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Predictors of Satisfaction Following Total Knee Arthroplasty

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ABSTRACT

Despite the success of total knee arthroplasty (TKA), numerous studies report that nearly one in five patients who underwent TKA was unsatisfied with their outcome. The purpose of our study was to identify the preoperative factors predictive of satisfaction following well-performed TKA. Using improvement in patient-reported outcomes less than the minimally clinically important change as an indicator of dissatisfaction in a cohort of primary TKA patients, we found that patients with greater preoperative pain and disability with less severe degradation in health-related quality of life were more likely to be satisfied with the result of TKA. Balancing severity of symptoms and impact to quality of life is important when counseling patients considering TKA.

Dissatisfaction following total knee arthroplasty (TKA) continues to be a significant problem. Nearly one in five patients who have undergone TKA is not satisfied with the outcome [1,2]. Satisfaction after TKA has been associated with chronicity of the disease state, fulfilled expectations and improvement in pain and function following surgery [1,3–5]. Predictors of dissatisfaction include postoperative complications requiring hospital readmission and low patient-reported outcome measures (PROMs) preoperatively and at 1-year follow-up [1]. Ethnic and socioeconomic factors have also been linked to poor outcomes following TKA [6].

The outcome of an intervention such as TKA can be effectively assessed using PROMs [7,8]. However, a statistically significant change in a PROM may not always equate to a clinically significant change in outcome. The minimally clinically important change (MCIC), defined as "…the smallest difference in score in the domain of interest which patients perceive as beneficial…," can be used to determine if a clinically relevant change in outcome has occurred [9,10].

Patients who did not report an MCIC in PROMs may not perceive a benefit following surgery and may be dissatisfied with their outcome. The purpose of our study was to identify preoperative factors predictive of satisfaction following well-performed TKA. These patient characteristics assessed preoperatively can aid in the indication of patients for TKA and to tailor a discussion of expectations following TKA.

Materials and Methods

Through our institutional IRB-approved Total Joint Replacement Registry, we retrospectively reviewed all patients who underwent primary unilateral TKA at our institution between May 2007 and November 2010. Baseline and 2-year follow-up data were collected. Patients were eligible for inclusion if they had a diagnosis of osteoarthritis, underwent primary unilateral TKA, gave consent to participate in our Total Joint Replacement Registry, and completed baseline and 2-year follow-up surveys. Patients without complete baseline and 2-year follow-up questionnaires were excluded. Patients with a diagnosis of inflammatory arthritis, who underwent simultaneous bilateral TKA, or underwent revision TKA prior to completing the 2-year follow-up survey were excluded. Patients who underwent contralateral TKA within the 2-year follow-up period were also excluded from analysis.

Sixteen thousand one hundred primary unilateral TKAs were performed during the collection period for this cohort. Of these cases, 4864 patients did not consent to participate in the registry. An additional 4829 patients were excluded from this study as they underwent a contralateral TKA or revision TKA during the 2-year follow-up period. Also excluded were 1247 and 1219 patients who did not complete the baseline or 2-year follow-up surveys, respectively. An additional 657 cases were excluded for incomplete WOMAC surveys at baseline or 2-year follow-up; and 934 patients were excluded for a diagnosis of inflammatory arthritis.

The data collected from the registry database included baseline demographics, preoperative and intraoperative health characteristics, and PROMs. Baseline demographics and health characteristics included age, gender, height, weight, the American Society of Anesthesiologists (ASA) physical status classification, procedure duration, length of stay (LOS), and Charlson–Deyo comorbidity index. The PROMs collected at both baseline and follow-up at 2 years included: the Western Ontario

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Table 1
Summary of Demographic Data.

	Mean ± STD
Age (years)	66.7 ± 9.6
Body-mass Index	30.2 ± 5.9
Length of Stay	5.0 ± 1.4
	N (%)
Female	1342 (57.1%)
Race	
White	2108 (90.8%)
Black	101 (4.3%)
Hispanic	64 (2.8%)
Other race	49 (2.1%)
Education	
High school or less	357 (15.4%)
Some college to college	1121 (48.4%)
Postgraduate	839 (36.2%)
American Society of Anesthesiologists Classification	
1–2	477 (79.7%)
3–4	477 (20.3%)
Chalson–Deyo Comorbidity Index	
0	1711 (72.9%)
1–2	569 (24.2%)
3+	68 (2.9%)

and McMaster Universities Arthritis Index (WOMAC), Knee and Osteoarthritis Outcome Score (KOOS), Lower Extremity Activity Scale (LEAS), EuroQol (EQ) instrument, and Visual Analog Scale for pain (VAS pain). An expectations survey was administered at baseline and a satisfaction survey was collected at the 2-year follow-up.

An anchor-based method was used to determine the MCICs of PROMs. The anchor was based on the following six-point question regarding perceived improvement in quality of life on the 2-year follow-up satisfaction survey:How much did your knee surgery improve the quality of your life?

1. More improvement than I ever dreamed possible
2. A great improvement
3. A moderate improvement
4. A little improvement
5. No improvement at all
6. The quality of my life is worse

This question was used to distinguish the patients who were substantially improved from the patients who were not substantially improved [10]. To accomplish this, the responses were categorized into improved (responses 1–3), unchanged (responses 4–5) and deteriorated (response 6) quality of life. Using a receiver operating characteristic (ROC) curve analysis we defined an optimal cutoff score as MCIC, discriminating between the improved and unchanged patients. Youden Index was used to identify this optimal cutoff value. The deteriorated patients were not considered in the construction of the ROC curves.

PROMs were evaluated using a change between baseline and follow-up at 2 years, and an improvement of PROM was defined as a change score on the PROM being greater than zero. We estimated the MCIC proportion (percent), which is the proportion of the sample with an improvement exceeding the MCIC. Patients who met the Bellamy criteria for severe disability (WOMAC domain scores <60) at baseline were eligible for the PROMs evaluation. Patients who had high baseline scores were removed from the PROMs evaluation to alleviate the problem of not having enough room in WOMAC for improvement. Patients were further classified into two groups for each of the PROMs according to the MCIC: an improvement in PROM exceeding the MCIC, and an improvement in PROM below the MCIC. Multiple logistic regression identified factors associated with improvement less than the MCIC. Parameters included in the model were age at surgery, gender, ethnicity, education, ASA classification, procedure duration, LOS, preoperative VAS pain score, LEAS, EQ and expectation score. All analyses were performed using SAS for Windows 9.3 (SAS Institute Inc., Cary, NC). A critical *P* value of 0.05 was set for all comparisons.

Table 3
Perceived Improvement in Quality of Life Due to Knee Arthroplasty at 2-Year Follow-Up.

Response	N (%)	Category	N (%)
More improvement than I ever dreamed possible	422 (18.3%)	Improved	2096 (91.0%)
A great improvement	1303 (56.6%)		
A moderate improvement	371 (16.1%)		
A little improvement	112 (4.9%)	Unchanged	158 (6.9%)
No improvement at all	46 (2.0%)		
The quality of my life is worse	49 (2.1%)	Deteriorated	49 (2.1%)

Results

We identified 2350 patients who underwent primary unilateral TKA and met the inclusion and exclusion criteria. The mean age of the patients in this cohort was 66.7 years and 57.1% were female. Mean body-mass index (BMI) of the cohort was 30.2. A summary of patient demographic data is included (Table 1).

There were improvements from baseline to 2-year follow-up in the WOMAC pain score (33.0 ± 19.9), stiffness score (31.6 ± 25.4) and function score (31.1 ± 19.3). There were also improvements from baseline to 2-year follow-up in the LEAS (1.7 ± 3.3) and VAS pain score (−43.4 ± 27.6) (Table 2). About 91% of patients reported improvement in quality of life at 2-year follow-up; 7.2% and 2.3% of patients reported no change or worsening quality of life, respectively, at 2-year follow-up (Table 3).

The cohort was then restricted to patients who met the Bellamy criteria for severe disability (WOMAC scores <60 at baseline) leaving 1604, 1717, and 1471 patients for WOMAC pain, stiffness, and function evaluations, respectively [11]. Of these, 71.54%, 81.19% and 77.09% of patients had improvement greater than or equal to the MCIC on the WOMAC pain, stiffness and function subscores, respectively, at 2-year follow-up (Table 4). Patients with higher EQ scores (better quality of life) at baseline were less likely to report improvement less than MCIC in the WOMAC pain, stiffness and function scores (OR 0.3 (95% CI 0.13–0.74), OR 0.21 (95% CI 0.08–0.60), OR 0.29 (95% CI 0.10–0.82), respectively). Patients with higher WOMAC scores at baseline were more likely to report improvement less than MCIC in the WOMAC pain, stiffness and function scores (OR 1.05 (95% CI 1.03–1.06), OR 1.06 (95% CI 1.04–1.07), OR 1.05 (95% CI 1.03–1.07), respectively). Patients with a

Table 2
Patient-Reported Outcome Scores at Baseline and 2-Year Follow-Up.

	Baseline	2-Year Follow-Up	
Instrument	Mean ± Std	Mean ± Std	*P*
WOMAC Pain Score	54.9 ± 17.3	87.9 ± 15.6	<.0001
WOMAC Stiffness Score	46.4 ± 20.4	78.0 ± 20.4	<.0001
WOMAC Function Score	54.3 ± 17.4	85.5 ± 16.0	<.0001
VAS Pain Score	54.9 ± 17.3	87.9 ± 15.6	<.0001

VAS, visual analog scale; WOMAC, Western Ontario and McMaster Universities Arthritis Index.

Table 4
Calculated Minimally Clinically Important Change (MCIC) Threshold Values for WOMAC Subscores and the Number of Patients with Improvement Greater than the MCIC at 2-Year Follow-Up.

	MCIC	Preoperative WOMAC Scores ≤ 60	Improvement > MCIC
WOMAC Pain Score	31.25	1606 (68.34%)	1149 (71.54%)
WOMAC Stiffness Score	25.00	1717 (73.06%)	1394 (81.19%)
WOMAC Function Score	26.93	1471 (62.60%)	1134 (77.09%)

WOMAC, Western Ontario and McMaster Universities Arthritis Index.