.32]	<0.001	-	-	-	-	0.11 [0.09; 0.13]	<0.001	0.08 [0.05; 0.10]	<0.001	
Step 3: Mental health and mindset characteristics											0.020
PHQ score	−0.26 [−0.28; −0.24]	<0.001	-	-	-	-	-	-	−0.03 [−0.06; −0.01]	0.004	
PCS score	−0.33 [−0.36; −0.31]	<0.001	-	-	-	-	-	-	−0.02 [−0.04; 0.01]	0.229	
CEQ credibility score	0.22 [0.19; 0.24]	<0.001	-	-	-	-	-	-	0.07 [0.04; 0.09]	<0.001	
CEQ expectations score	0.25 [0.22; 0.27]	<0.001	-	-	-	-	-	-	0.05 [0.02; 0.08]	<0.001	
BIPQ consequences	−0.36 [−0.38; −0.33]	<0.001	-	-	-	-	-	-	−0.01 [−0.04; 0.02]	0.695	
BIPQ timeline	−0.25 [−0.27; −0.22]	<0.001	-	-	-	-	-	-	−0.04 [−0.06; −0.01]	0.002	
BIPQ control	0.01 [−0.02; 0.03]	0.499	-	-	-	-	-	-	−0.02 [−0.04; 0.00]	0.079	
BIPQ identity	−0.33 [−0.35; −0.30]	<0.001	-	-	-	-	-	-	−0.01 [−0.03; 0.02]	0.679	
BIPQ concern	−0.36 [−0.39; −0.34]	<0.001	-	-	-	-	-	-	−0.03 [−0.06; −0.01]	0.021	
BIPQ comprehensibility	0.12 [0.09; 0.14]	<0.001	-	-	-	-	-	-	0.01 [−0.01; 0.04]	0.177	
BIPQ emotions	−0.38 [−0.40; −0.35]	<0.001	-	-	-	-	-	-	−0.03 [−0.06; 0.00]	0.078	

β, Standardized Beta Coefficient; CI, Confidence Interval; R^2, Increase in explained variance (Multiple R2) of MHQ outcome at 3 months for each group of variables; MHQ, Michigan Hand outcome Questionnaire (0-100); BMI, Body Mass Index; VAS, Visual Analogue Scale (0-100); EQ-5D, European Quality of Life Five Dimension; PHQ, Patient Health Questionnaire (0-12); PCS, Pain Catastrophizing Scale (0-52); CEQ, Credibility and Expectancy Questionnaire (3-27), BIPQ, Brief Illness Perception Questionnaire (0-10).

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