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Relative Prevalence of Anxiety and Depression in Patients with Upper-Extremity Conditions

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Abstract

Purpose—Prior research regarding the impact of mental health on upper-extremity musculoskeletal function and recovery have frequently grouped catastrophizing, anxiety, and depression. This study was designed to define the relative prevalence of heightened anxiety versus depressive symptoms among a patient population seeking upper-extremity care and to determine if those prevalences varied according to the symptomatic condition.

Methods—All adult patients presenting to a tertiary upper-extremity orthopaedic center between 6/1/2016 and 11/30/2016 (n=3315) completed the PROMIS Anxiety and Depression Computer Adaptive Tests (CATs). Descriptive statistics and multivariable linear regression assessed differences in average PROMIS scores between demographic and diagnostic groups. Patients were also analyzed according to crossing thresholds for heightened Anxiety and Depression scores based on established linkage tables with the Generalized Anxiety Disorder 7 and Patient Health Questionnaire-9 Depression scales respectively. Pearson chi square analysis and binary logistic regression were performed to determine if the proportion of patients crossing these thresholds varied according to the primary symptomatic condition, while accounting for patient age, sex, and race.

Results—African-American patients and those with carpal tunnel syndrome, trapeziometacarpal arthritis, or shoulder conditions reported significantly higher PROMIS Anxiety scores. Higher PROMIS Depression scores only varied by diagnosis. Seventeen percent of patients exceeded the Anxiety symptoms score threshold while 10% of patients exceeded the depressive symptom threshold. In logistic regression modeling, the likelihood of exceeding the anxiety threshold varied by diagnosis and was increased in African-American patients, and females. African-American race was associated with exceeding the depression threshold while accounting for sex and diagnosis.

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Conclusions—Patients with upper-extremity conditions more frequently report heightened anxiety than heightened depression. Patient race and diagnosis are independent predictors of anxiety among patients seeking care for upper-extremity conditions.

Level of Evidence—Diagnostic Level II

Keywords

anxiety; depression; PROMIS; upper extremity

INTRODUCTION

The substantial impact of psychosocial factors on patient outcomes has been well established in the orthopedic literature[1–6]. In patients with upper-extremity musculoskeletal conditions there is a strong correlation between psychological distress and pain intensity with both preoperative and postoperative physical impairment[7–11]. Mental health measures have a stronger association with patient-reported symptoms of hand arthritis than more objective measures, such as radiographic disease progression and range of motion[12,13]. Despite increasing evidence linking the symptoms of psychological distress to patient-reported pain and function, further study is needed to define the incidence of heightened anxiety and depression among patients with upper-extremity musculoskeletal conditions.

Twelve percent of 190 patients presenting to one of three academic hospital-based hand surgeons met criteria for major depression based on the PHQ-9 Patient Health Questionnaire[14]. Symptoms of anxiety and pain interference correlated with depression in this patient sample, but the prevalence of these psychological disorders was not defined. Gaining further understanding of the epidemiology of mental health conditions among patients seeking upper-extremity care will aid our ability to suggest mental health intervention, optimize care, and guide future research.

The National Institute of Health developed the Patient-Reported Outcomes Measurement Information System (PROMIS) to effectively assess a wide range of health domains, including those of anxiety and depression[15,16]. In its computer adaptive testing format, PROMIS assessments selectively draw from large pools of validated questions, providing a sensitive measure of mental health domains including depression and anxiety while only requiring a patient to answer four to twelve questions[17,18].

This study's primary aim was to determine the prevalence of heightened anxiety and depression in patients seeking specialty care for an upper-extremity musculoskeletal condition. Second, we aimed to determine if the magnitude of PROMIS scores and prevalence of anxiety and depression symptoms varied between upper-extremity musculoskeletal conditions.

METHODS

This cross-sectional study evaluated all new adult patients presenting to one of 12 upper extremity surgeons at an orthopedic tertiary care clinic between 6/1/2016 and 11/30/2016. Our study was exempt from institutional IRB approval as it collected de-identified patient

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data. All clinic patients used a computer tablet (iPad mini, Apple, Cupertino, CA) at check-in that was preloaded with PROMIS Anxiety-v1.0 and PROMIS Depression-v1.0. PROMIS scores were automatically uploaded into the patients' electronic health record immediately following completion.

PROMIS modules have been developed to be scored with a T-metric so that a score of 50 represents the normative population mean with a standard deviation of 10[19]. Higher scores represent more of each health domain. For example, a PROMIS Anxiety score of 60 represents anxiety symptoms one standard deviation greater than the normative population, while a Depression score of 40 represents less depressive symptoms than the normative population. A minimal clinically important difference (MCID) of 3.0 to 5.5 points has been suggested, with score changes of 3.0 to 4.5 in mental health domains being clinically relevant in a population of cancer patients[20,21]. However, because a clinically important difference for upper extremity patients has not yet been established, we chose to utilize both the upper and lower ends of the range (3 to 4.5) as a proxy for a clinically relevant difference between groups.

The PROMIS Anxiety module measures emotional distress caused by fear, anxious misery, hyperarousal, and related somatic symptoms[17]. Using item response theory (IRT), a crosswalk linking table exists to convert PROMIS Anxiety scores to the GAD-7, a seven-item instrument established to identify likely cases of Generalized Anxiety Disorder (GAD). A score of 10 or higher on the GAD-7 maximizes the sensitivity and specificity when judged against a diagnosis of GAD[22,23]. A score of 10 on the GAD-7 corresponds to a PROMIS anxiety score of 62.3[24]. Thus, a score of 62.3 was chosen as a minimum threshold value indicating a patient being affected by anxiety symptoms for PROMIS Anxiety for this study.

PROMIS Depression captures the respondent's negative mood, views of self, affect, and social cognition[17]. A linkage table has been developed to convert between PROMIS Depression scores and the Patient Health Questionnaire-9, or PHQ-9. A score greater than 10 on the PHQ-9, which corresponds to a PROMIS Depression score of 59.9 or greater, indicates moderate depression and allows for the highest sensitivity and specificity when judged against a diagnosis of major depression[25,26]. Therefore, a minimum threshold PROMIS Depression score of 59.9 was chosen indicating a patient being affected by depressive symptoms.

Statistical Analysis

Descriptive univariate statistics were used to evaluate the demographic data, average PROMIS scores, and prevalence of patients scoring above the designated PROMIS diagnostic thresholds in the study population. One-way ANOVA with Tukey's post-hoc analysis evaluated differences in average PROMIS scores between demographic groups. Pearson's chi-square analysis evaluated differences in the prevalence of those reaching PROMIS score thresholds between demographic groups.

Patients were then categorized as presenting for treatment of one of the following conditions: carpal tunnel syndrome, cubital tunnel syndrome, trapeziometacarpal arthritis, trigger finger(s), De Quervain tenosynovitis, Dupuytren contracture, ganglion cyst, rotator

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cuff tendinopathy, shoulder osteoarthritis, adhesive capsulitis, or other (Appendix 1). Pearson's chi-square analyzed the differences in prevalence of patients reaching PROMIS score thresholds between diagnostic groups.

Multivariable linear regression with forced entry was used to model the effects of age (continuous variable), sex (categorically defined with male as the reference group), race (categorically defined with Caucasian as the reference group), and upper extremity diagnosis (categorically defined with ganglion cyst, the group with the lowest frequency of Anxiety or Depression scores over the threshold, as the reference group) on the continuous dependent variable, PROMIS Anxiety score. Dummy variables were utilized for the categorical variables race and upper extremity diagnosis. This same procedure was repeated for the dependent variable, PROMIS Depression score.

Binary logistic regression was used to model the relationship between reaching the Anxiety score threshold (dependent variable) with forced entry of age (continuous level), sex (categorically defined with males as the reference group), race (categorically defined with Caucasians as the reference group), and diagnosis (categorically defined with ganglion cyst as the reference group). A backwards stepwise selection procedure was used to establish the final model with an alpha of .05 for removal. Model explanatory power and fit was assessed using the c-statistic and the Hosmer-Lemeshow lack-of-fit test. An unadjusted alpha of .05 level of significance was used for all tests. This same methodology was used to create a second regression model for the dependent variable of reaching the Depression score threshold.

RESULTS

3388 new patients presented during the study inclusion period. Of this group, 3315 had valid PROMIS scores necessary for study inclusion. The study population was predominantly female (54.2%), Caucasian (84.9%), and presented for hand conditions as opposed to shoulder conditions (64.7%). Patients averaged 53 (SD 17) years of age. The study population's average PROMIS Anxiety (51.6, SD 10.5) and Depression scores (46.4, SD 9.8) approximated the theoretical population mean of 50. African-American patients reported higher Anxiety scores than patients of other races (+5.3, 95% CI 4.2 – 6.5). There were no other clinically relevant differences in average PROMIS scores between demographic groups.

When accounting for diagnosis and demographic factors via linear regression, African-American patients and those with carpal tunnel syndrome, trapeziometacarpal arthritis, or shoulder conditions reported significantly higher PROMIS Anxiety scores than Caucasian patients or those with a diagnosis of a ganglion cyst (Table 1). A diagnosis of carpal tunnel syndrome, trapeziometacarpal arthritis, or adhesive capsulitis were the only statistically significant predictors of increasing Depression scores in multivariable analysis.

Anxiety and Depression Thresholds

Overall, 16.6% of the study population exceeded the PROMIS Anxiety threshold while 9.5% of the population exceeded the threshold for Depression, 85% of whom also met the

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threshold for Anxiety ($p<0.05$). African-American patients, and those presenting with shoulder or elbow complaints, were more likely than Caucasian or patients with hand complaints to exceed thresholds for being affected by anxiety and depression. Females reported anxiety more frequently than males (Table 2). There were no differences in age between affected and unaffected patients.

Patients with adhesive capsulitis, carpal tunnel syndrome, or rotator cuff tendinopathy reported the highest prevalence of PROMIS Anxiety scores above the treatment threshold (Figure 1), while those with ganglion cysts or Dupuytren's contracture reported the lowest. Patients with trigger fingers or ganglion cysts had the lowest rates of Depression scores above the threshold.

The binary logistic regression model for predicting anxiety symptoms over the threshold was statistically significant (LR Chi-square=141.2, df=4, $p<0.05$) with a c-statistic of 0.63. African-American race (OR 3.6, 95% CI 2.8–4.5) and female sex (OR 1.3, 95%CI 1.1–1.6) as well as several shoulder conditions (adhesive capsulitis OR 8.6, 95%CI 2.7–27.7; rotator cuff tendinopathy OR 5.5, 95% CI 2.1–114.7; shoulder osteoarthritis OR 4.6, 95% CI 1.6–13.2) and hand conditions (carpal tunnel syndrome OR 5.0, 95% CI 1.9–13.4; cubital tunnel syndrome OR 3.7, 95% CI 1.2–11.9; trapeziometacarpal arthritis OR 3.2, 95% CI 1.1–9.2) were significant predictors for being affected by anxiety. The overall regression model for predicting depression was also significant (LR Chi-square= 33.8, df=4, $p<0.05$, c-statistic=0.56), with African-American race (OR 2.7, 95% CI 1.6–4.6) as the sole predictor associated with being affected by depressive symptoms exceeding the threshold.

DISCUSSION

There is substantial variability in the reported prevalence of anxiety (13–29%) and depression (7–38%) in orthopedic patient populations. This is likely due to the heterogeneity of the populations studied and the instruments used to measure these psychological parameters[5,6,14,27–31]. Our study delivered PROMIS CATs to all patients presenting to our institution's upper-extremity clinic. Patients complete PROMIS modules at every visit, providing a large sample of PROMIS data and minimizing selection bias. Our results are consistent with smaller studies in which the prevalence of anxiety was equal to, or higher than, that of depression in upper-extremity populations[5,14,31]. This finding was substantiated in a meta-analysis that also identified anxiety (21.3%) as more prevalent than depression (19.9%) in patients with osteoarthritis[32]. Although our estimated prevalences of anxiety (16.6%) and depression (9.5%) were slightly smaller, it is clear that there is a meaningful prevalence of psychological distress in the form of both anxiety and depression present in patients with upper-extremity musculoskeletal conditions. If unable to universally assess all patients, our data indicate that screening for anxiety may be most efficient in women, African-American patients, and patients with select diagnoses among those who present to upper extremity clinics.

Ganglion cysts and Dupuytren's contracture were associated with the lowest levels of anxiety and depression scores. We suspect that this is attributable to those conditions frequently being painless. In our experience, patients are most likely to exhibit catastrophic

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thinking and become anxious when in pain. To this end, surgeons can provide a great service by explaining conditions in an understandable manner that builds resiliency and conveys empathy while eliminating misconceptions about conditions.

The orthopedic literature often group coping abilities, anxiety, and depression together as "psychological distress", but we would argue it may be prudent to view these entities separately. In a study of the association between psychological distress and DASH and QuickDASH scores, both traditional screening tools for depression (Center for Epidemiologic Studies Depression Scale) and anxiety (Pain Anxiety Symptoms Scale) each remained as significant independent predictors in multivariable modeling, which indicated that each contributed a unique influence on patients' perceived physical function[33]. Furthermore, in patients after distal radius fracture surgery, catastrophic thinking (poor coping strategy), but not depressive symptoms, predicted finger stiffness[34]. Similarly, anxiety, but not depression, was associated with reduced satisfaction in a cohort after carpal tunnel release[8]. Thus, given their differing prevalences and potentially unique impact on a patient's response to treatment, we see value in recognizing anxiety and depressive symptoms as two distinct entities in both research and patient care[8,33].

The identification of increased mean anxiety levels among females is consistent with multiple publications[35–37]. However, the greater number of African-American patients exceeding the anxiety and depression thresholds contradicts national epidemiologic studies[38–41]. Among 11,710 Americans, African-Americans and Caribbean Blacks were less likely than non-Hispanic white Americans to meet DSM-IV criteria for generalized anxiety disorder, panic disorder, and social anxiety in face-to-face interviews[40]. Reduced prevalence of anxiety disorders among non-Hispanic Blacks was confirmed by Breslau et al[41]. The discrepancy between our data and findings from the general population may be related to study methodology or access to healthcare. First, the referenced epidemiologic studies each used personal interviews, which risks responders minimizing anxiety or depressive symptoms as opposed our patients completing a self-administered survey. Second, in epidemiologic studies of the United States, minority populations are often more socio-economically disadvantaged which may prevent healthcare access and reduce the likelihood of mental health diagnoses. The National Institute of Mental Health reported that black adults sought mental health care only 52% as frequently as white adults, with the most commonly cited reason being cost of treatment or lack of insurance[42]. Notably, all patients in our study have demonstrated the resources to access specialty orthopedic care which likely removed any racially-based disparities in access to care that affect population studies. However, we cannot rule out socioeconomic status as a confounding variable for differences that we attributed to race. The higher average anxiety scores among African American patients was less surprising as epidemiologic studies report that, when affected, Hispanic and black individuals have increased severity, duration, and overall anxiety burden[38,39].

The cross-sectional nature of this study limits our ability to determine if the prevalence of anxiety and depression has an impact on treatment choice. Additionally, the upper-extremity diagnoses for this study are based on ICD-10 codes which do not allow for the assessment of the severity or duration of symptoms. Finally, this study uses patient-reported symptoms from the PROMIS Anxiety and Depression CATs to determine clinically relevant anxiety

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and depressive symptoms. This is not equivalent to an evaluation and diagnosis by a mental health professional. There is, however, evidence that the thresholds used in this study indicate symptoms that may warrant intervention based on other established mental health assessments[22,24,43]. Using thresholds to categorize patients is often needed when delivering treatment (e.g., perform a surgery or not, prescribe a drug or not) and is frequently used to characterize populations. However, some would argue against such categorization and encourage a focus on all health facets as a continuum. Thus, it is reasonable to assume that some patients who scored below the threshold would still benefit from intervention to reduce anxiety or depression.

The Institute of Medicine has called for an improved understanding of the interactions between social, behavioral, and physical health, in order to best serve our patients[44]. This study used a standardized metric, PROMIS, that effectively and efficiently assesses mental health, to reveal a substantial prevalence of anxiety, and to a lesser degree depression, that may warrant treatment in a population of patients with upper-extremity conditions. In high risk groups, such as females, African Americans, and patients with adhesive capsulitis or carpal tunnel syndrome, it is especially important for providers to be aware of the negative effect depression and anxiety can have on patient outcomes[10,11,45,46]. We hope that upper extremity surgeons will screen for these conditions, direct patients with heightened anxiety and depression toward treatment, and also remain cognizant of their language during their interactions with patients to best aid in their recovery.

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24. Appendix Table 34: Raw Score to T-Score Conversion Table (IRT Fixed Parameter Calibration Linking) for GAD-7 to PROMIS Anxiety. PROsetta Stone - PROMIS Anxiety and GAD-7.

25. Appendix Table 46: Raw Score to T-Score Conversion Table (IRT Fixed Parameter Calibration Linking) for PHQ-9 to PROMIS Depression PROsetta Stone - PROMIS Depression and PHQ-9.

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Appendix 1. ICD-10 codes for categorizing diagnoses

Carpal Tunnel Syndrome	G56.00	G56.03	G56.11
	G56.01	G56.10	G56.12
	G56.02		
Cubital Tunnel Syndrome	G56.20	G56.21	G56.22
	G56.23		
Trapeziometacarpal Arthritis	M18.9	M18.12	M18.10
	M18.0	M18.31	M18.51
	M18.11	M18.2	
Trigger Finger	M65.30	M65.329	M65.342
	M65.311	M65.331	M65.349
	M65.312	M65.332	M65.351
	M65.319	M65.339	M65.352
	M65.321	M65.341	M65.359
	M65.322		
Ganglion Cyst	M67.431	M67.40	M67.439
	M67.441	M67.442	M67.449
	M67.432		
Dupuytren Contracture	M72.0		
De Quervain Tendonitis	M65.4		
Rotator Cuff Tendinopathy	M75.100	M75.111	M75.121
	M75.101	M75.112	M75.122
	M75.102	M75.120	
Shoulder Osteoarthritis	M19.011	M19.019	M19.112
	M19.012	M19.111	M19.211
Adhesive Capsulitis	M75.00	M75.01	M75.02

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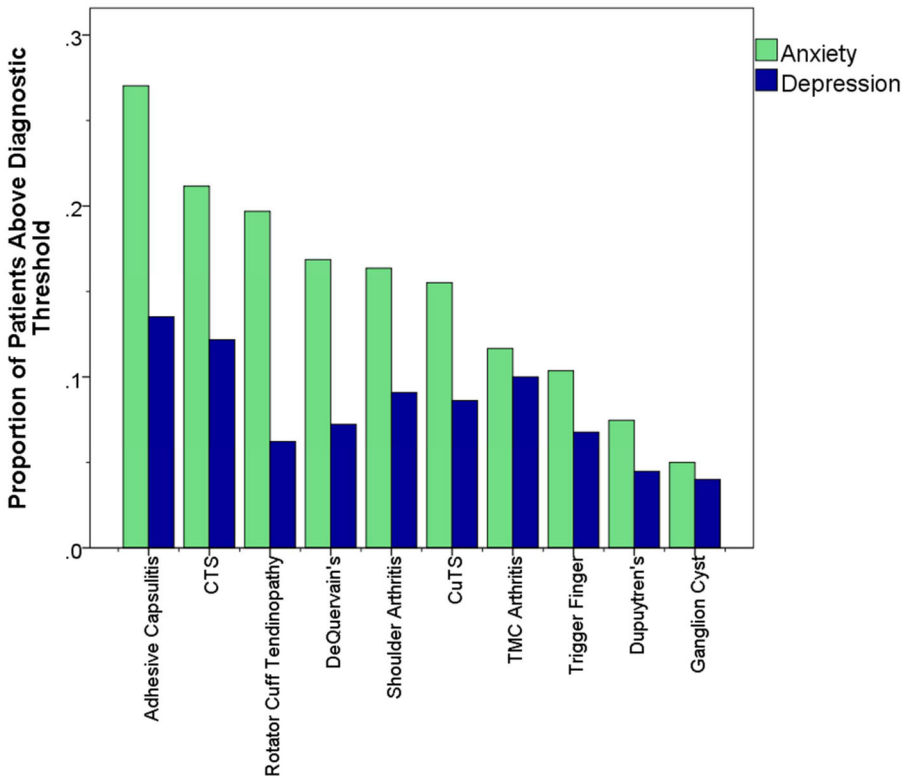

Figure 1.

Proportion of patients reaching PROMIS Anxiety and Depression treatment thresholds. Error bars represent 95% confidence intervals.

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Table 1

Significant independent predictors of increasing PROMIS scores on multivariable linear regression.

	PROMIS Anxiety		PROMIS Depression	
Predictors	**Unstandardized β coefficient**	**95% CI**	**Unstandardized β coefficient**	**95% CI**
African-American race[†]	5.1[**]	4.0–6.3	2.9	1.8–3.9
Age	0.04	0.01–0.06	0.05	0.02–0.07
[††]**Female Sex**	2.3	1.6–3.0	1.6	0.9–2.3
Diagnosis[‡]				
Adhesive Capsulitis	7.5[**]	3.6–11.3	5.0[**]	1.3–8.6
Rotator Cuff Tear	4.8[**]	2.3–7.3		
Carpal Tunnel Syndrome	4.5[**]	2.0–7.0	3.0[*]	0.6–5.3
Shoulder Osteoarthritis	4.1[*]	1.3–6.9		
Trapeziometacarpal Arthritis	3.2[*]	0.5–5.9	3.0[*]	0.4–5.5

[†]Reference category: Caucasian race

[††]Reference category: male sex

[‡]Reference category: ganglion cysts

[*]Clinically relevant at Δ3 points

[**]Clinically relevant at Δ4.5 points

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Table 2

Percentage of patients reaching the PROMIS Anxiety and Depression score thresholds.

	Anxiety ≥62.3)	Depression (≥59.9)
Female	18.5% (n=333) *	9.9% (n=177)
Male	14.4% (n=218)	9.0% (n=136)
African-American	36.5% (n=133) *	18.7% (n=68) *
Caucasian	14.0% (n=393)	8.3% (n=232)
Shoulder/Elbow	21.1% (n=247) *	10.7% (n=124) *
Hand	14.2% (n=304)	8.8% (n=189)

* Statistically significant at $p<0.05$