Clin Orthop Relat Res (2010) 468:798–806
DOI 10.1007/s11999-009-0963-y

CLINICAL RESEARCH

Preoperative Pain Catastrophizing Predicts Pain Outcome after Knee Arthroplasty

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Received: 22 January 2009 / Accepted: 16 June 2009 / Published online: 8 July 2009

Abstract Psychologic status is associated with poor outcome after knee arthroplasty yet little is known about which specific psychologic disorders or pain-related beliefs contribute to poor outcome. To enhance the therapeutic effect of a psychologic intervention, the specific disorders or pain-related beliefs that contributed to poor outcome should be identified. We therefore determined whether specific psychologic disorders (ie, depression, generalized anxiety disorder, panic disorder) or health-related beliefs (ie, self-efficacy, pain catastrophizing, fear of movement) are associated with poor outcome after knee arthroplasty. We conducted a cohort study of 140 patients undergoing knee arthroplasty at two hospitals. Patients completed a series of psychologic measures, provided various sociodemographic data, and were followed for 6 months. Patients were dichotomized to groups with either a favorable or a poor outcome using WOMAC pain and function scores and evidence-based approaches. After adjusting for confounding variables, we found pain catastrophizing was the only consistent psychologic predictor of poor WOMAC pain outcome. No psychologic predictors were associated consistently with poor WOMAC function outcome. An intervention focusing on pain catastrophizing seems to have potential for improving pain outcome in patients prone to catastrophizing pain.

Level of Evidence: Level I, prognostic study. See Guidelines for Authors for a complete description of levels of evidence.

One or more of the authors (DLR, JBW, WAJ) have received funding from a grant from the AD Williams Fund, Virginia Commonwealth University, Richmond, VA.
Each author certifies that his or her institution approved the human protocol for this investigation, that all investigations were conducted in conformity with ethical principles of research, and that informed consent for participation in the study was obtained.
This work was performed at Virginia Commonwealth University, Richmond, VA, USA.

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Introduction

Pain is the predominant symptom in patients seeking knee arthroplasty [35, 42, 43]. Substantial improvements in pain and function after knee arthroplasty are well established in large cohort studies with gains consistently on the order of 40% to 60% from 6 months to 2 years postoperatively relative to baseline [3, 5, 10, 11, 13, 15, 16, 19, 33]. However, these studies do not indicate the number and characteristics of patients who respond poorly to the surgery. For example, 33% of patients in one study (n = 423) did not have measurable improvements in pain 6 months after surgery [10]. Similar estimates were reported 2 to 7 years after arthroplasty in another study [18]. Murray and

Frost [41] reported 30% of their large cohort of 1429 patients had moderate or severe pain 1 year after knee arthroplasty.

Functional improvements also vary among patients after knee arthroplasty and occur at a slower rate than pain improvements. Only one-third of patients report no functional problems with the surgical knee [56] and approximately 20% report dissatisfaction with their functional ability 1 year or more after surgery [24]. Functional deficits after surgery affect many activities with as much as 40% of patients still requiring the use of an assistive device to ambulate [18].

Although the clinical effectiveness [42] and cost-effectiveness of knee arthroplasty have been established [45], the functional and economic impacts of persistent pain and lost function for patients with poor outcome have not been determined. One commonly attributed cause of persistent unexplained pain and poor function is psychologic distress [12, 57].

Several groups of researchers have documented the predictive role of preoperative psychologic distress on arthroplasty outcome [1, 2, 4, 5, 14, 26, 34, 47]. The most common approach to quantifying psychologic distress in these studies [1, 2, 35, 47] was to use a global measure, the Mental Health score or the Mental Component Summary (MCS) score of the SF-36 [30], in lieu of more specific measures of psychologic status. Use of global psychologic distress measures does not assist in guiding the type of psychologic treatment that may be most valuable. Ayers et al. [2] used various specific measures of psychologic status including depression, anxiety, and pain catastrophizing, but the focus of their study was primarily on the predictive role of the MCS of the SF-36. Measures that identify the specific type of distress would better guide the design of interventions to improve pain and function outcomes in patients with psychologic distress.

During the past decade, researchers have examined psychologic disorders (eg, depression, generalized anxiety disorder) and pain-related beliefs in patients with arthritis. Psychologic disorders such as depression are relatively common and require no elaboration. Among the more common pain-related beliefs studied in patients with arthritis are self-efficacy [36] (the belief that one has the ability to control pain), pain catastrophizing [28] (the belief that pain will get worse and that one is helpless to deal with it), and fear of movement [20] (the belief that movement will create additional injury and pain). We presumed one or more of these specific disorders or pain-related beliefs would predict pain or physical function outcome.

We therefore asked whether either psychologic disorders or pain-related beliefs could predict either pain or physical function outcome after knee arthroplasty.

Patients and Methods

We conducted a prospective longitudinal cohort study between December 2005 and April 2008, recruiting 283 patients with long-standing knee osteoarthritis who consented to primary knee arthroplasty and who attended a preoperative educational class at one of two facilities. Patients were excluded if they underwent revision surgery ($n = 26$) or did not consent to participate in our study ($n = 55$). Patients were recruited to the extent that they were available for recruitment because of their participation in the routinely provided preoperative educational classes. Of the 283 patients recruited, 157 were selected to participate in followup data collection. Patients were recruited on alternate weeks by the study coordinator who selected patients for followup solely based on the week of recruitment. Because of staffing shortages and limited funding, we chose this pragmatic approach to achieve our sample requirements. The study coordinator was blind to all patient measures. To assess for selection bias, we used t-tests or chi square to compare the demographic and clinical characteristics of patients selected for followup surveys and those not selected and found no differences (Table 1). For the 157 patients who were sent followup questionnaires, 140 (89.2%) completed the 6-month questionnaire (Fig. 1).

Of the 157 patients participating in the longitudinal study, 129 underwent primary TKA. These patients all had cruciate-retaining TKAs with all components cemented; all patellae were resurfaced. The remaining 28 patients had a cemented fixed-bearing medial unicompartmental knee arthroplasty. Standardized postoperative nursing and physical therapy protocols were used for all patients. Patients were mobilized out of bed on the first postoperative day, and all patients had a postoperative anticoagulation protocol using warfarin. Postoperative pain management was provided with epidural anesthesia or intravenous patient-controlled analgesia for the first postoperative day followed by oral analgesics on subsequent days. All participants provided informed consent by signing Institutional Review Board-approved consent forms.

We conducted a power analysis (nQuery Advisor 7.0, Statistical Solutions Ltd, Farmer's Cross, Cork, Ireland) based on 6-month outcomes. We reasoned that if a psychologic disorder or pain-related belief measure indicated patients with higher scores had odds of poor outcome that were twice those of patients with lower scores, that the psychologic measure was a clinically important outcome predictor. When the sample size is 123, the logistic regression test of $b = 0$ ($a = 0.050$ two-sided) will have 80% power to detect a b of 0.7 (an odds ratio of 2.0); this assumes that one covariate x (eg, depression score) is being added to the model after adjustment for prior covariates,

Table 1. Characteristics of the patients

Variable	Patients participating in the longitudinal study		Patients not participating in the longitudinal study		t-Test or Pearson chi square test
	Number	Mean (SD) or percent	Number	Mean (SD) or percent	p Value
Age (years)	157	63.7	124	63.8	0.98
Gender (percent female)	157	70.7%	126	66.7%	0.47
Race/ethnicity (percent black)	157	19.7%	126	19.8%	0.98
Body mass index	155	30.9 (7.1)	122	30.2 (5.5)	0.35
Comorbidity score	157	6.3 (3.7)	119	6.9 (3.8)	0.15
Percent with low back pain	155	49.7%	123	44.7%	0.41
Percent with lower extremity pain on nonsurgical side	155	42.6%	123	42.3%	0.95
Education (percent high school or less)	155	31.6%	122	38.5%	0.23
Marital status (percent divorced or separated)	157	8.9%	126	11.9%	0.41
WOMAC preoperative pain score	157	10.1 (3.8)	121	10.6 (4.1)	0.35
WOMAC preoperative function score	157	31.2 (13.1)	121	33.5 (14.2)	0.16
Depression scale	154	6.3 (5.3)	119	6.3 (4.6)	0.99
Fear of movement scale	153	25.9 (7.5)	118	26.1 (7.4)	0.85
Pain catastrophizing scale	156	13.9 (12.2)	120	15.2 (12.4)	0.39
Self-efficacy scale	150	6.3 (2.2)	119	6.3 (2.2)	0.98
Mental health score (SF-36)	155	74.3 (16.2)	124	72.5 (17.6)	0.35
General anxiety disorder	154	20.8%	116	19.8%	0.85
Panic disorder	156	1.9%	122	4.9%	0.29

SD = standard deviation.

that its multiple correlation with covariates already in the model is 0.10, and that the proportion of patients with a poor outcome is 30%. The power analysis indicated that we had at least 80% power to detect an odds ratio of 2 or greater for one or more of the psychologic variables in predicting poor outcome.

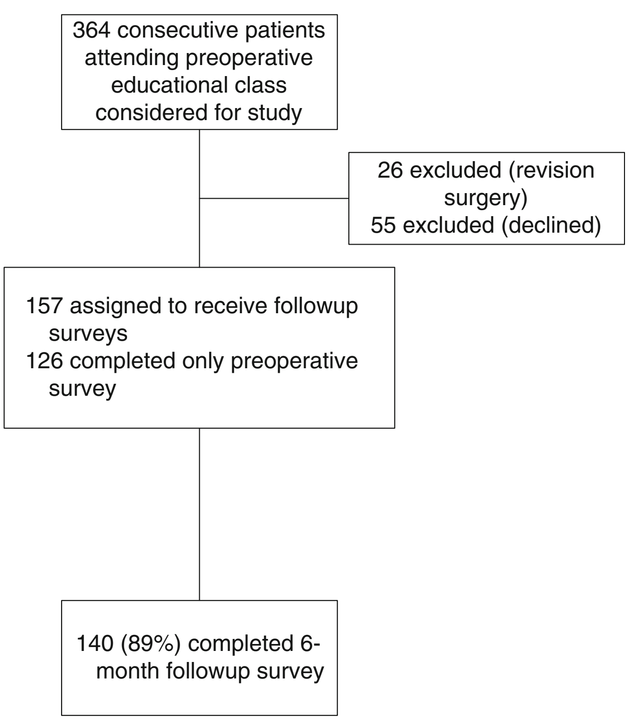

Fig. 1 The flow of patients in the study is shown.

We collected data on the patients' age, gender, height, weight, body mass index (BMI), race/ethnicity, marital status, and educational attainment. Patients also reported the duration of their knee pain and whether they had been diagnosed with inflammatory arthritis in addition to osteoarthritis. Patients also were asked what other areas of their body were painful and the options were low back, neck, arm, or the nonsurgical lower extremity. The Self-Administered Comorbidity Questionnaire, a validated comorbidity questionnaire, was used to quantify the extent and severity of comorbidities and the impact these had on functional status [46].

We chose the PHQ-8 [31, 32], a validated self-report measure of depression severity, and the Generalized Anxiety Disorder and Panic Disorder modules from the PRIME-MD [48, 49, 51], a validated battery of mental health tests designed for outpatients. Criterion scores were validated for the PHQ-8 and the Generalized Anxiety and Panic Disorder measures and we used these criterion scores to dichotomize patients in our study into those with and those without each of the three mental health disorders. The cut score of 10 or greater on the PHQ-8 is indicative of current major depression with sensitivities and specificities greater than 0.9 based on comparison to diagnoses made by mental health professionals [31, 48]. Generalized Anxiety and Panic Disorder measures have good diagnostic validity as compared with diagnoses made by mental health professionals, with sensitivities and specificities ranging from 63% to 99% [48, 49, 51].

The Tampa Scale of Kinesiophobia, an instrument originally designed for patients with low back pain, is a validated measure of fear of movement [55]. The instrument has high reliability (intraclass coefficient, 0.81), and responsiveness (standardized response mean, −1.11). The instrument has not, to our knowledge, been used with patients after knee arthroplasty. However, in our experience, some patients have fear when moving their knee after arthroplasty, and we believed this was an important mental health construct to assess. Scores range from 11 to 44 with higher scores indicating higher fear of movement.

We also used the short form of the Arthritis Self-efficacy Scale [40]. Self-efficacy relates to a person's belief that they have the capability to complete the actions required to meet functional demands. The scale has high internal consistency (Cronbach's $\alpha = 0.9$) and can differentiate among patients with different rheumatic disorders [40]. The eight-item instrument is scored from 1 to 10 with higher scores indicating higher self-efficacy. Interventions designed to improve self-efficacy, the belief that one is capable of overcoming a disorder, are effective for patients with knee arthritis [36–38]. However, in one study of patients with hip or knee arthroplasty, preoperative self-efficacy apparently did not predict 6-month functional status, but only 23 of the 103 patients had knee arthroplasty [54].

The Pain Catastrophizing Scale (PCS) was designed to capture the extent of a patient's negative or exaggerated orientation to pain with primary constructs directed toward rumination, magnification, and helplessness [52]. Psychometric properties of the PCS have been studied extensively in various disorders and are reliable (eg, Chronbach's alpha $\geq$ .75) and valid (eg, correlated with pain severity and interference measures) [6, 44, 52]. In addition, interventions designed to reduce pain catastrophizing are effective for various disorders characterized by chronic pain, including arthritis [25, 27]. The PCS is a 13-item scale with scores ranging from 0 (no catastrophizing) to 52 (severe catastrophizing). We chose to dichotomize the PCS score because of the extensive evidence suggesting high scores on the PCS are associated with an increased risk of poor outcome [9, 14, 21–23]. However, we found no published cut-point for differentiating high from low pain catastrophizing. Our intent was to provide a clinically useful cut-point for clinicians who may want to screen their patients for high pain catastrophizing. We dichotomized the PCS by using the highest tertile of scores from the entire sample of patients admitted to our study. Patients scoring in the highest tertile (16 or higher) were considered to have high pain catastrophizing, whereas patients who scored less than this cut-point were considered to have low pain catastrophizing.

Patients completed the Likert Version 3.1 of the WOMAC Pain and Function questionnaires [39]. The WOMAC has been studied extensively and is reliable and valid for quantifying the extent of pain and disability in patients undergoing knee arthroplasty [39].

We used two cut-points to determine when meaningful change occurred in WOMAC pain or function scores. First, we dichotomized patients into those who did and those who did not improve by 50% or greater based on changes in WOMAC pain and function scores from baseline to 6 months postsurgery. Our rationale for this approach is that large sample studies generally indicate average improvement for patients is approximately 50% relative to initial scores [3, 5, 11, 13, 15, 19, 33]. By dichotomizing patients in this way, we believe we are able to group patients into clinically meaningful groups. By using a 50% criterion for change, we effectively reduce the potential influence of baseline scores, which are important predictors of outcome [15]. Use of a criterion of 50% improvement has been used by others to effectively dichotomize patients into distinct responder groups [7, 17]. For a sensitivity analysis, we used individual patient estimates of minimally important differences, 6-month changes derived from the literature [3, 5, 11, 13, 15, 19, 33]. For 6-month change scores, we dichotomized our sample based on whether changes exceed the 6-month minimal clinically important difference (MCID) [10]. These changes were greater than 4 points for WOMAC pain and greater than 15 points for WOMAC function.

For patients who received followup measures, a packet was sent to the patient's home for completion 6 months postsurgery. We chose 6 months because it captures the preponderance, if not essentially all, of the improvement associated with knee arthroplasty while avoiding earlier postoperative differences in pain perception, which might be ascribed to differences in wound healing, physical conditioning, or physical therapy protocols. Changes in WOMAC pain or function scores after 6 months of recovery are negligible in one study [29] or only 1 or 2 WOMAC points in other studies [13, 33].

All patients received two followup reminder phone calls 1 week apart after mailing if the packet was not returned in 1 week. All patients underwent in-hospital postoperative rehabilitation using standardized physical therapy protocols. After hospitalization, patients received physical therapy at the discretion of the operating surgeon. Patients self-reported a mean of 16 (standard deviation [SD], 13) outpatient physical therapy visits at the 6-month followup.

To determine whether psychologic disorders or pain-related beliefs predicted either WOMAC pain or function, we used generalized linear mixed effect models to model the dichotomized 6-month followup WOMAC pain and function scores. Specifically, the logistic regression models were used to model the logarithm of the odds (ie, logit) of an event (for example, change by less than 50% of 6-month WOMAC pain scores) as a linear function of the clinically important covariates, including age, gender, BMI, having rheumatoid arthritis, race, comorbidity score, and psychologic variables. Essentially, the effects of the psychologic predictors on the probability of occurrence of the event (ie, poor outcome) can be studied effectively using the logistic regression models.

We did not include the Panic Disorder scores because the prevalence was too low (1.9%) to include in the analysis. Four mixed logistic regression models were built to predict poor outcome. Because we had two measures that we were interested in predicting (WOMAC pain and function) and two different analyses for each measure (50% change and MCID change), a total of four models were needed. Using generalized linear mixed models can appropriately account for correlation between patients seen by the same surgeon in the same hospital. The correlation structure was taken to be compound symmetry, that is, it was assumed that the correlation was the same between the patients seen by the same surgeon in the same hospital. The psychologic variables having p values less than 0.10 were retained in the final models. We assessed for multicollinearity among psychologic measures during the model building process and none was found.

Results

For the entire sample with available 6-month followup data, the average improvement in WOMAC pain was 53.6% (SD, 39%) and the average improvement for WOMAC function was 49.4% (SD, 44%). These average changes are consistent with those from numerous cohort studies with similar lengths of followup [3, 10, 11, 13, 33].

For WOMAC pain, only the dichotomized PCS score (odds ratio [OR], 2.67; 95% confidence interval [CI], 1.2–6.1) predicted improvement by the less than 50% poor outcome criterion after adjustment for potential confounders. In a sensitivity analysis, the dichotomized PCS score more powerfully predicted poor outcome (OR, 6.04; 95% CI, 1.75–20.81) as defined using the WOMAC change $\leq$ 4 points change MCID poor outcome criterion (Table 2). For WOMAC function, the only psychologic variable to stay in the model when using the change less than 50% criterion was the dichotomized PCS score (OR, 2.18; 95% CI, 0.91–5.19). In the sensitivity analysis using the MCID poor outcome criterion, no psychologic variables entered the WOMAC function model (Table 3).

Table 2. Logistic regression models for predicting poor outcome in WOMAC pain scores

Model*	Number	F value	p Value	Odds ratio (95% confidence interval)†
Model 1: change by < 50%	136			
PCS score of ≥ 16‡		5.47	0.02	2.67 (1.2–6.1)
Model 2: change ≤ 4 WOMAC pain points	126			
Self-efficacy score (continuous)		2.96	0.09	0.80 (0.62–1.03)
TSK (continuous)§		3.19	0.08	0.92 (0.85–1.01)
PCS score of ≥ 16		8.29	0.005	6.04 (1.75–20.81)

* Both models in the table are adjusted for age, gender, comorbidity score, rheumatoid arthritis status, race/ethnicity, preoperative WOMAC pain score; the models also account for correlation among patients seen by the same surgeon and surgery done in the same hospital; †odds ratios should be interpreted such that continuous covariates of age, comorbidity score, and preoperative WOMAC pain score are fixed at their mean; ‡Pain Catastrophizing Scale (PCS) dichotomized with a cut-point of 16; §Tampa Scale of Kinesiophobia scored on a continuous scale.

Table 3. Logistic regression models for predicting poor outcome in WOMAC function scores

Model*	Number	F value	p Value	Odds ratio (95% confidence interval)†
Model 1: change by < 50%	136			
PCS score of ≥ 16‡		3.12	0.08	2.18 (0.91–5.19)
Model 2: change ≤ 15 WOMAC function points	136			
None				

* Both models in the table are adjusted for age, gender, comorbidity score, rheumatoid arthritis status, race/ethnicity, preoperative WOMAC pain score; the models also account for correlation among patients seen by the same surgeon and surgery done in the same hospital; †odds ratios should be interpreted such that continuous covariates of age, comorbidity score, and preoperative WOMAC pain score are fixed at their mean; ‡Pain Catastrophizing Scale (PCS) dichotomized with a cut-point of 16.

Discussion

The literature has suggested psychologic distress is an important predictor for poor outcome after knee arthroplasty [1, 2, 5, 14, 34, 47], but we found no studies that quantified the effects of specific psychologic disorders or health-related beliefs on pain or physical function outcome. Ayers et al. [2] found that patients who had knee arthroplasty with SF-36 MCS scores less than 50 had higher levels of catastrophizing, depression, and anxiety than patients with scores of 50 or greater. They did not, however, report whether these specific psychologic distress measures predicted outcome independent of the more general SF-36 MCS score. Given that most studies have used general measures of psychologic distress in lieu of specific measures of disorders or pain-related beliefs [1, 2, 5, 14, 34, 47], a study of these more specific constructs and their impact is needed. We hypothesized that one or more of the specific psychologic disorders or health-related beliefs that we studied would predict poor outcome. Identification of specific psychologic disorders and beliefs that predict poor outcome is important because psychologic interventions should be tailored to the specific disorder or pain-related belief to be most effective.

Our study has several limitations. First, we followed patients for only 6 months after surgery. Although evidence suggests outcomes at 6 months and those at 1 or 2 years are similar, with either no difference or only a 1- or 2-WOMAC point change [10, 13, 29, 33], a longer-term followup may have shown differences compared with those at 6 months. Second, our sample size was smaller than some cohort studies [10, 33]. Despite the relatively small sample, we showed the characteristics of the sample reflected the larger population of patients seen by our team of orthopaedic surgeons. We also observed relatively consistent findings with the sensitivity analysis, which generally support the argument that sample size was adequate for the question we posed. Third, our patients did not undergo interviews by mental health experts, but rather completed self-report forms for identification of several mental health disorders. Although this is becoming standard practice in some areas of medicine for screening purposes [31, 48, 50, 51], our findings may have been different had our patients undergone interviews with specialists in mental health. Fourth, patient expectations influence outcome [57] and we did not include a patient expectation measure in our study. Fifth, our use of dichotomous outcome measures also has limitations. Although continuous and dichotomous measures have been used to describe outcome after knee arthroplasty, some information is lost when continuous measures are converted to dichotomous measures. However, we believe our rationale for this approach is defensible. The focus of our study was on the subgroup of patients who have a poor outcome after knee arthroplasty. This subgroup, by definition, comprises approximately one-third of all patients who undergo knee arthroplasty [57]. It was with this subgroup in mind that we dichotomized our outcome measures to best capture differences that may exist among patients who do and do not experience clinically important changes in pain and functional status. Our choice of 50% improvement as the primary outcome measure was based on the substantial literature indicating this is the expected average improvement after knee arthroplasty [3, 5, 10, 11, 13, 34]. A strength of this approach is it is less dependent on the patients' baseline functional or pain status, unlike the MCID approach, which varies depending on baseline severity [53]. Despite these limitations, we believe the approaches we used to define poor outcome are evidence-based and provide clinically useful ways of interpreting the potential impact of the psychologic disorders and pain-related beliefs that we studied. We also dichotomized the Pain Catastrophizing Scale (PCS) score based on substantial evidence that suggests that patients with higher scores have a poorer prognosis [9, 14, 21–23]. We dichotomized this variable to capture the upper tertile of patients, those with the highest levels of pain catastrophizing. This is an arbitrary cut-point and likely contributed some error in prediction but it does provide a clinically usable cut-point for clinical practice applications. Sixth, our process of recruiting patients for longitudinal analysis was not random but pragmatic because, with limited staff availability, we chose to use an alternate week approach to recruitment. Our analysis reported in Table 1 supports our contention that the approach was not biased but it is possible that patients included for longitudinal analysis differed in other ways from those not selected.

Our findings add to the current knowledge regarding the potential impact of psychologic distress on pain and function outcome. Previously, the standard approach was to use general measures of psychologic distress such as the MH-5 from the SF-36. We are unaware of any studies, other than the current study, that quantify the impact of specific forms of psychologic distress on 6-month followup pain and function. We found that of the six specific types of psychologic distress, pain catastrophizing was the most powerful and consistent predictor of poor outcome.

With regard to WOMAC pain outcomes, pain catastrophizing highly predicted poor outcome after adjusting for confounding. Given that patients report pain to be the most common reason for having an arthroplasty [35, 42, 43], this finding may have important implications: patients with PCS scores of 16 or greater had an odds of poor outcome (less than 50% improvement) that was 2.67 times that of patients with PCS scores of 15 or less, fixing the continuous covariates at their mean levels. The sensitivity analysis suggested a much greater effect with odds of poor outcome ($\leq$ 4 WOMAC points of improvement at 6 months) that was more than six times greater in patients with PCS scores of 16 or greater as compared with patients with lower scores. In the sensitivity analysis, the only other psychologic measures that entered the WOMAC pain models were the self-efficacy measure and the kinesiophobia measure. These measures were significant in only one of the two models, which suggest these measures may not be stable predictors of poor outcome.

We examined the potential role of self-efficacy and fear of movement by treating these variables as continuous measures in our models, unlike the PCS, which we dichotomized to separate the high pain catastrophizers from the low pain catastrophizers. In a post hoc analysis, we dichotomized the self-efficacy and fear of movement measures much as we did with the PCS in the current models. Self-efficacy and fear of movement did not enter the prediction models for either WOMAC pain or function prediction even when the data were dichotomized to capture patients with the highest levels of fear or the lowest self-efficacy. These analyses confirmed the PCS was the key psychologic predictor of poor pain outcome. We conducted a similar post hoc analysis to determine if type of knee arthroplasty (total versus unicompartmental) influenced the outcome. Type of knee arthroplasty also did not enter the prediction models and suggests PCS findings are robust and are not dependent on whether the patient receives a total or a unicompartmental knee arthroplasty. We are unaware of evidence suggesting patients with unicompartmental knee arthroplasty should respond differently than patients with total knee arthroplasty regarding the role of psychologic distress on outcome. However, use of patients with differing surgical procedures is a limitation of the study.

For WOMAC function outcomes, only the PCS score stayed in the model after adjustment for confounders. For the primary outcome measure with less than 50% improvement, the PCS had odds of 2.18 indicating that patients scoring 16 or greater on the PCS were more likely to have a poor outcome as compared with patients scoring less than 16 on the PCS, fixing the continuous covariate measures at their mean levels. However, the PCS was not significant in the sensitivity test model using the improvement of 15 points or less on the WOMAC function scale. These findings suggest PCS may not be an important predictor of function outcome but additional study is warranted.

We were surprised to find the PCS was the only predominant predictor of poor pain outcome in our study. Approximately 20% of our sample had symptoms of major depression and an additional 20% had symptoms of generalized anxiety disorder. With the exception of panic disorder, the score ranges for all the mental health measures suggested we had a reasonable representation of the various disorders that we assessed, yet most did not predict poor outcome. We suspect that because the therapeutic effect of knee arthroplasty is so large (approximately 50% improvement in WOMAC pain and function at 6 months) that most of the potentially deleterious effects of these mental health disorders are washed out by the large surgical treatment effect. It appears that only pain catastrophizing is associated with a substantial negative effect on outcome.

We found only one other study that examined whether the PCS predicted poor pain outcome after knee arthroplasty [14]. The authors found preoperative PCS scores were greater in the patients who reported persistent pain 2 years after surgery [14]. However, they examined only 48 patients and did not conduct a multivariable analysis to adjust for potential confounders or determine whether other specific mental health disorders also may have influenced outcome.

Pain catastrophizing is a concept that has substantial support [6, 9, 25, 27]. Our study appears to add to this literature by estimating the magnitude of effect of pain catastrophizing on 6-month pain and function outcomes. These data argue for development of a perioperative behavioral pain-coping intervention for patients with high pain catastrophizing before knee arthroplasty. Behavioral interventions designed to reduce pain catastrophizing that are delivered by phone and in person are effective for patients treated medically for arthritis [8]. There appears to be potential for improvements, in particular pain outcome, after a behavioral pain-coping intervention in select patients scheduled for knee arthroplasty.

Acknowledgments We thank the patients who consented to participate and the orthopaedic surgeons who conducted the surgeries.

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