Patient-reported outcomes three months after treatment of metacarpal and phalangeal fractures or dislocations

a multicentre snapshot study

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Aims

To evaluate patient-reported outcomes three months after treatment of metacarpal and phalangeal fractures or dislocations, and to identify factors that are associated with worse patient-reported outcomes.

Methods

This cross-sectional, multicentre snapshot study included all adult patients with metacarpal and phalangeal fractures or dislocations during a three-month period between August and October 2020. The primary outcome was the Michigan Hand Outcomes Questionnaire (MHQ) three months after injury. The MHQ scores were compared to normative MHQ scores of 90 points of the affected hand of patients who sustained unilateral trauma derived from a previous study. Subgroup analyses were performed for the most common injury types. Multivariable linear regression was used to study associations between patient characteristics and worse MHQ scores.

Results

The MHQ scores of 512 patients were analyzed. The median MHQ score was 80 (IQR 65 to 91) for nonoperatively treated patients (n = 398) and 78 (IQR 66 to 85) for operatively treated patients (n = 114). After nonoperative treatment, 104/398 patients (26%) reached a MHQ score equal to or better than the normative MHQ score, ranging between 11% (1/9) and 42% (13/31) among the nine most common injury types. After operative treatment, this was 11% (13/114), ranging between 10% (3/29) and 31% (5/16) among the three most common injury types. No significant differences in MHQ scores were found between common injury types. Older age, the presence of hand comorbidities, and referral to hand therapy were associated with a worse MHQ score after nonoperative treatment.

Conclusion

These results suggest that most patients have not returned to a normal hand function within three months following metacarpal and phalangeal fractures or dislocations. Older age, the presence of hand comorbidities, and referral for hand therapy were associated with worse hand functioning after nonoperative treatment. The findings are relevant for clinicians to evaluate recovery and for patients to manage their expectations.

Bone & Joint Open

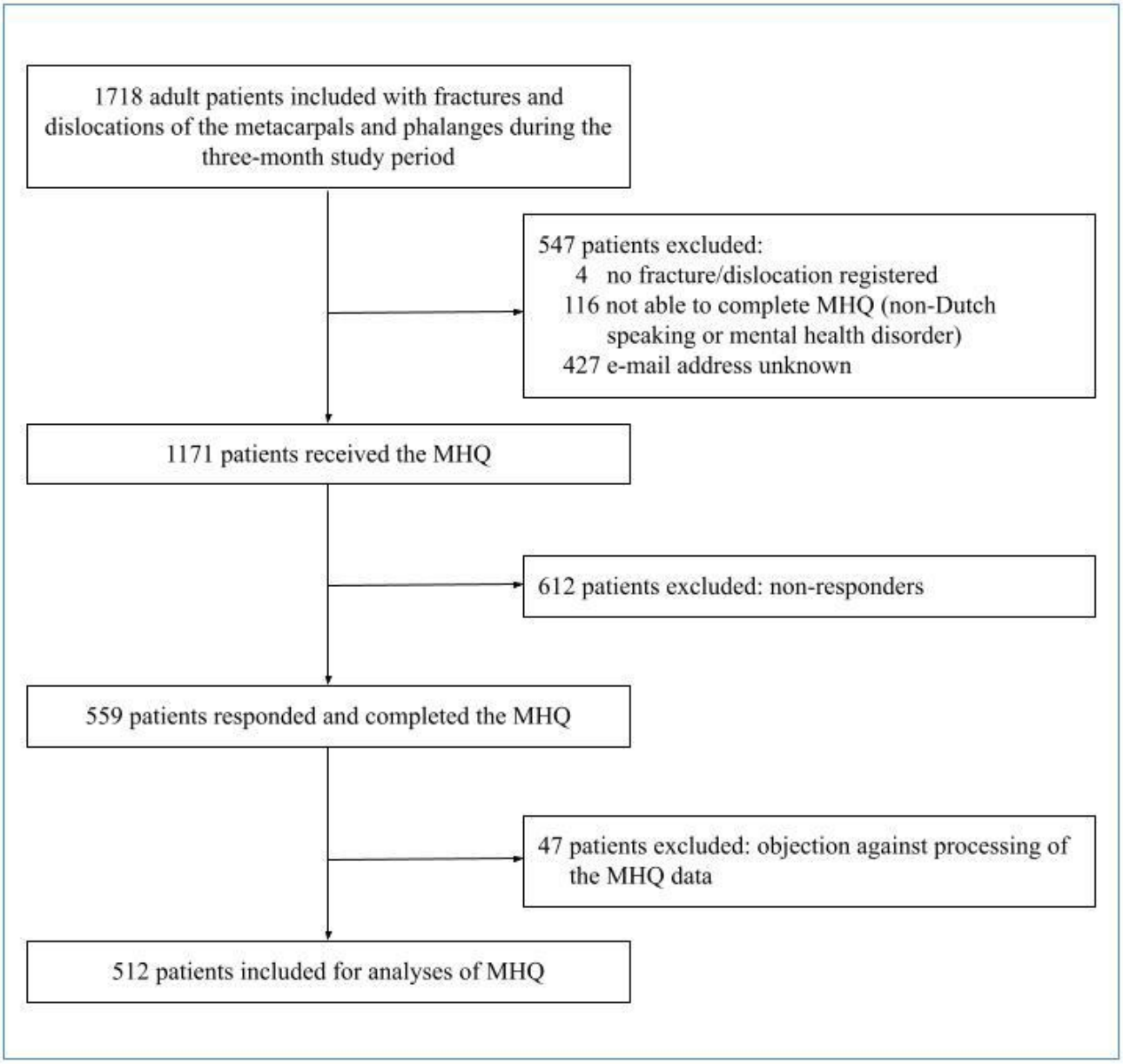

Fig. 1
Flow diagram of included patients. MHQ, Michigan Hand Outcomes Questionnaire.

Take home message

- These results emphasize the importance of considering patient-reported outcomes in managing hand fractures, since full recovery is not reached after three months.
- Older age, the presence of hand comorbidities, and referral for hand therapy were associated with worse hand functioning after nonoperative treatment.
- The Michigan Hand Outcomes Questionnaire scores identified by this study may serve as reference values for future studies.

Introduction

Fractures and dislocations of the metacarpals and phalanges are common, especially in the young working population. These injuries can result in significant functional impairment and are associated with high healthcare costs.[1,2] Treatment consists of various nonoperative and operative options. These interventions aim to restore anatomy, reduce pain, and promote functional recovery, with the ultimate goal of facilitating a quick return to daily activities and work. However, the effectiveness of these treatments can vary depending on factors like injury types, treatment, and individual patient characteristics. For the majority of metacarpal and phalangeal fractures or dislocations, there is a lack of high-quality evidence to guide treatment decisions.[3,4]

Little is known about the short-term outcomes after hand fractures and dislocations.[5-9] In daily practice, patient-reported outcome measures (PROMs) can tailor treatment plans and assist in providing appropriate rehabilitation when needed. Additionally, patient education and communication are essential for managing expectations and addressing concerns during recovery.

Therefore, the primary aim of this study was to evaluate patient-reported outcomes three months after metacarpal

Table I. Baseline characteristics of the study sample compared to non-eligible patients and non-responders.

Variable	MHQ respondents (n = 512)	Not eligible/non-responders (n = 1,202)	p-value
Male sex, n (%)	293 (57)	802 (67)	< 0.001*
Median age, yrs (IQR)	50 (31 to 63)	37 (26 to 56)	< 0.001†
Work status, n (%)			< 0.001*
Student	32 (6.3)	110 (9.2)	
Working	278 (54)	552 (46)	
Not working	24 (4.7)	100 (8.3)	
Retired	74 (14)	133 (11)	
Unknown	104 (20)	307 (26)	
Hand comorbidity, n (%)	62 (12)	138 (11)	0.711*
Trauma mechanism, n (%)			0.352*
Low energy	443 (87)	1,028 (86)	
High energy	10 (2.0)	15 (1.2)	
Crush	59 (12)	159 (13)	
Soft-tissue injury, n (%)	102 (22)	182 (13)	0.012*
Unknown, n	50	111	
Median days from injury to presentation (IQR)	0 (0 to 1)	0 (0 to 1)	0.089†
Treatment method, n (%)			< 0.001*
Nonoperative treatment	398 (78)	1,047 (87)	
Operative treatment	114 (22)	155 (13)	
Treating specialism, n (%)			0.006*
Trauma surgeon	373 (73)	860 (72)	
Plastic surgeon	71 (14)	117 (9.7)	
Orthopaedic surgeon	33 (6.4)	98 (8.2)	
Emergency physician	35 (6.8)	127 (11)	
Complications, n (%)	12 (2.3)	23 (1.9)	0.564*
Hand therapy referral, n (%)	195 (38)	308 (26)	< 0.001*
Unknown, n	5	16	

*Pearson's chi-squared test.
†Wilcoxon rank-sum test.

Table II. Baseline characteristics of the study sample.

Variable	Nonoperative treatment (n = 398)	Operative treatment (n = 114)	p-value
Male, n (%)	220 (55)	73 (64)	0.096*
Median age, yrs (IQR)	50 (31 to 64)	46 (30 to 60)	0.144†
Work status, n (%)			0.030*
Student	28 (7.0)	4 (3.5)	
Working	202 (51)	76 (67)	
Not working	18 (4.5)	6 (5.3)	
Retired	64 (16)	10 (8.8)	
Unknown	86 (22)	18 (16)	
Hand comorbidity, n (%)	55 (14)	7 (6.1)	0.027*
Trauma mechanism, n (%)			0.027‡
Low energy	347 (87)	96 (84)	
High energy	4 (1.0)	6 (5.3)	
Crush	47 (12)	12 (11)	
Soft-tissue injury, n (%)	75 (21)	27 (24)	0.513*
Unknown, n	47	3	
Median days from injury to presentation (IQR)	0 (0 to 1)	0 (0 to 1)	0.473†
Treating specialism, n (%)			< 0.001*
Trauma surgeon	297 (75)	76 (67)	
Plastic surgeon	37 (9.3)	34 (30)	
Orthopaedic surgeon	29 (7.3)	4 (3.5)	
Emergency physician	35 (8.8)	0 (0.0)	
Complications, n (%)	8 (2.0)	4 (3.5)	0.314‡
Hand therapy referral, n (%)	110 (28)	85 (77)	< 0.001*
Unknown, n	1	4	

*Pearson's chi-squared test.
†Wilcoxon rank sum test.
‡Fisher's exact test.

and phalangeal fractures or dislocations. The secondary aim was to identify factors associated with worse Michigan Hand Outcomes Questionnaire (MHQ) scores.[10]

Methods

This study is reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement.[11] Approval for the study was obtained from the Medical research Ethics Committees United and the institutional review board of each participating hospital. Due to the study design, the expected large study population, and the associated burden of obtaining informed consent for this type of injury, as well as the minimal risk to human subjects, a waiver of informed consent was granted for this study.

Study design and participants

This study is part of a large multicentre snapshot study. The study questions and research protocol were designed and approved before the start of the study. Data were routinely collected for quality monitoring. All consecutive adult patients with metacarpal and phalangeal fractures or dislocations presenting to the emergency department (ED) of 12 hospitals (one academic teaching hospital, one community non-teaching hospital, and ten community teaching hospitals) in the Netherlands during a three-month period between 1 August and 31 October 2020 were included. All Dutch-speaking

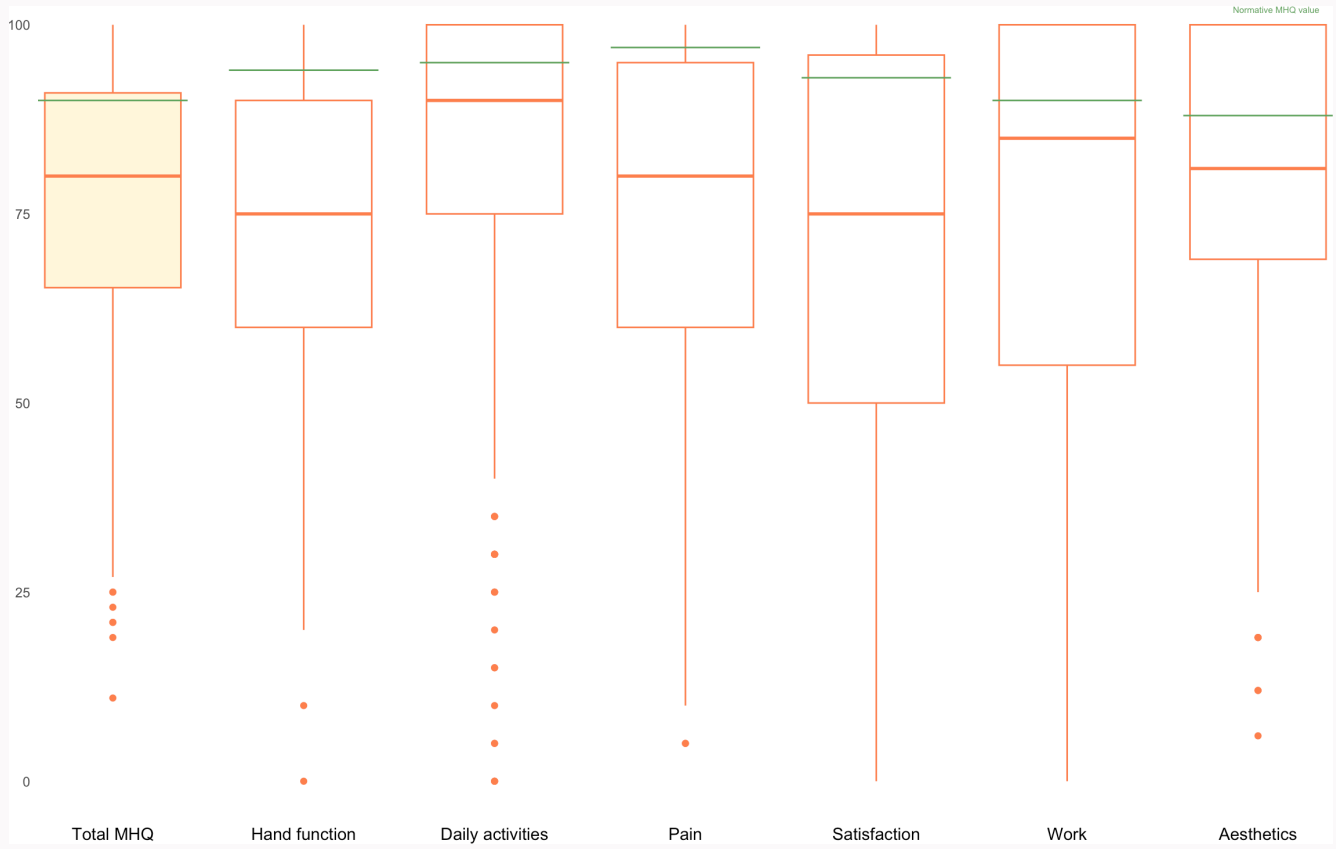

Fig. 2
Michigan Hand Outcomes Questionnaire (MHQ) total and subdomain scores three months post-injury for patients treated nonoperatively (n = 398). The horizontal green line across each boxplot denotes the normative MHQ value, providing a reference for normal hand function. The boxplots illustrate the median (red line), IQR (box), and potential outliers (dots) for each MHQ domain.

patients whose email addresses were registered in the electronic patient file received a web-based MHQ questionnaire three months after initial presentation as standard of care. Non-Dutch speaking patients and patients who were unable to fill out the questionnaire because of neurodevelopmental and cognitive disorders were excluded and did not receive the questionnaire. Patients who completed the questionnaire but indicated opt-out for processing of the MHQ data were excluded from analysis.

Procedures

A designated local investigator of each participating hospital (Snapshot Hand Fractures Collaborative Study Group members; see Acknowledgements) collected data from electronic patient files using a predetermined digital form designed by the authors and facilitated by Castor EDC (Electronic Data Capture) software. The local investigators received training from the coordinating investigator to ensure accurate data collection. Instances of uncertainty regarding fracture classification or treatment approach were resolved through consultation with a trauma surgeon. The following patient and injury characteristics were documented: sex, age, work status, presence of hand comorbidities, injury mechanism, time between injury and presentation, treating physician (trauma surgeon, orthopaedic surgeon, plastic surgeon, or emergency physician), complications (recorded up to one month after initial presentation), soft-tissue injuries (wounds, significant lacerations, ligament, tendon, and nail bed injuries), clinically observed deformities, rotational deformities, and fracture dislocation exceeding 2 mm as observed on radiographs. Injury types were classified according to the AO/OTA 2018 classification system for hand fractures.[12] Dislocations were added. The full classification is provided in Supplementary Table i.

Outcome assessment

The primary outcome was the MHQ. This questionnaire is composed of 57 questions covering six domains: 1) overall hand function; 2) activities of daily living (ADLs); 3) pain; 4) work performance; 5) aesthetics; and 6) patient satisfaction with hand function, and a demographic section asking about patients' age, ethnic background, and socioeconomic status. The domains three to six are scored for the right and left hand separately. The total score ranges from 0 to 100, where a higher score defines a better hand function.[10] The median MHQ scores found by our study were compared to the mean normative scores of the affected hand of patients who sustained unilateral trauma to bring our results in perspective.[13] The following normative scores were used: 90 for MHQ total scores; 94 for hand function; 95 for ADLs; 97 for pain (the MHQ scoring algorithm was used to recode the pain score of 5.7 to normalize the score to a range of 0 to 100); 88 for aesthetics; and 95 for satisfaction. The normative score of the domain work was not reported by this study, therefore we used the normative score of the total MHQ score of 90 as the normative score for the domain work.

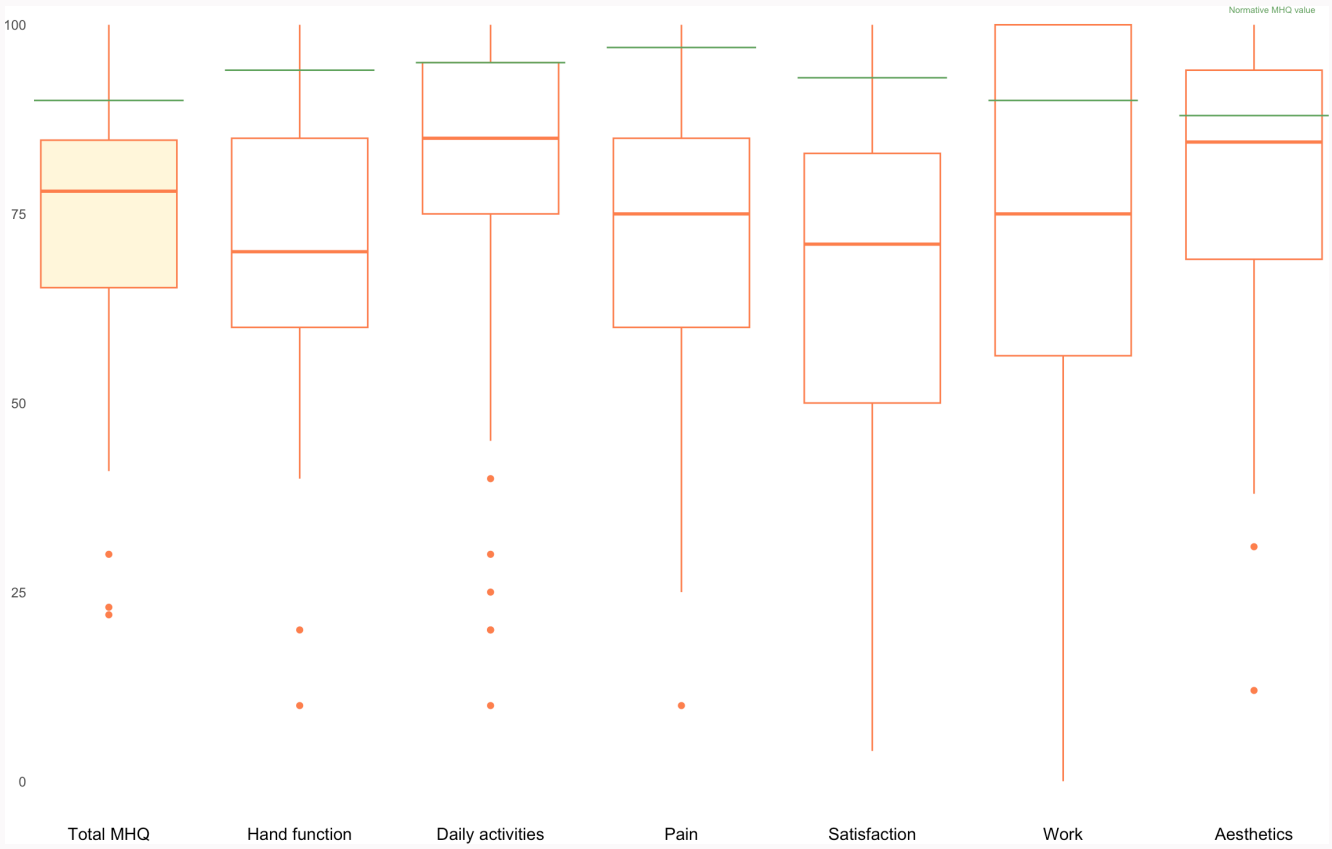

Fig. 3
Michigan Hand Outcomes Questionnaire (MHQ) total and subdomain scores three months post-injury for patients treated operatively (n = 114). The horizontal green line across each boxplot denotes the normative MHQ value, providing a reference for normal hand function. The boxplots illustrate the median (red line), IQR (box), and potential outliers (dots) for each MHQ domain.

Statistical analysis

Nonoperative and operative treatment were analyzed separately. Descriptive statistics were used to summarize patient and injury characteristics. Descriptive statistics were reported using medians along with IQRs for continuous variables. For normally distributed data, means and SDs were used. Additionally, categorical variables were summarized using frequencies and percentages. Baseline characteristics were compared between the study sample and non-eligible patients and non-responders. Additionally, the relationship between patient and injury characteristics and the chosen treatment method was examined. Pearson's chi-squared test was used to analyze dichotomous variables, with Fisher's exact test applied when expected frequencies were less than 5. Continuous variables were compared using the Wilcoxon rank-sum test. Statistical significance was set at $p < 0.05$.

MHQ scores and subdomain scores were analyzed for all patients treated nonoperatively and operatively and summarized as boxplots. Additionally, MHQ scores and subdomain scores were analyzed across different injury types with one-way analysis of variance (ANOVA). We also evaluated the number of patients reaching a score that is related to a normal hand function, and the number of patients reaching a score that is related to a decreased hand function per injury type. For this analysis, a score of less than 90 was defined as a decreased hand function and a score of 90 or more as a normal hand function. Only the most common injury types were selected for these analyses (the nine most common injury types treated nonoperatively, and the three most common injury types treated operatively, as reported in Supplementary Tables i and ii).

Associations between MHQ score and patient and injury characteristics were analyzed using multivariable linear regression. Expert-based variable selection was used to select variables for the analysis. For cases with missing work status data, it was assumed that the patients were employed, reflecting the status of the majority group. Similarly, missing data on soft-tissue injuries were imputed by assuming the absence of such injuries. Linearity of the relation between the continuous variables age and MHQ score was assessed through visual inspection of scatter plots, which suggested a linear relation. Statistical significance was set at $p < 0.05$. All statistical analyses were performed using RStudio v. 2023.06.0 + 421 (Posit, USA).

Results

During the study period, 1,718 patients with metacarpal and phalangeal fractures or dislocations presented to the ED of one of the 12 participating hospitals. Of 1,718 patients, four were excluded because of incomplete data registration, 116 because they were non-Dutch speaking patients or patients unable to participate due to mental health disorders, and 427 patients because the email address was unknown. In total, 1,171 patients received the MHQ. A total of 559 patients responded, resulting in a response rate of 48%. Furthermore, 512 patients gave consent for processing of the MHQ data

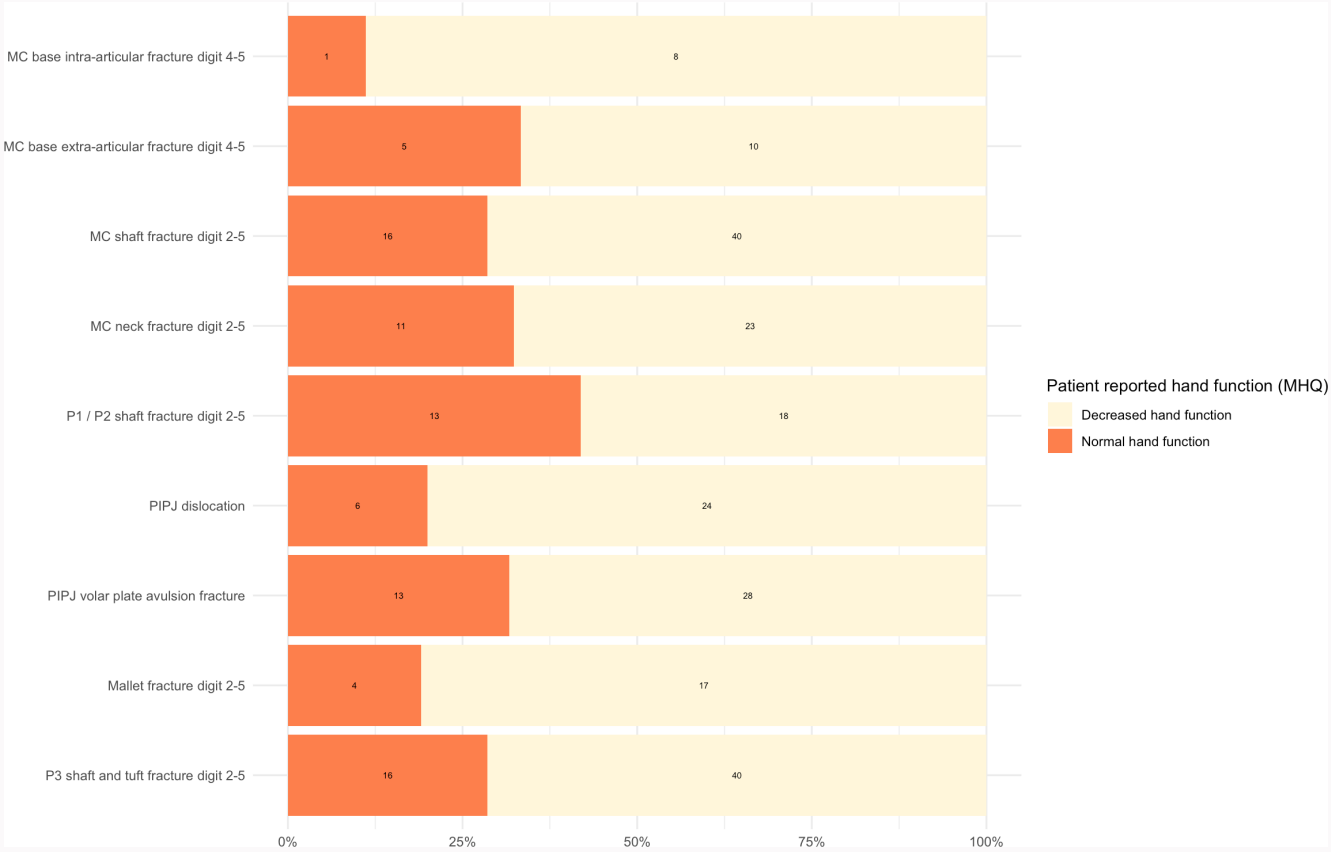

Fig. 4

Patient-reported hand function according to the Michigan Hand Outcomes Questionnaire (MHQ) score by injury type three months post-injury for patients treated nonoperatively. The bars represent the percentage of patients reporting normal hand function (orange) versus decreased hand function (yellow) in comparison to the normative MHQ score of 90. The numbers within each bar indicate the count of patients in each category. MC, metacarpal; PIPJ, proximal interphalangeal joint; P1, proximal phalanx; P2, middle phalanx; P3, distal phalanx.

(Figure 1). Differences in patient and injury characteristics between MHQ respondents and non-responders and non-eligible patients are shown in Table I. Significant differences were observed in several key demographics and clinical factors. MHQ respondents were found to have a lower proportion of males (57% (293/512) vs 67% (802/1,202); $p < 0.001$, chi-squared test) and were older (median age 50 years (IQR 31 to 63) vs 37 years (IQR 26 to 56); $p < 0.001$, Wilcoxon rank-sum test). There was a significant difference in work status between MHQ respondents and non-eligible/non-responders ($p < 0.001$, chi-squared test), and MHQ respondents were more frequently subjected to operative treatment (22% (114/512) vs 13% (155/1,202); $p < 0.001$, chi-squared test). Furthermore, there was a significant difference in treating specialism ($p = 0.006$, chi-squared test), with MHQ respondents more commonly treated by trauma and plastic surgeons. Hand therapy referral rates were also higher among MHQ respondents (38% (195/512) vs 26% (308/1,202); $p < 0.001$, chi-squared test). Of 512 patients, 398 (78%) were treated nonoperatively and 114 (22%) operatively. Patient and injury characteristics of the study sample are provided in Table II.

Primary outcome

The median MHQ score of patients treated nonoperatively was 80 (IQR 65 to 91). For operatively treated patients, the median MHQ total score was 78 (IQR 65 to 85). Patients treated nonoperatively reported the lowest score in the domains hand function (median MHQ 75 (IQR 60 to 90)) and satisfaction (median MHQ 75 (IQR 50 to 96)), and the highest score in daily activities (median MHQ 90 (IQR 75 to 100)) (Figure 2). Patients treated operatively reported the lowest score in the domain hand function (median MHQ 70 (IQR 60 to 85)) and the highest score in daily activities (median MHQ 85 (IQR 75 to 95)) (Figure 3). No significant differences were found in MHQ total scores between the nine most common injury types treated nonoperatively and the three most common ones treated operatively (Table III and Table IV). Overall, 104 patients (26%) treated nonoperatively reached a MHQ score equal to or better than the normative MHQ score, ranging between 11% (1/9) and 42% (13/31) between the nine most common injury types (Figure 4). After operative treatment, 13 patients (11%) reached a MHQ score equal to or better than the normative MHQ score, ranging between 10% (3/29) and 31% (5/16) between the three most common injury types (Figure 5).

Factors associated with MHQ outcome

In multivariable linear regression analysis, several factors showed a significant association with lower MHQ total scores (i.e. worse hand function) following nonoperative treatment. These factors included older age, hand comorbidities, and referral for hand therapy (Table V). The intercept represents the predicted MHQ score of 94.5, when all predictor variables are zero.

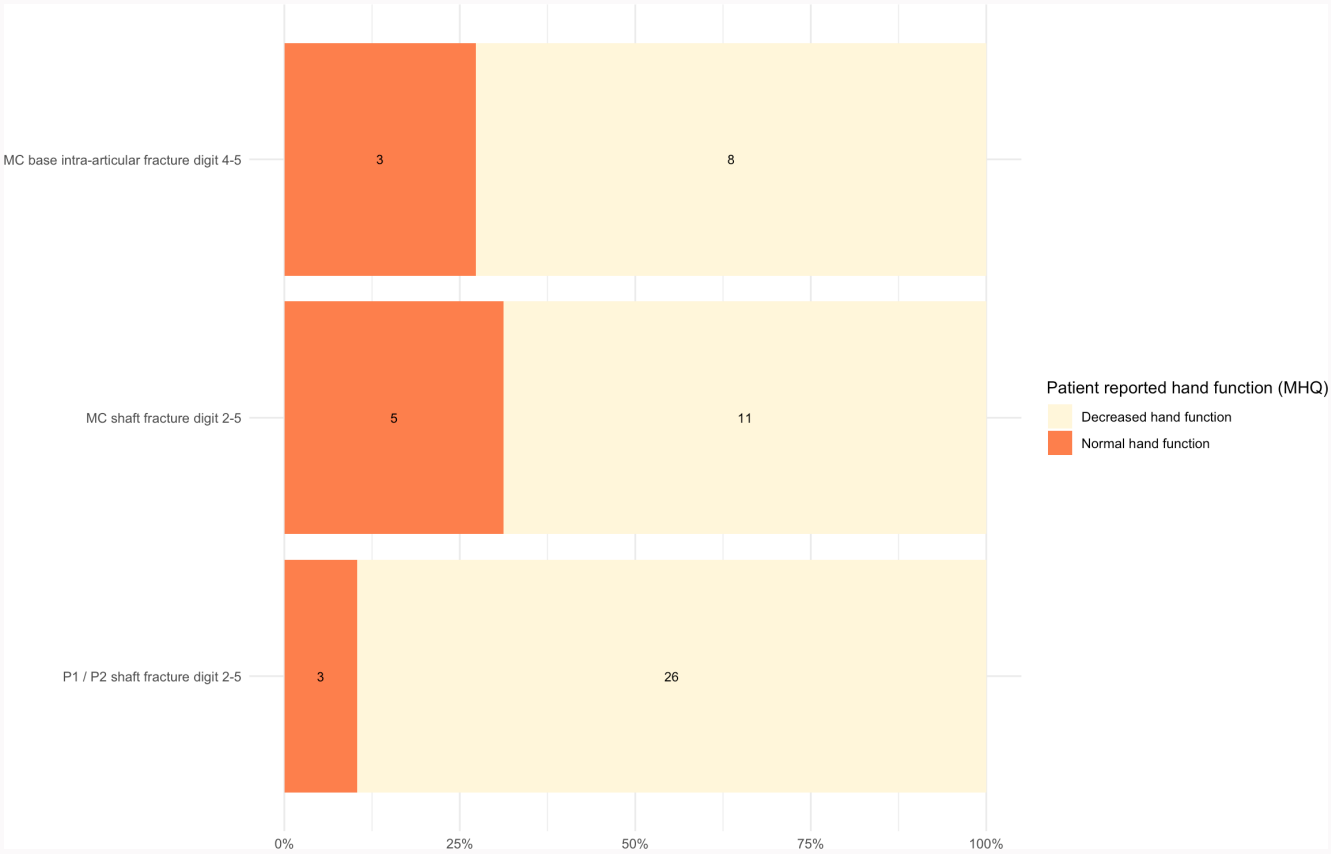

Fig. 5

Patient-reported hand function according to the Michigan Hand Outcomes Questionnaire (MHQ) score by injury type three months post-injury for patients treated operatively. The bars represent the percentage of patients reporting normal hand function (orange) versus decreased hand function (yellow) in comparison to the normative MHQ score of 90. The numbers within each bar indicate the count of patients in each category. MC, metacarpal; P1, proximal phalanx; P2, middle phalanx.

Discussion

Little is known about the short-term patient-reported outcomes after metacarpal and phalangeal fractures or dislocations.[8,9,14] PROMs are relevant for clinicians to evaluate recovery and for patients to manage their expectations. In this multicentre cross-sectional cohort study, we evaluated PROMs of the most common injury types treated nonoperatively and operatively. The findings suggest that most patients do not achieve a normal hand function within three months after treatment. We found no differences between injury types. Older age, the presence of hand comorbidities, and referral for hand therapy were associated with a worse MHQ score after nonoperative treatment.

Studies reporting short-term results after treatment of different types of hand fractures or dislocations are scarce, especially after nonoperative treatment. Systematic reviews on the most common types of hand fractures all conclude that studies reporting PROMs as their outcome of interest are very limited and underscore the high need for consistency in reporting results, including PROMs, to allow future meta-analysis.[8,9,14] These conclusions strengthen the importance of our results, reporting MHQ scores three months following injury in relation to the normative MHQ scores. The results showed that patients regained 80% (nonoperative) and 78% (operative) of a normal hand function in the first three months in terms of MHQ, when a MHQ score of 100 is interpreted as a 100% hand function. At the same time, the results showed that 26% of the nonoperatively treated patients and 11% of the operatively treated patients reached a MHQ score equal to or better than the normative MHQ score. Overall, these three-month results could be interpreted as a relatively good outcome and suggest that scores may continue to improve over time concerning the normative MHQ score of 90. This is supported by the results of studies on hand injuries other than hand fractures. Studies evaluating patient-reported outcomes after treatment of distal radius fractures and surgical repair of the ulnar collateral ligament of the thumb showed that the patient-reported outcomes from three to 12 months continued to increase.[15,16]

Older age, the presence of hand comorbidities, and referral for hand therapy were associated with lower MHQ scores for patients treated nonoperatively. No studies report factors associated with MHQ scores or other PROMs after hand fractures. We hypothesized that injury type and soft-tissue injury were associated with lower MHQ scores. Interestingly, this was not confirmed by our analysis. Furthermore, our analysis revealed that the association between hand therapy referral and lower scores persisted even after adjusting for injury severity-related confounders. This contradictory finding that hand therapy was associated with lower MHQ scores might be explained by the fact that these patients have an increased awareness of their functional limitations compared to patients not referred. Additionally, socio-economic factors and the lack of a guideline with recommendations for hand

Table III. Analysis of Michigan Hand Outcomes Questionnaire (MHQ) scores of the nine most common injury types treated nonoperatively.

Variable, median (IQR)	MC base intra-articular fracture digit 4 to 5 (n = 9)	MC base extra-articular fracture digit 4 to 5 (n = 15)	MC shaft fracture digit 2 to 5 (n = 56)	MC neck fracture digit 2 to 5 (n = 34)	P1/ P2 shaft fracture digit 2 to 5 (n = 31)	PIPJ volar plate avulsion fracture (n = 41)	Mallet fracture digit 2 to 5 (n = 21)	P3 shaft and tuft fracture digit 2 to 5 (n = 56)	PIPJ dislocation (n = 30)	p-value*
MHQ	75 (61 to 84)	78 (63 to 93)	76 (59 to 91)	82 (58 to 92)	83 (70 to 96)	81 (70 to 94)	78 (62 to 89)	84 (74 to 93)	83 (68 to 89)	0.307
Hand function	60 (55 to 70)	70 (58 to 83)	70 (50 to 91)	75 (51 to 90)	75 (60 to 88)	75 (65 to 85)	75 (55 to 85)	75 (65 to 90)	70 (56 to 80)	0.317
ADLs	90 (80 to 95)	90 (73 to 100)	88 (70 to 100)	95 (76 to 100)	100 (83 to 100)	95 (75 to 100)	90 (75 to 100)	95 (85 to 100)	90 (85 to 100)	0.593
Pain	75 (50 to 100)	75 (53 to 95)	80 (55 to 100)	73 (60 to 94)	90 (63 to 100)	80 (55 to 95)	75 (55 to 95)	85 (70 to 100)	80 (66 to 90)	0.371
Satisfaction	71 (33 to 75)	79 (63 to 94)	67 (45 to 96)	75 (44 to 96)	92 (56 to 100)	79 (54 to 96)	75 (54 to 96)	88 (67 to 96)	77 (47 to 83)	0.085
Work	90 (60 to 95)	70 (50 to 100)	73 (50 to 100)	100 (65 to 100)	90 (65 to 100)	95 (55 to 100)	80 (45 to 85)	95 (70 to 100)	100 (80 to 100)	0.068
Aesthetics	81 (81 to 100)	81 (72 to 97)	88 (75to 100)	75 (56 to 94)	88 (75 to 100)	88 (75 to 100)	69 (62 to 94)	81 (69 to 96)	81 (77 to 94)	0.248

*One-way analysis of variance (ANOVA).
ADLs, activities of daily living; MC, metacarpal; MHQ, Michigan Hand Outcomes Questionnaire; P1, proximal phalanx; P2, middle phalanx; P3, distal phalanx; PIPJ, proximal interphalangeal joint.

Table IV. Analysis of Michigan Hand Outcomes Questionnaire (MHQ) scores of the three most common injury types treated operatively.

Variable, median (IQR)	MC base intra-articular fracture digit 4 to 5 (n = 11)	MC shaft fracture digit 2 to 5 (n =16)	P1/ P2 shaft fracture digit 2 to 5 (n = 29)	p-value*
MHQ score	74 (70 to 89)	83 (57 to 92)	79 (70 to 85)	0.893
Hand function	65 (50 to 78)	78 (55 to 96)	75 (65 to 85)	0.470
ADLs	85 (70 to 93)	93 (64 to 100)	95 (80 to 100)	0.336
Pain	75 (68 to 88)	75 (56 to 86)	80 (70 to 85)	0.440
Satisfaction	75 (54 to 86)	75 (31 to 97)	67 (50 to 83)	0.968
Work	75 (58 to 90)	85 (59 to 100)	75 (65 to 100)	0.683
Aesthetics	94 (72 to 100)	91 (75 to 100)	88 (62 to 94)	0.377

*One-way analysis of variance
ADLs, activities of daily living; MC, metacarpal; MHQ, Michigan Hand Outcomes Questionnaire; P1, proximal phalanx; P2, middle phalanx.

therapy referral could also play a role. Early identification of factors related to hand functioning could help clinicians to provide targeted support to patients at higher risk of functional impairment.

A strength of the study is that, to our knowledge, this is the first study evaluating short-term PROMs after common hand fractures or dislocations treated nonoperatively or operatively. Based on expert experience, it is common to inform patients that full functional recovery and return to work may take up to three months. However, until now, there was no evidence to support the use of this timeframe. Therefore, our findings, suggesting that most patients do not achieve a normal hand function within three months after treatment, provide new information. Another strength is the multicentre snapshot study design that allowed collection of a large amount of data in a short period of time.

Our study also has several limitations. First, although the response rate of 48% could be considered relatively high, the respondents were not completely representative for the not-eligible patients and non-responders.[17] For example, respondents were significantly more often female, were older, had a higher complication rate, and were more frequently referred for hand therapy. Additionally, our results showed that higher age, presence of hand comorbidity, and hand therapy referral were associated with lower MHQ scores. It is possible that the MHQ scores reported in this study underestimate the actual MHQ scores (i.e. the actual MHQ scores may be better than the scores found by this study). These differences should be taken into account when interpreting the results. Second, PROMs were only measured at three months after injury. To overcome this limitation of a one-point measurement and to put these results into perspective, we compared the three-month MHQ results to the normative values of the total MHQ score of patients with unilateral hand trauma. A third limitation is the applicability of the normative MHQ score. From the results of the study reporting the normative MHQ score, it is unclear how long ago the trauma occurred, what the severity of the injury was, and what the exact trauma mechanism was. Trauma other than a fracture, such as burn injury, was also included. Furthermore, treatment details on nonoperative or operative treatment were unknown.[13] Therefore, the normative MHQ score of 90 after unilateral hand trauma might be an overestimation when compared to hand fractures only. Regardless, this study found a significantly lower score for patients with prior trauma, compared to healthy participants, which suggests that these patients have not returned to completely healthy values. Therefore, comparing these results with the normative value provides new insights on the expected recovery three months after treatment and the expected recovery in the longer term. Fourth, the large variation in the incidence of the different injury types resulted in small numbers for some injury types. Therefore, we only analyzed the MHQ scores of the nine most common injury types treated nonoperatively and the three most common injury types treated operatively. No statistically significant differences in MHQ scores were found among the analyzed injury types, which contradicts our expectations before the study. A potential reason for the lack of significant

Table V. Multivariable linear regression for Michigan Hand Outcomes Questionnaire (MHQ) score of 293 patients treated nonoperatively for the nine most common injury types.

Variable	Coefficient	95% CI	p-value
Intercept	94.2	78.7 to 109.7	
Male sex	3.6	-0.86 to 8.1	0.114
Age (per yr)	-0.20	-0.36 to -0.04	0.016
Work status			0.061
Student	Ref		
Working	-10	-19 to -0.84	
Not working	-17	-31 to -3.4	
Retired	-7.7	-20 to 5.1	
Hand comorbidity	-6.86	-12.9 to -0.867	0.035
Trauma mechanism			0.424
Low energy	Ref		
High energy	13	-7.6 to 35	
Crush	1.9	-5.7 to 9.5	
Injury type			0.173
MC base intra-articular fracture digit 4 to 5	Ref		
MC base extra-articular fracture digit 4 to 5	0.17	-15 to 15	
MC shaft fracture digit 2 to 5	-3.4	-16 to 9.4	
MC neck fracture digit 2 to 5	-3.8	-17 to 9.7	
P1/P2 shaft fracture digit 2 to 5	5.4	-8.2 to 19	
PIPJ palmar plate avulsion fracture	2.6	-11 to 16	
Mallet fracture digit 2 to 5	-0.06	-14 to 14	
P3 shaft and tuft fracture digit 2 to 5	4.8	-8.6 to 18	
PIPJ dislocation	6.0	-7.8 to 20	
Complications	1.2	-14 to 16	0.879
Hand therapy referral	-5.7	-11 to -0.64	0.027

Results are presented as regression coefficients with corresponding 95% CIs. A negative score indicates that the factor is associated with a worse Michigan Hand Outcomes Questionnaire (MHQ) score. The intercept represents the predicted MHQ score when all predictor variables are zero.
MC, metacarpal; MHQ, Michigan Hand Outcomes Questionnaire; P1, proximal phalanx; P2, middle phalanx; P3, distal phalanx; PIPJ, proximal interphalangeal joint.

differences could be the influence of confounding variables or the small sample size of the individual injury types.

In conclusion, these results emphasize the importance of considering PROMs in managing hand fractures, since full recovery is not reached after three months. The findings could be used to optimize expectations of patients and are relevant for clinicians to evaluate recovery. Additionally, the MHQ scores identified in this study may serve as reference values for future studies. Further research with a longer follow-up is needed to assess whether these patients eventually regain normal function and to identify potential injury types that may not recover to normal hand function.

Supplementary material

Tables showing the number of patients who completed the Michigan Hand Outcomes Questionnaire (MHQ) after nonoperative treatment across all injury categories; and the number of patients who completed the MHQ after operative treatment among all injury categories.

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Data sharing

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