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Preoperative expectations and early postoperative met expectations of extremity orthopaedic surgery

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ABSTRACT

Background: Preoperative patient expectations and met expectations are likely associated with the outcome of treatment. However, there is a lack of data regarding the preoperative expectations and early postoperative met expectations of patients undergoing extremity orthopaedic surgery. The purpose of this study was to identify the predictors of early postoperative met expectations in a cohort of patients undergoing extremity orthopaedic surgery and to assess the relationship between patient expectations and patient-reported outcome (PRO) measures. We hypothesized that patients with higher preoperative expectation scores and higher postoperative met expectation scores would have better early postoperative outcomes.

Methods: Four hundred thirty-five patients age seventeen and older who underwent extremity orthopaedic surgery at one institution were prospectively enrolled in this study. Each patient completed a preoperative questionnaire that included an assessment of demographics, pain, function, general health, treatment expectations, activity level, and Patient-Reported Outcome Measurement Information System (PROMIS) computer adaptive testing. Expectations were evaluated using the Expectations Domain of the Musculoskeletal Outcomes Data Evaluation and Management System (MODEMS) questionnaire. Patients completed a follow-up questionnaire two weeks after surgery that also assessed MODEMS met expectations and satisfaction (Surgical Satisfaction Questionnaire (SSQ-8)).

Results: The mean preoperative expectation score was 86.95 ± 16.59, and the mean postoperative met expectation score was 55.02 ± 27.63 (0–100 scale with 100 representing the highest level of expectations). Greater met expectations were significantly associated with white race ($p = 0.025$), college degree ($p = 0.011$), and higher income ($p = 0.002$). Greater met expectations were also significantly associated with greater postoperative physical function, social satisfaction, activity level, and subjective improvement, as well as lower pain interference, joint pain, body pain, fatigue, anxiety, and depression ($p < 0.01$ for each). Multivariable analysis results found that less postoperative joint pain and greater postoperative social satisfaction, improvement, and physical function were all significant independent predictors of greater met expectations at two weeks postoperative ($p < 0.01$ for each).

Conclusion: Greater preoperative expectations are associated with better activity and less pain two weeks after surgery. Met expectations of extremity orthopaedic surgery were associated with postoperative physical function, social satisfaction, activity, pain, anxiety, depression, and subjective improvement. These results may have implications for preoperative counseling and risk factor modification.

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1. Introduction

The incidence of orthopaedic procedures in the U.S. has significantly increased in recent years and will likely continue to rise because of the increasingly active and aging population.[1,2] This

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Table 1
Preoperative MODEMS expectation scores.

What Results Do You Expect From Your Treatment?	Number (%) of Patients Reporting Level of Expectation							
	Not at all likely (1)	Slightly likely (2)	Somewhat likely (3)	Very likely (4)	Extremely likely (5)	Mean Score*	Standard Deviation:	n=
1. Relief from symptoms (pain, stiffness, swelling, numbness, weakness, instability)	2 (0.0%)	1 (0.0%)	30 (7.1%)	118 (27.8%)	274 (64.5%)	88.88	16.95	425
2. To do more everyday household or yard activities	5 (1.2%)	9 (2.1%)	30 (7.1%)	88 (20.9%)	289 (68.6%)	88.42	20.36	421
3. To sleep more comfortably	3 (0.7%)	11 (2.7%)	41 (10.1%)	82 (20.2%)	268 (66.2%)	87.10	21.00	405
4. To go back to my usual job	12 (3.4%)	4 (1.1%)	25 (7.0%)	73 (20.6%)	241 (67.9%)	87.11	23.27	355
5. To exercise and do recreational activities	3 (0.7%)	7 (1.6%)	36 (8.5%)	94 (22.1%)	285 (67.1%)	88.29	19.42	425
6. To prevent future disability	7 (1.7%)	13 (3.2%)	58 (14.2%)	95 (23.3%)	235 (57.6%)	82.97	23.73	408
Overall Mean Preoperative Expectations:						**86.95**	16.59	

*The mean expectations score was converted to a 100-point scale, where higher values indicated more met expectations.

increase is likely due in part to the growth of experience in elective orthopaedic surgeries and the subsequent increase in the population considered as candidates for these surgeries.[3] With the expansion of elective orthopaedic surgeries, patient reported outcomes (PROs) have been given greater weight in consideration of operative success and have also been increasingly linked to reimbursement rates from healthcare payers.[1,3]

Several studies have established an association between met expectations of orthopaedic surgery and postoperative satisfaction, with most studies finding that patients who had their preoperative expectations met are more satisfied postoperatively.[3–9] These studies have focused on the expectations of joint- or procedure-specific cohorts.[10–16] Although the findings provide important consideration for the patient populations analyzed, the specificity of these studies can limit the applicability to the population of extremity orthopaedic surgeries as a whole. Furthermore, there has been a lack of data regarding the association between met expectations and treatment outcomes in patients undergoing orthopaedic surgery, especially in the early-postoperative period.

Preoperative expectations are measured through multiple tools, which include the Hospital for Special Surgery (HSS) Expectations Survey, the Expectations Domain of Musculoskeletal Outcomes Data Evaluation and Management System (MODEMS), the Expectations Domain of the New Knee Society Scoring System, and the Sunnybrook Surgery Expectations Survey.[3] However, many of these tools are untested and have only been used in single studies, which limits the ability to compare patient-reported data across studies.[3] The Expectations Domain of MODEMS is a validated instrument that assesses patient expectations and can be utilized in patients undergoing all types of orthopaedic procedures on any joint.[3,17] Currently, no studies utilizing MODEMS expectations have assessed a general population of patients undergoing extremity orthopaedic surgery.

The purpose of this study was to identify the predictors of early postoperative met expectations in a cohort of patients undergoing extremity orthopaedic surgery and to assess the relationship between patient expectations and patient-reported outcome (PRO) measures. We hypothesized that patients with higher preoperative expectation scores and higher postoperative met expectation scores would have better early postoperative outcomes.

2. Methods

Patients at least 17 years of age undergoing extremity orthopaedic surgery at the University of Maryland Rehabilitation and Orthopaedic Institute were eligible for enrollment into the Maryland Orthopaedic Registry (MOR), which is an institutional review board (IRB) approved, web-based registry.[2] Patients were excluded from participation in the study if they were unable to read or write English, were incarcerated, or were a ward of the state. Eligible patients were enrolled from 8/30/2016 to 3/19/2018 and provided informed consent. Perioperative patient education was conducted for each procedure as per each surgeon's standard practice and was not intentionally altered for study design or as a result of the survey. Perioperative patient analgesia was given based on the type of procedure as well as provider and patient preferences and was not intentionally altered for study design or as a result of the survey.

Within one week of surgery, patients completed an electronic baseline preoperative assessment. The following questionnaires were included in this baseline assessment: Patient-Reported Outcomes Measurement Information System (PROMIS) computer-adaptive testing (Physical Function, Pain Interference, Fatigue, Social Satisfaction, Anxiety, and Depression), the Expectations Domain of MODEMS, Visual Analog Pain Scale, the Tegner activity scale, the International Physical Activity Questionnaire (IPAQ), the Marx Activity Rating Scales, the International Knee Documentation Committee Subjective Knee Evaluation Form, the American Shoulder and Elbow Surgeons (ASES) Shoulder Assessment Form, and the Brief Michigan Hand Questionnaire (BHMQ).[2] After the baseline questionnaires, patients' electronic medical records were also reviewed for surgical and patient factors, including the Current Procedural Terminology (CPT) Codes, American Society of Anesthesiologists (ASA) score, Charlson Comorbidity Index, Braden Scale, smoking status, alcohol use, and current medications (including presence of preoperative narcotics).[2] After the baseline assessment, patients received a questionnaire at two weeks to

Table 2
Preoperative vs. Early Postoperative Met Expectation Scores by Joint.

	Normalized Expectation Score				p-value
	Preoperative (±SD)	n=	2-Week Follow-Up (±SD)	n=	
Shoulder	86.80 (18.14)	115	53.57 (27.98)	114	< **0.0001**
Elbow	89.60 (12.61)	25	52.90 (22.70)	25	< **0.0001**
Hand or Wrist	84.60 (17.73)	69	57.35 (26.26)	69	< **0.0001**
Hip	89.63 (13.36)	39	59.13 (27.34)	38	< **0.0001**
Knee	87.82 (15.54)	174	54.67 (29.10)	173	< **0.0001**
Foot or Ankle	74.02 (21.90)	11	51.74 (22.50)	12	**0.026**

Table 3
Early postoperative MODEMS met expectation scores.

Are the Results of Your Treatment What You Expected?	Number (%) of Patients Reporting Level of Expectation							
	Definitely yes (1)	Probably yes (2)	Not sure (3)	Probably not (4)	Definitely not (5)	Mean Score*	Standard Deviation:	n=
1. Relief from symptoms (pain, stiffness, swelling, numbness, weakness, instability)	106 (25.4%)	142 (34.1%)	121 (29.0%)	21 (5.0%)	27 (6.5%)	67.05	27.31	417
2. To do more everyday household or yard activities	73 (18.9%)	84 (21.7%)	111 (28.7%)	45 (11.6%)	74 (19.1%)	52.39	33.99	387
3. To sleep more comfortably	79 (19.0%)	105 (25.3%)	75 (18.1%)	51 (12.3%)	105 (25.3%)	50.12	36.70	415
4. To go back to my usual job	96 (25.8%)	94 (25.3%)	71 (19.1%)	35 (9.4%)	76 (20.4%)	56.65	36.5	372
5. To exercise and do recreational activities	64 (16.1%)	97 (24.4%)	111 (28.0%)	34 (9.4%)	91 (22.9%)	50.57	34.42	397
Overall Mean Early Postoperative Met Expectations:						**55.02**	27.63	

*The mean expectations score was converted to a 100-point scale, where higher values indicated more met expectations.

assess their met expectations (Expectation Domain of MODEMS) and satisfaction (Surgical Satisfaction Questionnaire (SSQ-8)).[2]

The Expectations Domain of MODEMS was used to assess patients' preoperative and met expectations.[3,16,17] The baseline questions measured preoperative expectations for relief of symptoms, relief from sleep issues, prevention of future disability, and return to daily household activities, work, and exercise. Patients rated these questions on a scale from 1 to 5, where 1 corresponded to the lowest level of expectations ("Not at all likely") and 5 corresponded to the highest level of expectations ("Extremely likely").[17] The follow-up questions assessed if the preoperative expectations were met. Patients rated the questions on a scale from 1 to 5, where 1 corresponded to completely met expectations ("Definitely yes") and 5 corresponded to unmet expectations ("Definitely not").[17] Preoperative expectation scores (baseline MODEMS) were then converted to a 0–100 point score, with a score of 0 representing the lowest level of expectations and a score of 100 representing the highest level of expectations. Met expectations were also converted to a 0–100 point score, with 0 representing the lowest level of met expectations and 100 representing completely met expectations.

The study data from pre- and postoperative questionnaires as well as the patients' medical record data was collected using the Research Electronic Data Capture (REDCap™).[18] De-identified patient data were extracted from REDCap™ and analyzed using bivariate and multivariable statistical analysis. Potential confounding variables were controlled with multivariable analysis.

2.1. Statistical analyses

Mean preoperative expectation and met expectation scores for categorical variables were compared using ANOVA. Significant differences were identified with p-values < 0.05. Associations between preoperative expectations, met expectations, and other continuous variables were assessed using Spearman's correlation coefficients (ρ), with significant differences identified with p-values < 0.05.

A multivariable regression model was created with all baseline categorical variables and two-week patient-reported outcome variables as possible independent predictors of two-week met expectations. Backward, stepwise, linear regression was used to create a model in which all remaining variables were significant independent predictors of two-week met expectations. Significant differences were identified with p-values < 0.05.

3. Results

A cohort of 435 patients undergoing extremity orthopaedic surgery who completed both baseline and two-week postoperative assessments were analyzed in this study. The frequency of patient responses to the preoperative expectation questionnaires are listed in Table 1. Overall, patients had high preoperative expectations, with a mean baseline expectation score of 86.95 ± 16.59. More than 80% of patients rated each expectation question as either "extremely likely" or "very likely." Patients had the highest expectations for "relief from symptoms" (88.88 ± 16.95) and the lowest expectations for "prevention of future disability" (82.97 ± 23.37). Table 2 shows that patients undergoing hip surgery had the highest preoperative expectations (89.63 ± 13.36), and patients undergoing foot or ankle surgery had the lowest preoperative expectations (74.02 ± 21.90) ($p < 0.05$).

The frequency of patient responses to the early postoperative met expectation questionnaires are listed in Table 3. At two weeks postoperatively, patients had an overall mean met expectation score 55.02 ± 27.63. This mean score was significantly lower than the overall mean preoperative expectation score ($p < 0.0001$). Patients rated "relief from symptoms" as their most met expectation (67.05 ± 27.31) and rated "sleeping more comfortably" as their least met expectation (50.12 ± 36.70). The mean two-week met expectation scores by joint were also significantly lower than the preoperative expectation scores for each joint (Foot or Ankle, $p = 0.026$; all other joints, $p < 0.0001$) (Table 2). Patients undergoing hip surgery had the most met expectations (59.13 ± 27.34), and patients undergoing foot or ankle surgery had the least met expectations (51.74 ± 22.50); however, the difference between these groups was not significant ($p > 0.05$).

An overview of the demographics with the mean met expectation scores for each categorical classification are shown in Table 4. Patients who identified as "white" for their race, graduated from college, were employed or a student, or earned more than $70,000 had significantly higher met expectation scores ($p < 0.05$). Patients who had a family/friend caregiver available had significantly lower met expectation scores compared to patients who did not have a family or friend available ($p = 0.025$).

Correlations between met expectations and continuous demographic variables are shown in Table 5. There were no significant correlations between met expectations and age ($p = 0.63$) or BMI ($p = 0.74$). A greater Charlson Comorbidity Index score was significantly associated with a lower met expectation score ($\rho = -0.14$, $p = 0.032$). There were no significant correlations between met expectations and number of surgeries ($\rho = 0.008$, $p = 0.88$), number of orthopaedic surgeries ($\rho = -0.03$, $p = 0.54$), or

Table 4
Categorical Patient Demographics vs. Mean Early Postoperative Met Expectation Scores.

	Number of Patients (Percent):	Mean Met Expectations Score (±SD):	p-value
Sex: (n = 435)			
Male	232 (53%)	57.23 (27.57)	0.07
Female	203 (47%)	52.46 (27.54)	
Race: (n = 431)			
Black	95 (22%)	48.12 (30.24)	**0.025**
White	298 (69%)	56.80 (26.58)	
Other	38 (9%)	56.96 (26.71)	
Ethnicity: (n = 428)			
Non-Hispanic or Latino	400 (93%)	55.26 (27.29)	0.33
Hispanic or Latino	28 (7%)	49.96 (31.60)	
Education: (n = 430)			
Not a College Graduate	206 (48%)	51.38 (28.41)	**0.011**
College Graduate or Above	224 (52%)	58.12 (26.33)	
Employment status: (n = 435)			
Currently Employed	277 (64%)	56.44 (27.76)	**0.001**
Student	67 (15%)	61.29 (25.70)	
Not Currently Employed/Other	91 (21%)	46.02 (26.76)	
Marital Status: (n = 429)			
Married or domestic partnership	197 (46%)	57.50 (26.76)	0.08
Single/Other	232 (54%)	52.74 (28.33)	
Caregiver Status: (n = 432)			
Available	423 (98%)	54.57 (27.61)	0.06
Not Available	9 (2%)	72.04 (24.53)	
Family/Friend Caregiver Status: (n = 425)			
Family/Friend Available	412 (97%)	54.21 (27.58)	**0.025**
Family/Friend Not Available	13 (3%)	71.60 (24.83)	
Income: (n = 435)			
Less than $70,000	174 (40%)	50.08 (28.85)	**0.002**
More than $70,000	241 (55%)	59.19 (26.40)	
Not Reported	20 (5%)	48.08 (23.45)	
Insurance Status: (n = 435)			
Uninsured	68 (16%)	54.09 (30.25)	0.41
Employer Sponsored Coverage or Other Private	303 (69.7%)	56.05 (27.52)	
Government Sponsored	64 (14.7%)	51.05 (25.16)	
Smoking Status: (n = 428)			
Smoker	43 (10%)	48.79 (28.66)	0.13
Never smoked	307 (72%)	56.79 (26.89)	
Quit Smoking	78 (18%)	52.60 (29.12)	
Recreational Drug Use: (n = 435)			
No	404 (93%)	55.09 (27.49)	0.84
Yes	31 (7%)	54.05 (29.77)	
Recreational Marijuana Use: (n = 435)			
No	410 (94%)	55.33 (27.47)	0.35
Yes	25 (6%)	49.97 (30.15)	
Alcohol Consumption: (n = 430)			
Never	123 (29%)	53.47 (28.98)	0.66
1-4 times per month	198 (46%)	55.22 (27.61)	
2 or more times per week	109 (25%)	56.79 (26.23)	
Preoperative Opioid Use: (n = 431)			
No	320 (74%)	56.07 (27.54)	0.10
Yes	111 (26%)	50.98 (27.47)	
ASA Score: (n = 425)			
1	166 (39%)	56.26 (28.22)	0.53
2	230 (54%)	53.80 (27.02)	
3	29 (7%)	51.03 (28.17)	
Depression Symptoms: (n = 434)			
No	382 (88%)	55.63 (26.99)	0.21
Yes	52 (12%)	50.46 (32.00)	
Operative Joint (n = 435)			
Upper Extremity	209 (48%)	54.75 (26.78)	0.84
Lower Extremity	226 (52%)	55.27 (28.45)	
Laterality (n = 433)			
Left Extremity	228 (53%)	55.03 (28.76)	0.95
Right Extremity	205 (47%)	55.20 (26.23)	
Prior Operation on Operative Joint (n = 433)			
No	339 (78%)	55.61 (27.18)	0.49
Yes	94 (22%)	53.37 (28.96)	
Injury Prior to Surgery: (n = 435)			
No	153 (35%)	56.36 (26.64)	0.46
Yes	282 (65%)	54.30 (28.16)	
Workers' Compensation: (n = 435)			
No	420 (97%)	55.38 (27.53)	0.16
Yes	15 (3%)	45.08 (29.35)	
Legal Claim: (n = 435)			

Table 4 (*continued*)

	Number of Patients (Percent):	Mean Met Expectations Score (±SD):	p-value
No	405 (93%)	55.65 (27.54)	0.08
Yes	30 (7%)	46.54 (27.77)	
Legal Claim (MVC): (n = 435)			
No	426 (98%)	55.19 (27.61)	0.37
Yes	9 (2%)	46.81 (28.53)	
Legal Claim (PI): (n = 435)			
No	421 (97%)	55.11 (27.55)	0.69
Yes	14 (3%)	52.14 (30.62)	

Table 5
Continuous Patient Demographics vs. Mean Early Postoperative Met Expectation Scores.

Demographic:	Mean (±SD)	Spearman's ρ*	p-value
Mean Age in years	41.09 (15.68)	0.02	0.63
Mean in BMI kg/m^2	29.39 (6.66)	0.02	0.74
Charlson Comorbidity Index	2.08 (1.39)	−0.14	**0.032**
Number of Surgeries (ANY)	3.52 (5.1)	0.008	0.88
Number of Orthopaedic Surgeries	1.37 (2.33)	−0.03	0.54
Number of Surgeries on Operative Joint	0.35 (0.87)	−0.04	0.42

*ρ, Spearman's rank correlation coefficient (vs. Mean Early Postoperative Met Expectation Scores).

Table 6
Preoperative and met expectations for the top 10 CPT codes for upper and lower extremity procedures.

CPT Code:	Count:	Procedure Description:	Mean Preoperative Expectations Score:	Mean Met Expectations Score:
Upper Extremity Procedures:				
29826	38	Arthroscopy, shoulder, surgical; decompression of subacromial space with partial acromioplasty, with coracoacromial ligament (i.e., arch) release, when performed	91.4 ± 17.5	52.8 ± 27.7
23430	23	Arthroscopy, shoulder, surgical; decompression of subacromial space with partial acromioplasty, with coracoacromial ligament (i.e., arch) release, when performed	86.1 ± 18.0	45.8 ± 25.7
29806	22	Arthroscopy, shoulder, surgical; capsulorrhaphy	89.4 ± 12.4	57.1 ± 26.6
29825	21	Arthroscopy, shoulder, surgical; with lysis and resection of adhesions, with or without manipulation	93.6 ± 10.2	53.8 ± 30.5
29823	20	Arthroscopy, shoulder, surgical; debridement, extensive	88.2 ± 15.4	58.5 ± 29.7
23472	17	Arthroplasty, glenohumeral joint; total shoulder (glenoid and proximal humeral replacement (e.g., total shoulder))	79.6 ± 21.1	47.0 ± 26.5
29827	16	Arthroscopy, shoulder, surgical; with rotator cuff repair	89.4 ± 22.4	56.4 ± 30.1
64721	14	Neuroplasty and/or transposition; median nerve at carpal tunnel	88.3 ± 17.7	65.6 ± 21.9
26055	11	Tendon sheath incision (e.g., for trigger finger)	87.8 ± 19.9	57.0 ± 25.2
29824	10	Arthroscopy, shoulder, surgical; distal claviculectomy including distal articular surface (Mumford procedure)	91.3 ± 16.5	59.5 ± 21.2
Lower Extremity Procedures:				
29888	65	Arthroscopically aided anterior cruciate ligament repair/augmentation or reconstruction	86.3 ± 20.7	47.5 ± 31.2
29881	60	Arthroscopy, knee, surgical; with meniscectomy (medial OR lateral, including any meniscal shaving) including debridement/shaving of articular cartilage (chondroplasty), same or separate compartment(s), when performed	89.5 ± 14.3	58.5 ± 28.9
29876	49	Arthroscopy, knee, surgical; synovectomy, major, 2 or more compartments (e.g., medial or lateral)	86.8 ± 20.5	59.4 ± 27.4
29882	30	Arthroscopy, knee, surgical; with meniscus repair (medial OR lateral)	88.25 ± 15.3	55.4 ± 33.7
29879	28	Arthroscopy, knee, surgical; abrasion arthroplasty (includes chondroplasty where necessary) or multiple drilling or microfracture	84.1 ± 20.5	52.3 ± 28.3
29877	22	Arthroscopy, knee, surgical; debridement/shaving of articular cartilage (chondroplasty)	86.6 ± 15.4	51.6 ± 30.7
29914	16	Arthroscopy, hip, surgical; with femoroplasty (i.e., treatment of cam lesion)	94.1 ± 8.1	51.6 ± 31.4
29916	15	Arthroscopy, hip, surgical; with labral repair	93.8 ± 8.2	50.8 ± 32.3
29874	13	Arthroscopy, knee, surgical; for removal of loose body or foreign body (eg, osteochondritis dissecans fragmentation, chondral fragmentation)	85.9 ± 18.7	54.3 ± 25.3
27130	12	Arthroplasty, acetabular and proximal femoral prosthetic replacement (total hip arthroplasty), with or without autograft or allograft	90.8 ± 9.3	52.9 ± 26.6

Expectations were analyzed against Current Procedural Terminology (CPT) code using ANOVA. Upper Extremity Procedures: There were no significant differences in Preoperative Expectations between CPT codes ($p = 0.49$) or Met Expectations ($p = 0.60$). Lower Extremity Procedures: There were no significant differences in Preoperative Expectations between CPT codes ($p = 0.64$) or Met Expectations ($p = 0.67$).

number of surgeries on the operative joint ($\rho = -0.04$, $p = 0.42$).

A list of the top 10 CPT codes for upper and lower extremity procedures with an analysis of preoperative and met expectations by CPT code is shown in Table 6. There were no differences in either preoperative or met expectations based on CPT code for upper and lower extremity procedures ($p > 0.40$).

Correlations between met expectations and PROs for the preoperative and early postoperative time points are shown in Table 7. Greater mean met expectations were significantly associated with greater preoperative PROMIS Physical Function ($\rho = 0.12$, $p = 0.012$), IKDC score ($\rho = 0.19$, $p = 0.012$), and Current Tegner Score ($\rho = 0.12$, $p = 0.016$). Greater mean met expectations were significantly associated with lower preoperative PROMIS Fatigue ($\rho = -0.10$, $p = 0.034$), Anxiety ($\rho = -0.14$, $p = 0.003$), and

Table 7
PRO Measures vs. Early Postoperative Met Expectations.

PRO Measure:	Mean Score (±SD)	Spearman's ρ*	p value
PREOPERATIVE:			
PROMIS Physical Function	42.06 (8.83)	0.12	**0.012**
PROMIS Social Satisfaction	42.38 (9.29)	0.08	0.10
PROMIS Pain Interference	60.07 (7.04)	−0.06	0.23
PROMIS Fatigue	51.52 (10.36)	−0.10	**0.034**
PROMIS Anxiety	54.90 (8.74)	−0.14	**0.003**
PROMIS Depression	48.70 (9.36)	−0.10	**0.032**
IKDC	51.02 (16.16)	0.19	**0.012**
ASES	41.91 (21.30)	0.14	0.09
BMHQ	47.77 (19.36)	0.17	0.15
NPS Joint	4.86 (2.78)	−0.10	**0.045**
NPS Body	1.34 (1.98)	−0.12	**0.014**
IPAQ MET-Minutes/Week	7269 (6025)	0.07	0.19
Tegner Score, Pre-Injury	5.87 (2.67)	0.00	0.99
Tegner Score, Current	2.24 (1.87)	0.12	**0.016**
Marx Lower ARS	38.83 (36.98)	0.04	0.36
Marx Upper ARS	57.55 (29.43)	0.07	0.14
Braden Score	22.65 (1.03)	0.03	0.48
Charlson Score	2.08 (1.39)	−0.14	**0.032**
EARLY POSTOPERATIVE:			
PROMIS Physical Function	35.53 (8.90)	0.26	< **0.0001**
PROMIS Social Satisfaction	38.99 (8.07)	**0.30**	< **0.0001**
PROMIS Pain Interference	61.68 (7.63)	−0.26	< **0.0001**
PROMIS Fatigue	54.43 (10.02)	−0.25	< **0.0001**
PROMIS Anxiety	53.63 (9.55)	−0.24	< **0.0001**
PROMIS Depression	49.43 (10.49)	−0.16	**0.0007**
NPS Joint	4.09 (2.38)	**−0.34**	< **0.0001**
NPS Body	1.68 (2.15)	−0.15	**0.002**
IPAQ MET-Minutes/Week	3854 (3707)	0.27	< **0.0001**
Tegner Score, Current	1.15 (1.35)	0.26	< **0.0001**
Social Satisfaction	69.14 (15.99)	**0.40**	< **0.0001**
Improvement	56.01 (24.75)	**0.31**	< **0.0001**

*ρ, Spearman's rank correlation coefficient (vs. Mean Early Postoperative Met Expectation Scores).

Table 8
PRO Measures (Change and Early Postoperative) vs. Preoperative Expectations.

PRO Measure:	Mean Score (±SD)	Spearman's ρ*	p-value
CHANGE (2-WEEK SCORE − PREOPERATIVE SCORE):			
PROMIS Physical Function	−6.53 (9.99)	−0.08	0.11
PROMIS Social Satisfaction	−3.39 (10.11)	−0.007	0.88
PROMIS Pain Interference	1.61 (8.54)	0.01	0.81
PROMIS Fatigue	2.90 (10.54)	0.07	0.14
PROMIS Anxiety	−1.27 (8.39)	−0.01	0.81
PROMIS Depression	0.73 (7.99)	0.05	0.34
Joint Pain	−0.75 (2.92)	−0.02	0.75
Pain in the rest of the body	0.34 (2.14)	−0.07	0.14
IPAQ MET-Minutes/Week	−3641 (6336)	−0.15	**0.033**
Tegner Score	−1.10 (1.90)	−0.09	0.06
EARLY POSTOPERATIVE (2 WEEKS):			
PROMIS Physical Function	35.53 (8.90)	−0.01	0.78
PROMIS Social Satisfaction	38.99 (8.07)	0.01	0.84
PROMIS Pain Interference	61.68 (7.63)	0.03	0.58
PROMIS Fatigue	54.43 (10.02)	−0.01	0.85
PROMIS Anxiety	53.63 (9.55)	−0.01	0.80
PROMIS Depression	49.43 (10.49)	−0.04	0.44
NPS Joint	4.09 (2.38)	−0.05	0.27
NPS Body	1.68 (2.15)	−0.19	< **0.0001**
IPAQ MET-Minutes/Week	3854 (3707)	−0.07	0.27
Tegner Score, Current	1.15 (1.35)	0.04	0.37
Social Satisfaction	69.14 (15.99)	0.08	0.09
Improvement	56.01 (24.75)	0.05	0.31

*ρ, Spearman's rank correlation coefficient (vs. Mean Preoperative Expectations).

Depression ($\rho = -0.10$, $p = 0.032$), as well as lower preoperative joint pain ($\rho = -0.10$, $p = 0.045$) and pain in the rest of the body ($\rho = -0.12$, $p = 0.014$). Greater mean met expectations were significantly associated with greater two-week PROMIS Physical Function ($\rho = 0.26$, $p < 0.0001$), PROMIS Social Satisfaction ($\rho = 0.30$, $p < 0.0001$), IPAQ MET-Minutes/Week ($\rho = 0.27$, $p < 0.0001$), Current Tegner Score ($\rho = 0.26$, $p < 0.0001$), Social Satisfaction ($\rho = 0.40$, $p < 0.0001$), and Improvement ($\rho = 0.31$, $p < 0.0001$). Greater mean met expectations were significantly associated with lower two-week PROMIS Pain Interference ($\rho = -0.26$, $p < 0.0001$), Fatigue ($\rho = -0.25$, $p < 0.0001$), Anxiety ($\rho = -0.24$, $p < 0.0001$), and Depression ($\rho = -0.16$, $p = 0.0007$), as well as lower two-week joint pain ($\rho = -0.34$, $p < 0.0001$) and pain in the rest of the body ($\rho = -0.15$, $p = 0.002$).

Correlations between preoperative expectations and the change in PRO measures (two-week score − preoperative score) as well as two-week PRO measures are shown in Table 8. The only significant correlation between the change in a PRO measure and preoperative expectations was a weak, negative correlation between preoperative expectations and the change in IPAQ MET-Minutes/Week ($\rho = -0.15$, $p = 0.033$). This correlation indicates that patients with lower preoperative expectations tend to be much less active after surgery compared to before surgery. There was also a weak, negative correlation between preoperative expectations and early postoperative pain in the rest of body ($\rho = -0.19$, $p < 0.0001$).

The results of the multivariable analysis with met expectations are shown in Table 9. For the demographic variables, having a family/friend caregiver available ($p = 0.005$) and being unemployed (or other) ($p = 0.008$) were both significant independent predictors of less met expectations. Making more than $70,000/year ($p = 0.009$) was a significant independent predictor of greater met expectations. For the early postoperative PROs, greater early postoperative Social Satisfaction ($p < 0.0001$), Improvement ($p = 0.008$), and PROMIS Physical Function ($p = 0.002$) were significant independent predictors of greater met expectations. Less postoperative joint pain was a significant independent predictor of greater met expectations ($p = 0.002$).

4. Discussion

Due to the increasing number of orthopaedic procedures performed per year, more emphasis has been placed on patient-reported outcomes in the determination of operative success.[1–3,19–23] Several studies have demonstrated an association between met expectations and postoperative satisfaction in joint- or procedure-specific cohorts.[3–9] To date, there is little validated evidence on the association between met expectations and treatment outcomes in patients undergoing extremity orthopaedic surgery, especially in the early postoperative period. Also, while the Expectations Domain of MODEMS has been validated for a range of musculoskeletal disorders,[3,17] to our knowledge it has not been utilized in the assessment of early postoperative met expectations of a cohort of patients undergoing extremity orthopaedic surgery.

In this study, we determined that patients who had more met expectations of surgery had better early postoperative physical function, social satisfaction, and improvement, as well as less early postoperative pain, fatigue, anxiety, and depression. These results support our hypothesis that patients with higher postoperative met expectation scores would have better early postoperative outcomes. Several studies have also linked fulfilled expectations with better postoperative outcomes; however, these studies have assessed outcomes at later time points (3 months–5 years postoperatively) and in joint- or procedure-specific populations.[6–8,14,17,24] To our knowledge, our study is the first to show an association between fulfilled expectations and early postoperative outcomes in a cohort undergoing extremity orthopaedic surgery.

Although the average met expectation score (55.02 ± 27.63) was much lower compared to preoperative expectations (86.95 ± 16.59)

Table 9
Multivariate analysis of Early Postoperative Met Expectations.

Parameter:	Estimate	SE	t Ratio	p-value	Adjusted R^2
Family/Friend Caregiver Status (Available)	−19.8	7.1	−2.8	0.005	0.28
Employment Group (Not Currently Employed/Other)	−8.2	3.0	−2.7	0.008	
Income Status (more than $70,000/year)	6.8	2.6	2.6	0.009	
Early Postoperative PROMIS Physical Function	0.4	0.1	3.1	0.002	
Early Postoperative Joint Pain	−1.8	0.6	−3.1	0.002	
Early Postoperative Social Satisfaction	0.4	0.1	4.3	<0.0001	
Early Postoperative Improvement	0.1	0.1	2.7	0.008	

Estimate: regression coefficient

($p < 0.0001$), which is to be expected at an early time point postoperatively, our results indicate that more met expectations soon after surgery could be predicted by less pain as well as better functional and psychosocial outcomes. In our multivariable analysis, we found that having less early postoperative joint pain and greater early postoperative Improvement, Social Satisfaction, and PROMIS Physical Function were significant independent predictors of early postoperative met expectations. Our data demonstrates that striving to meet patient expectations of orthopaedic surgery could help to improve patient outcomes soon after surgery. In our study, "relief from symptoms" was the highest-scoring preoperative expectation and the most met expectation postoperatively. Therefore, correctly identifying patients' preoperative symptoms that are motivating an elective procedure and working to maximize relief of those specific symptoms during treatment could help to improve important early postoperative outcomes, such as pain, function, and psychosocial well-being.

We also found that patients with greater preoperative physical function and lower preoperative pain, fatigue, anxiety, and depression were more likely to have their expectations met after extremity orthopaedic surgery. Scott et al. also found that patients with better preoperative Oxford scores (assessment of pain and function) and mental health scores had greater fulfillment of their expectations of total hip and knee replacements.[5] Similarly, Mancuso et al. found that better preoperative health status was an independent predictor of more fulfilled expectations of total hip arthroplasty.[14] In a systematic review to determine the association between clinical status and patient expectations of joint arthroplasty procedures, Dyck et al. found that fulfillment of patient expectations was consistently associated with better baseline clinical status, including both disease-specific and general health measures.[24] This information, in conjunction with our data, could help surgeons during preoperative counseling, especially for elective procedures.

We found that patients with greater preoperative expectations had less of a decline in activity soon after surgery compared to before surgery and less early postoperative pain in the rest of the body. These results support our hypothesis that patients with higher preoperative expectation scores would have better early postoperative outcomes. In their systematic review of joint arthroplasty patients, Dyck et al. also found that greater preoperative patient expectations were consistently associated with better postoperative disease-specific and general health outcomes.[24] Similarly, Henn et al. found that greater preoperative expectations of rotator cuff repair were a significant independent predictor of both better performance at one year and greater improvement compared to baseline on several shoulder outcome measures.[16] These findings suggest that preoperative expectations should be an important consideration when determining the likely causes of postoperative outcomes of orthopaedic surgery.

Although this study was prospective and had a robust sample size with a diverse patient population, there were several limitations. First, all of the surgeries included in the study were conducted at an academic orthopaedic hospital, which can have key differences in patient population compared to non-academic centers. A multivariable analysis was used to attempt to control for this discrepancy. Second, our cohort consisted of more patients with shoulder ($n = 115$) and knee ($n = 174$) operations compared to the other joints (elbow, $n = 25$; hand or wrist, $n = 69$; hip, $n = 39$; foot or ankle, $n = 11$), which could limit the generalizability of our results. Third, there were some patients who completed the preoperative questionnaire but not the early postoperative questionnaire, and we found some significant differences between this group of patients and those who completed both preoperative and early postoperative questionnaires.[25] Lastly, our study design did not fully account for differences in patient education or administration of analgesia, both of which may impact met expectations.[26,27] However, we found no significant differences in preoperative or met expectations by CPT code. As each procedure contains unique qualities to its patient education and analgesia administration, our findings provide some evidence that these factors did not impact met expectations.

Many studies have provided substantial evidence in joint- and procedure-specific populations to support the hypothesis that greater preoperative expectations and postoperative met expectations can predict better postoperative outcomes.[3–9,14,16,17] In our study, we found that both greater preoperative expectations and early postoperative met expectations were significantly associated with better early postoperative outcomes in a cohort of patients undergoing extremity orthopaedic surgery. Future studies will be necessary to assess the postoperative expectations and outcomes of patients undergoing extremity orthopaedic surgery at later time points postoperatively.

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Declaration of competing interest

We have no potential conflicts of interest to disclose.

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