Orthopaedic Hand Patient Support Systems Have Valuable Insight to Patient Function and Pain

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Abstract

Patient-reported outcome measures (PROs) are increasingly used in clinical assessment. Research on how patient support systems contribute to physician understanding of patient condition is limited. Thus, insights from significant others may provide value, especially when concerns exist regarding patient response validity. Patients recruited from the pre-operative environment undergoing orthopaedic hand procedures responded to PROMIS-Pain Interference (PI), PROMIS-Upper Extremity (UE), PROMIS-Depression (D), and QuickDASH. They then selected a significant other (SO) to do the same. Patients and SOs were also asked to complete the West Haven-Yale Multidimensional Pain Inventory (WHYMPI) as a measure of support-related responses. Patient and SO responses were compared, and support-related responses were added in subsequent analyses to examine their effect on SO PRO assessment.

Keywords

pain management, patient feedback, population health, qualitative methods, relationship-centred administration, survey data

- Patients and their significant others (SOs) provide similar reports of patient pain and function (QuickDASH: r = 0.720, $P < 0.001$, PI: r = 0.710, $P < 0.001$, UE: r = 0.682, $P < 0.001$, D: r = 0.400, $P < 0.001$).
- Additionally, patients with concerned SOs share a more similar understanding of physical functioning through QuickDASH ($P = 0.016$).
- Thus, SOs are valuable reporters of patient outcomes and may provide an additional perspective for consideration.

Introduction

Patient-reported outcome measures (PROs) are being increasingly implemented in clinical practice to measure patient pain, functionality, and overall quality of life.[1] PRO surveys were originally used for clinical research purposes as a health status measurement, but have more recently been adopted by physicians to provide a standardized approach to a) measuring outcomes following intervention and b) understanding patient perspective on their symptoms.[1,2] This allows physicians to track severity of symptoms over time, assess the efficacy of a certain treatment or surgical procedure, and inform treatment decisions by comparing individual data to population norms.[3,4] Many orthopaedic hand, wrist, and forearm surgeons rely specifically on QuickDASH, PROMIS-Upper Extremity (UE), and PROMIS-Pain Interference (PI) measures to provide quantifiable patient perspective information on pain and function of the upper extremity.[5] QuickDASH is an abbreviated and validated version of the "Disabilities of the Arm, Shoulder, and Hand" outcome measure,[5] and PI and UE have been validated as accurate measurement systems for orthopaedic patient assessment of hand and wrist pain and function.[6,7] To provide comprehensive care, many orthopaedic subspecialties also utilize

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psychologically geared PROMs such as PROMIS-Depression (D), which offer an assessment of a patient's mental well-being.[3]

Patient's interpretation of pain, function, and disability are known to be influenced by a variety of factors, including their psychosocial state, social background, and coping styles.[8] Additional risk factors that may influence patient self-assessment include fears about pain or injury, negative belief about self-recovery, and despondent or anxious affect.[9] Because outcomes-based measures are reflective of subjective patient analysis of their symptoms, these surveys may be affected by such factors.[10] A theorized limitation for patient-reported outcomes surveys is response shift bias, which occurs when patient responses to surveys shift over time, whether positively or negatively, without underlying change in pain or function. This is attributed to a change in the patient's interpretation of the PRO over time and has been hypothesized to occur in response to a psychological change in the patient, such as coping with a change in health status.[10] Additionally, studies have demonstrated that pain reports by patients are influenced by perceived solicitous (ie, concerned) attention from significant others and observed pain behaviour frequency.[11,12] A reported technique for a more accurate depiction of patient pain level in these scenarios is the use of credible information from a significant other (SO), such as a family member.[13]

SO knowledge of patient condition is frequently utilized in the setting of assessment and decision making for patients.[14,15] This is commonly employed in scenarios such as palliative care with cognitive impairment and caring for those who are unconscious or have intellectual disabilities.[13] Additionally, SOs are often employed in the setting of patient pain assessment, whereby family members' assessments are used in situations where self-reporting is impaired.[13,16] In fact, studies have shown family members are more accurate proxy reporters of their loved one's pain compared to their physicians, which suggests familial input offers value in patient assessment.[16] SO assessment is also noted to add validity when compared to patient assessment alone in the interpretation of psychological disorders.[17] While SO assessment is not commonly utilized in orthopaedics, patient-reported outcomes regarding hand pain and function are noted to be influenced by psychological factors such as satisfaction with life, gratitude, resilience, and optimism.[18] Thus, a SO may offer value in assessment of orthopaedic PROs. However, factors that influence SO decision making and assessment of patients, such as knowledge of a patient's condition or interpersonal factors between SOs and patients, are proposed to exist.[19,20] Thus, an assessment that helps control for variable condition knowledge and interpersonal factors would be valuable in the setting of SO patient assessment.[11,12] To our knowledge, no study has investigated whether SOs provide a valuable perspective on orthopaedic PROs and what factors may influence this assessment.

The purpose of this study is to assess patient and SOs responses to patient-reported outcomes surveys such as PROMIS or QuickDASH. We hypothesize that patient-reported outcomes of pain and function will correlate with their SOs interpretation, while assessments of depression may differ. Additionally, we hypothesize that patients who receive greater support from their SO while in pain (ie, express sympathy, ask what they can do to help) will have SOs that report more similarly in assessments of patient pain and functioning.

Methods

Orthopaedic hand patients were recruited for this study from a Midwestern, multi-centre academic hospital system between August 2021 and June 2022. Patients were recruited prior to their surgery at one ambulatory surgical centre and one hospital. In addition, they designated a SO who they felt could best describe their pain, function and emotional status – often a family member who drove them to the hospital during their day of surgery. Inclusion criteria required that patients were English speaking, at least 18 years of age, and were accompanied by a SO with knowledge of their current condition who could also be surveyed.

Consented patients and their SOs each completed the following surveys individually using a Redcap application on a mobile tablet device: QuickDASH, PROMIS-Upper Extremity (UE), PROMIS-Pain Interference (PI), and PROMIS-Depression (D).[7,21,22] SOs completed these surveys from the perspective of the patient. Both patients and their significant others filled out surveys independently on tablets within the same room, unaware of each other's responses. The QuickDASH survey provides a similar accuracy of measurement to the "Disabilities of the Arm, Shoulder, and Hand" outcome measure but is shortened to 11 items to provide a favourable patient experience.[5] The QuickDASH assesses patient upper extremity pain and function (ie, With what difficulty can you open a tight new jar?; Please rate the severity of your arm, shoulder, or hand pain). A validated algorithm subsequently calculates a QuickDASH score between 0 and 100, with a higher score indicating greater disability.

The three PROMIS surveys were also administered to both patients and SOs. PI encompasses patients' level of pain and how that affects the ability to sleep and interact with others (e.g., In the past 7 days how much did pain interfere with your day to day activities?), while UE investigates patients' hand function (e.g., Are you able to carry a heavy object (over 10 lbs/5 kg)?). Additionally, D provides information on patients' level of depression and overall mental well-being (e.g., In the past 7 days I felt worthless). These surveys were also scored on a 5-point likert scale and used the computerized adaptive test feature, which is a validated computer program that selects subsequent questions based on previous patient answers.[23] Thus, it maximizes efficiency while providing the most clinically useful information. An algorithm calculates a T-score and standard error, with a mean general population T-score of 50. For PI and D,

higher scores suggest patient pain causes more interference and patients are experiencing more depression, respectively. For UE, a lower score indicates greater disability.

Each PRO score (QuickDASH, PI, UE, and D) was compared between patient and SO using the Wilcoxon Signed Rank test with median and IQR presented. Additionally, all patient and SO PRO scores were analysed using a linear correlation model. Statistical significance was set at $P < 0.05$. All analyses were performed using SAS 9.4 (SAS Institute Inc, Cary, NC, USA).

The West Haven-Yale Multidimensional Pain Inventory (WHYMPI) was developed in 1985 to address the complexity of measuring chronic pain, specifically in terms of the psychological factors involved with perceiving pain.[24] The WHYMPI survey consists of three parts and examines the impact of pain on patients' lives, the extent patients participate in daily activities, and the responses of others to patients' demonstration of pain.[24] The second part has been isolated and utilized in clinical research to measure how patients perceive significant others responding to their demonstration of pain (support-related responses).[25] In 1995, the creators of WHYMPI developed an analogous version that measures significant others' perception of their own behaviours towards patients experiencing pain.[25] The patient and SO support-related response scales consist of 14 and 17 questions, respectively. Both versions are based on a 7-point Likert scale (0 = never, 6 = very often) and subdivided into negative (e.g., express irritation with patients), solicitous (concerned; e.g., ask what they can do to help), and distracting (e.g., suggest they do an activity) responses. Higher solicitous and distracting scores and lower negative response scores indicate greater SO support in their respective categories.

Patient and SO solicitous, distracting, and negative scores were compared using the Wilcoxon Signed Rank test with median and IQR presented. Additionally, to assess the effect of support-related response scales on the strength of patient-SO PRO correlations, a multivariate stepwise regression analysis was employed. In this model, the patient PRO served as the dependent variable with the analogous SO PRO as the primary independent variable. Then, each patient and SO support-related response scale (solicitous, distracting, and negative) were entered as potential independent variables to analyse any effect on patient-SO PRO correlation strength.[26] In addition to our hypothesized analyses, a post-hoc analysis was conducted to examine the relationship between support-related response scales and patient PROs themselves; a multivariate stepwise model was utilized with patient PROs as the dependent variable and patient/SO scales (solicitous, distracting, and negative) as the independent variables. Statistical significance was set at $P < 0.05$. All analyses were performed using SAS 9.4 (SAS Institute Inc, Cary, NC, USA). The study was approved by the institutional review board under IRB #14484.

Results

Prior to surgery, 70 orthopaedic hand patients and their significant others were recruited for this study. Of those recruited, 68 total pairs completed all aspects of the patient-reported outcomes and support-related response survey. Both patients and significant others had a relatively even gender split and a racial/ethnic breakdown representative of the United States population (Supplementary Table 1).[27] Of note, most patients chose their spouse as their designated SO.

When examining the differences in outcomes scores between patients and significant others, SOs reported worse outcomes for QuickDASH (patient: 44.63, SO: 47.73, $P = 0.0329$), UE (patient: 33, SO: 31.8, $P = 0.0403$), and D (patient: 46, SO: 49.9, $P = 0.0156$) (Table 1). Thus, SOs tend to estimate greater levels of experienced pain and functional disability than patients. Investigation into patient and SO support-related response surveys yielded significantly increased distracting scores from SOs (patient: 2.0, SO: 3.0, $P = 0.0010$), meaning SOs reported they are more

Table 1. Comparisons of PRO and WHYMPI Scores Between Patient and Significant Other.

Variable	N	Statistic	Patient	Significant other	Difference (SO-Patient)	Signed rank P-value
QuickDash[a]	68	Median (IQR)	44.63 (20.45,63.64)	47.73 (31.82, 65.91)	4.92 (−7.95,17.2)	**0.0329**
PROMIS-PI[a]	68	Median (IQR)	59 (54, 66)	60.3 (54.4, 66.2)	0.45 (−3.45, 4.8)	0.6675
PROMIS-UE[b]	68	Median (IQR)	33 (28, 42)	31.8 (26.4, 40.6)	−1.6 (−7.9, 2.65)	**0.0403**
PROMIS-D[a]	66	Median (IQR)	46 (41, 53.35)	49.9 (40.95, 57.55)	5.2 (−3.4, 9.6)	**0.0156**
WHYMPI Negative[c] Responses	68	Median (IQR)	0.5 (0, 1)	0.5 (0, 1.5)	0 (−0.5, 0.75)	0.2715
WHYMPI Solicitous[d] Responses	68	Median (IQR)	3.33 (2.17, 4.5)	3.8 (3, 4.4)	0.38 (−0.85, 1.22)	0.1221
WHYMPI Distracting[d] Responses	68	Median (IQR)	2 (0.75, 3)	3 (1.67, 4)	0.83 (−0.42, 1.87)	**0.0010**

[a]Higher scores indicate greater disability.
[b]Lower scores indicate greater disability.
[c]Lower scores indicate greater support.
[d]Higher scores indicate greater support.
PRO=patiet-reported outcome measure; PI=pain interference; UE=upper extremity; SO=significant other; WHYMPI=West Haven-Yale Multidimensional Pain Inventory. Bolded values are significant P-values.

distracting to patients in pain compared to patient reports of SOs (Table 1).

The relationship between SO and patient understanding of patient-reported outcomes was next assessed. Patient and SO QuickDASH (r = 0.720, P < 0.001), PI (r = 0.710, P < 0.001), UE (r = 0.682, P < 0.001), and D (r = 0.400, P < 0.001) all correlate positively and significantly with their respective scales. In addition to the strong correlation between patient and SO, the patient QuickDASH survey also had strong correlations to patient PI (r = 0.818) and UE (r = −0.880) (Table 2).

Next, we determined whether patient or SO support-related responses influenced the correlation between patient and SO report of patient function and pain. The patient level of concern (i.e., solicitous) influenced the strength of patient and SO QuickDASH correlation (F change = 6.11, P = 0.016) (Table 3). Thus, when patients reported their SOs were more concerned when they demonstrated pain, those SOs were better able to predict patient QuickDASH responses. No other patient support-related response added any strength to the patient and SO QuickDASH correlation, or any other PRO correlation (PROMIS). Additionally, when examining the impact on the SOs reported support-related responses, the

none of the subscales (negative, solicitous, distracting) added strength to any patient and SO PRO correlation.

Finally, we investigated whether patient and SO support-related responses were correlated with patient PRO scores themselves. Greater patient QuickDASH scores (i.e., worse pain/function) were associated with increased patient and SO solicitous scores, meaning that worse levels of pain and function were associated with higher levels of SO's measured level of concern (Table 4). Additionally, lower patient UE scores (i.e., worse function) were associated with increased patient solicitous scores (Table 4).

Discussion

While PROMIS and QuickDASH surveys have been validated for evaluation of function and pain in orthopaedic hand patients, the utility of a SO's perspective on these outcomes has not yet been explored. Overall, our study supported our primary hypothesis that SOs can similarly assess patient function and pain, and negated our assumption that SO and patient understanding of depression would be dissimilar. Additionally, our study supported our secondary hypothesis, that patient and SO assessment of pain and function are

Table 2. Linear Correlation of Outcomes-Based Scores Between Patient and Significant Other.

	Patient QuickDASH	Patient PROMIS PI	Patient PROMIS UE	Patient PROMIS D	SO QuickDASH	SO PROMIS PI	SO PROMIS UE
Patient QuickDASH							
Patient PROMIS PI	.818**						
	P < .001						
Patient PROMIS UE	−.880**	−.843**					
	P < .001	P < .001					
Patient PROMIS D	.274*	.266*	−.315**				
	P = .024	P = .028	P = .009				
SO QuickDASH	.720**	.818**	−.629**	.306*			
	P < .001	P < .001	P < .001	P = .013			
SO PROMIS PI	.681**	.710**	−.648**	.234	.852**		
	P < .001	P < .001	P < .001	P = .058	P < .001		
SO PROMIS UE	−.671**	−.659**	.682**	−.276*	−.833**	−.819**	
	P < .001	P < .001	P < .001	P = .025	P < .001	P < .001	
SO PROMIS D	.228	.305*	−0.241*	.400**	.432**	.454**	−.276**
	P = .061	P = .011	P = .048	P = .009	P < .001	P < .001	P = .025

PI=pain interference; UE=upper extremity; D=depression SO=significant other. Pearson correlation (r) values are bolded with two-tailed significance values shown below.

Table 3. Patient and SO PRO Stepwise Linear Regression Using Patient WHYMPI Scales as Additional Independent Variables.

Dependent Variable	Step & Predictor	Significance	B	Std. Error	Beta	R2 Change	F Change
Patient QuickDASH	Step 1: SO QuickDash	<0.001	0.756	0.094	0.674	0.530	74.280
	Step 2: Pt W Solicitous	0.016	3.759	1.521	0.208	0.040	6.110
Patient PROMIS PI	Step 1: SO PROMIS PI	<0.001	0.575	0.082	0.651	0.424	48.671
Patient PROMIS UE	Step 1: SO PROMIS UE	<0.001	0.692	0.095	0.668	0.447	53.325
Patient PROMIS D	Step 1: SO PROMIS D	<0.001	0.427	0.105	0.452	0.204	15.389

PRO=patient-reported outcome measure; PI=pain interference; UE=upper extremity; SO=significant other; WHYMPI=West Haven-Yale Multidimensional Pain Inventory. Bolded values are significant P-values.

Table 4. Stepwise Regression Analysis Between Patient PRO and Negative, Solicitous, and Distracting WHYMPI Scales. Estimate Represents Increase/Decrease in Patient PRO per 1 Unit Increase in WHYMPI Scale.

Outcome	Initial Variables	Variables selected	Estimate	P-value
Patient QuickDASH	Patient	WHYMPI Solicitous	4.15	0.0338
	Significant Other	WHYMPI Solicitous	5.12	0.0360
Patient PROMIS PI	Patient	None	NA	NA
	Significant Other	None	NA	NA
Patient PROMIS UE	Patient	WHYMPI Solicitous	−2.52	0.0080
	Significant Other	None	NA	NA
Patient PROMIS D	Patient	None	NA	NA
	Significant Other	None	NA	NA

PRO=patient-reported outcome measure; PI=pain interference; UE=upper extremity; WHYMPI=West Haven-Yale Multidimensional Pain Inventory.

more similar in the setting of a concerned (i.e., solicitous) SO. However, this phenomenon was only present when considering one specific measure of pain and function (QuickDASH); the same relationship did not exist when comparing patient and SO PI, UE, and D scores. Moreover, ad hoc analyses suggest that patients who report worse outcomes may have more support from their SO.

The relationship between patient and SO has been previously explored in patients with chronic pain, though reports of concordance differ. In a USC study of 52 couples where one partner is experiencing either rheumatoid arthritis, back pain, or osteoarthritis, partners and patients reported similar pain severity outcomes based on MPI Pain Severity.[28] Conversely, a study from the University of British Columbia (UBC) reported that 46% of significant others (n = 222) with partners experiencing rheumatoid arthritis pain had differing understandings of pain using a numerical rating scale from 0 to 10.[3] Additionally, couples had different assessments of patient physical function as measured by the DASH questionnaire (73% discordant: 39.2% overestimated, 33.9% underestimated). We found no difference in patient and SO estimation of PI; however, we did find that SOs reported worse functional outcomes than those reported by the patient (QuickDASH, UE) (Table 1). This may be explained by patients underestimating their condition due to reluctance in expressing the full extent of their disability, or because of response shift bias throughout their treatment course. Additionally, significant others may overestimate the patient's disability due to empathy or communication patterns where patients over magnify their symptoms. Regardless, it is important to note that these differences (UE: 1.6, QD: 4.92) fell outside the MCID values for PRO surveys in orthopaedic hand patients (UE: 6.2, QD: 18.2), suggesting that SOs and patients report within a similar clinical understanding.[29] Nevertheless, there were strong correlations between patient and SO QuickDASH, PI, and UE (Table 2). These strong correlations suggest that while SOs provide an alternative perspective of patient-reported level of functioning, their understanding is similar enough to add value to the understanding of patient condition.

Both the USC and UBC studies are in congruence with our finding that support-related responses played no role in the concordance of patient and partner understanding of pain severity.[28] However, the UBC study found that patients who reported problematic support from their spouse (e.g., gave you information that you found upsetting) had dissimilar views of physical function (DASH), suggesting that more solicitous SO's would have a similar understanding of physical function.[3,30] Similarly, our work finds that patients who report more solicitous SOs have a more congruent understanding of physical function as measured by QuickDASH (Table 3). Thus, the opinion of concerned SOs may provide even more value in assessing patient outcomes.

In addition to analysing the correlation between SO and patient-reported outcomes, we examined whether patient and SO support-related responses were correlated with patient PRO scores themselves. In doing so, we found patients who reported worse physical function (i.e., QuickDASH, UE) also reported greater concern (i.e., WHYMPI solicitous) from their SO (Table 4). Our findings differ from a study of 193 orthopaedic hand patients from Massachusetts General Hospital that observed the relationship between patient-reported physical function (QuickDASH) and perceived emotional and instrumental support as measured by the PROMIS-Emotional Support and -Instrumental Support (e.g., I have someone to trust to talk with about my feelings). The authors found that patients who reported greater support from their social surroundings also reported better physical function.[31] While we both used validated surveys to measure support-related responses, these findings likely differ due to different measures utilized (i.e.,PROMIS-Emotional Support).

There are limitations to our study. First, our patient-SO pairs were recruited solely in a pre-operative environment, thus limiting our exposure to patients who may have pain that is not addressed via surgical intervention. However, we selected this patient population to ensure there was adequate need for SO support due to the severity of the pain level. Thus, these results may not be applicable to patients who have pain levels that do not warrant surgical intervention. Second, multiple validated surveys exist for measuring patient and SO support-related responses, including the WHYMPI subscales and PROMIS-Emotional Support. While we chose a survey utilized in chronic pain populations, it's difficult to assess which of these validated surveys is the most appropriate for examining our patient population.

Nevertheless, the WHYMPI was chosen as it has been developed specifically for addressing chronic pain.

To our knowledge, there is little to no investigation into significant others' perspective on orthopaedic patient-reported outcomes. This study finds significant others may be valuable reporters of patient pain and function. As implementation of patient-reported outcomes in the orthopaedic clinic setting is becoming more common, these findings suggest patients' significant others can offer valuable insight into their condition, particularly when patients are unable to respond for themselves or are experiencing response shift bias from fatigue.

Conclusion

The value of a patient's support system in reporting on pain and function symptoms has not been previously explored in such a patient population. While our data cannot suggest whether patients or their support systems have more accurate understanding of patient outcomes, our work - in conjunction with previous outlining the fluctuation of patient-reported PROs due to factors such as pain, emotional state, and response fatigue - suggests that support systems may provide an important piece of understanding in assessing patient condition.

Declaration of Conflicting Interests

Ethical Statement

Funding

Location of Work

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Supplemental Material

Supplemental material for this article is available online.

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