

# Patients' expectations about total knee arthroplasty outcomes

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## Abstract

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**Objective** The aim of this study was to ascertain patients' pre-operative expectations of total knee arthroplasty (TKA) recovery.

**Methods** Two hundred and thirty-six patients with knee osteoarthritis (OA) who underwent TKA completed self-administered questionnaires before their surgery. Patients' expectations of time to functional recovery were measured using an ordinal time–response scale to indicate expected time to recovery for each of 10 functional activities. Expected time to recovery was dichotomized into short- and long-term expectations for recovery of each activity using median responses. Knee pain and function were ascertained using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC). Other measures included the SF-36, the Depression, Anxiety and Stress Scale (DASS) and the Medical Outcomes Study Social Support Survey (MOS-SSS). Multivariate logistic regression was used to identify pre-operative characteristics associated with short- vs. long-term expectations.

**Results** Sixty-five percent of the patients were females and 70% Whites; mean age was 65 years. Patients were optimistic about their time to functional recovery: over 65% of patients expected functional recovery within 3 months. Over 80% of the patients expected to perform 8 of the 10 activities within 3 months. Patients who expected to be able to perform the functional activities in <6 weeks were more likely to be younger, male, and have lower self-reported pain and better general health before surgery compared to those who expected to be able to perform the activities 3 months post-surgery or later.

**Conclusion** Pre-operative patient characteristics may be important to evaluate when considering individual patients' expectations of post-operative outcomes.

Osteoarthritis (OA) severely impacts quality of life, contributing to long-term physical disability and detrimental psychosocial effects.<sup>1,2</sup> There is no cure for knee OA, but patients who fail medical treatment can elect to have total knee arthroplasty (TKA). Numerous studies have outlined patient characteristics that may be related to willingness to undergo surgery.<sup>3</sup> Previous research has shown that African Americans, compared to Whites or Hispanics, are less likely to opt for surgical treatment for knee osteoarthritis. The variation of preferences by race may be related to patient knowledge and outcome expectations.<sup>4–6</sup> Surgical expectations have been shown to be multidimensional and influenced by patient and clinical characteristics.<sup>7</sup> Moreover, pre-operative patient expectations can predict surgical outcomes.<sup>8</sup> Patients often report the importance of an outcome; however, they may not take into consideration time to recovery.<sup>7</sup> It is therefore necessary to obtain a more comprehensive understanding of patients' surgical outcome expectations, including which factors may influence these expectations, to avoid patient dissatisfaction after surgery.<sup>9</sup> Creating realistic individual expectations of surgical risks and benefits and time to functional recovery is imperative during patients' decision-making processes to ensure future satisfaction with TKA. The purpose of this study was to ascertain patient pre-operative expectations of time to recovery before undergoing TKA, and to determine which patient characteristics were associated with these expectations.

## Methods

### Participants

We included consecutive patients with OA scheduled to undergo TKA between 2004 and 2007 at St. Luke's Episcopal Hospital, a private hospital in Houston, TX. Inclusion criteria were as follows: (i) radiologic diagnosis of knee OA; (ii) no prior TKA; (iii) adequate cognitive status; (iv) living in the community at the time of the surgery (not in long-term care facilities); (v)

ability to communicate in English; (vi) access to a telephone; and (vii) 40 years of age or older. Patients were excluded if they were undergoing revision surgery, had inflammatory arthritis (e.g. rheumatoid arthritis, neurological disorders, Paget's or metabolic bone disorders), were involved in litigation processes, or were seeking or receiving workers' compensation benefits.

Six hundred and fifteen patients were originally identified; of these, 265 (43%) were ineligible. Of the 350 eligible patients, 90 (26%) declined to participate and 260 (74%) agreed to participate. Fourteen participants (0.5%) were excluded from this analysis because they underwent unicompartmental knee arthroplasty and not TKA. Therefore, 236 patients were included in this analysis. The study was approved by the Baylor College of Medicine, St Luke's Episcopal Hospital and The University of Texas MD Anderson Cancer Center's Institutional Review Boards.

### Data collection

All patients completed self-administered questionnaires upon enrolment, which included: demographic and clinical data, health status measured with generic and OA-specific instruments, psychosocial variables and measurement of patient pre-operative expectations.

#### *Demographic and clinical data*

Patient demographics included age, gender, marital status, education and ethnicity. Measurement of comorbidities included body mass index (BMI) and a questionnaire asking about current (nine conditions) and past (six conditions) co-morbidities. A simple count of current and/or past co-morbidities was used for analysis.

#### *Health status*

1. The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) was used to assess knee pain and function. It is scored from 0 to 100, with higher scores denoting worse outcomes. The WOMAC's responsiveness, reliability, validity and

internal consistency have been thoroughly tested.<sup>3,8,10–12</sup>

- Health-related quality of life (HRQoL) was measured with the Medical Outcomes Study Short Form version 2 (SF-36), a generic, multi-item health measure which inquires about the status of several dimensions of health in the past 4 weeks. Its validity, reliability and responsiveness have been tested in a variety of diseases and populations. It has been widely used in the OA and TKA populations.<sup>8,13–15</sup> We used the two composite scores for physical (PCS) and mental (MCS) health, and 7 subscales including role-physical (RP), bodily pain (BP), general health perceptions (GH), vitality (VT), social functioning (SF), role-emotional (RE) and mental health (MH). All SF-36 subscales range from 0 (worst health) to 100 (best health).<sup>16</sup> For the PCS and MCS, a score of 50 is a population-based norm, with each 10 point deviation from 50 representing one standard deviation.<sup>16,17</sup> We did not include the physical function subscale in our analyses to avoid collinearity with the WOMAC function subscale, as this was noted in preliminary analyses. Bodily pain was included because the pain items in the WOMAC are activity specific and differ from those of the SF-36. Moreover, during data analysis no collinearity between the two pain measures was noted.

#### *Psychosocial domains*

- Depression, Anxiety and Stress Scale (DASS-21) is a 21-item self-administered questionnaire with 3 subscales: depression, anxiety and stress. Possible scores range from 0 (none) to 21 (most severe).<sup>18</sup> Both the DASS-21 and its longer version (DASS-42) have been validated in various populations, including older patients.<sup>18–21</sup>
- Social support was measured using the Medical Outcomes Study Social Support Survey (MOS-SSS), a 19-item self-administered questionnaire measuring 5 social support dimensions: emotional, informational, tangi-

ble, affectionate and positive social interaction. Scores were scaled with a possible range of 0–100, with higher values indicating more support. The questionnaire has shown to be reliable and valid among diverse populations including elderly patients with chronic disease.<sup>22</sup>

#### *Pre-operative expectations of time to functional recovery*

Patients were asked about expectations for time to recovery using 11 items related to activities of daily living. These included: rising from sitting, kneeling, going up and down the stairs, walking 1 block without a cane, walking 5 blocks without a cane, getting in/out of a car, putting on socks, driving, performing light domestic duties, going shopping and going back to work. The activities were selected based on an expert panel of orthopaedic surgeons, rheumatologists and allied health professionals who selected by consensus the functional activities they considered most relevant for patients undergoing TKA. Participants were asked when they expected to resume performing each activity and were given the following 6 ordinal time points: 1 week, 6 weeks, 3 months, 6 months, 1 year, 'never'; a 'not applicable' option was also given. Fixed time points were selected to allow for patients to easily compare the various activities and to allow for comparison between patients. For one activity, 'going back to work', half of the participants responded 'not applicable' because they were retired, so this activity was not included in the analysis. In addition to examining each activity individually, we also generated an overall expectations index score calculating the mean expectation of time to recovery across the 10 activities per patient on a continuous scale measured in weeks. The generated index demonstrated good internal consistency with a Cronbach's alpha of 0.74. The distribution of the mean index scores was not normal, and for the analysis, we dichotomized the expectation index by median split on the mean time to recovery for individual

activities for each participant. The median time was 7.8 weeks. Participants with an expectation index score at or below the median were categorized as having short-term expectations of recovery (51.3%) and those above the median as having long-term expectations (48.7%). Previous research regarding patient expectations of recovery from TKA has also dichotomized expectation responses to have interpretable results.<sup>7,8,23</sup>

### Statistical analysis

Chi-square tests were performed to evaluate patient baseline characteristics differences by expectations for categorical variables; *t*-tests or Wilcoxon's rank-sum tests were used for continuous variables. The variance-to-mean ratio (VMR), dividing the item variance over the item mean, was calculated for each activity to assess dispersion of the rescaled index scores. Collinearity within independent variables was assessed using the Pearson's product-moment correlation; highly correlated measures ( $r \geq 0.7$ ) were not included in the models.

Multivariate logistic regression analyses were performed using overall short- vs. long-term expectations as the dependent variable. Independent variables included demographic characteristics, pain and function as determined by the WOMAC, SF-36 subscales and psychosocial variables. Age, gender and race were included in all modelling via a forced entry approach. The remainder of the independent variables were included via a stepwise selection process using an inclusion criterion of  $P < 0.25$  to enter the model and an exclusion criterion of  $P > 0.05$  to exit the model. All of the analyses were performed using SAS, v9.1 (SAS institute, Cary, NC, USA).

### Results

Patient characteristics are presented in Table 1. Most participants were women (65%) and Whites (70%); mean age was 65 years. The majority of participants reported at least one other chronic health condition in addition to

OA. Knee pain and function levels indicated that, in general, patients experienced moderate to high levels of pain and disability. Health-related quality of life measures indicated that patients experienced limitations in daily activities due to physical health, pain and/or emotional problems, with scores on associated measures below those of the general population. Psychosocial indices of depression, anxiety and stress indicated mean levels were 4, 3 and 8 of depression, anxiety and stress, respectively, within our patient population.

**Table 1** Participant baseline characteristics

Patient characteristic	<i>n</i> = 236
Age: mean (min–max)	65 (41–89)
Gender: <i>n</i> (%)	
Male	82 (35)
Female	154 (65)
Ethnicity: <i>n</i> (%)	
Whites	165 (70)
Non-whites	71 (30)
Knee surgery: <i>n</i> (%)	
Unilateral	223 (94)
Bilateral	13 (6)
BMI: mean (SD)	33 (7)
Retired: <i>n</i> (%)	109 (46)
Co-morbidities: mean (min–max)	
Current	2 (1–7)
Past	1 (0–4)
WOMAC: mean (SD)	
Pain	55 (19)
Function	54 (19)
SF-36: mean (SD)	
Role-physical	33 (10)
Bodily pain	33 (7)
General health perceptions	46 (10)
Vitality	44 (11)
Social functioning	39 (12)
Role-emotional	42 (14)
Mental health	50 (11)
PCS	29 (8)
MCS	51 (13)
DASS: mean (SD)	
Depression	4 (6)
Anxiety	3 (5)
Stress	8 (8)
MOS, mean (SD)	81 (19)

SD, standard deviation; BMI, body mass index; WOMAC, Western Ontario McMaster Universities Osteoarthritis Index; PCS, physical component score; MCS, mental component score; DASS, Depression, Anxiety and Stress Scale; MOS, Medical Outcomes Study Social Support Survey.

Most patients reported having high levels of social support.

Table 2 shows the pre-operative expectations of time to recovery for the 10 activities measured (cumulative frequencies) and the VMR for each activity. Seventy per cent of patients expected to be able to rise from sitting within 1 week of surgery. Additionally, approximately half of the patients expected to be able to get in and out of a car within 1 week of surgery, and 94% of the patients expected to be able to perform this activity by 6 weeks. The large majority of patients expected to be able to put on socks by 6 weeks. Eighty five percent of patients expected to be able to drive within 6 weeks, and 80% of patients believed they would be able to perform light domestic duties within the same time frame. Approximately 80% of patients expected to be able to go up and down stairs by the 3-month mark; however, 20% thought they would not be able to perform this activity until after 6 months or 1 year; one person believed she/he would never be able to go up and down stairs. Almost 90% believed they would be able to walk 1 block without a cane by 3 months, while approximately 69% believed they would be able to walk 5 times that distance in 3 months. Approximately 33% of patients expected to be able to kneel within 6 weeks; only 6% believed they would never be able to kneel after surgery. The VMR of time (in weeks) expected to perform activities varied widely. The largest

variation was observed for kneeling and walking 5 blocks without a cane.

When compared to patients with long-term expectations of recovery, those with short-term expectations had statistically significantly less knee pain and better knee function, fewer problems with work or daily activities, a more positive outlook on their general health, more energy, less interference in social activities, higher positive affect and less anxiety (Table 3). Depression scores were lower in the short-term expectations group but did not reach statistical significance (0.06). Females were also more likely to have long-term expectations than males.

Logistic regression models are shown in Table 4. The first column shows univariate odds ratios (OR) for each variable. The second column shows the results of the multivariate analysis including the various SF-36 subscales, and the third column shows the model including only the summary SF-36 PCS and MCS and not the subscales. Patients who were older, female, had more knee pain and believed their general health was poor were more likely to expect a longer time to recovery.

## Discussion

Patient satisfaction, pain relief and function improvement are significant and desired outcomes of TKA and have been noted to be associated with both pre-operative status and patient expectations of the surgery.<sup>8,24–26</sup> Recent

**Table 2** Cumulative participant expectations for 10 measured activities\*

	1 week	6 weeks	3 months	6 months	1 year	Never	VMR
Rising from sitting	70 (165)	95 (224)	99 (234)	100 (235)	100 (235)	100 (236)	3.8
Getting in/out of car	47 (110)	94 (219)	98 (229)	100 (232)	100 (233)	100 (233)	5.7
Put on socks	39 (91)	88 (205)	97 (227)	100 (233)	100 (233)	100 (233)	4.4
Drive	15 (34)	85 (191)	97 (219)	100 (225)	100 (225)	100 (225)	2.9
Perform light domestic duties	11 (25)	80 (185)	96 (223)	98 (228)	100 (231)	100 (232)	5.7
Go up and down the stairs	8 (19)	47 (109)	80 (185)	98 (226)	100 (230)	100 (231)	7.3
Go shopping	6 (14)	70 (161)	93 (215)	99 (229)	100 (230)	100 (231)	4.4
Walk 1 block without a cane	6 (13)	62 (141)	88 (199)	97 (220)	100 (225)	100 (226)	7.7
Kneel	3 (6)	31 (72)	65 (150)	84 (195)	94 (218)	100 (232)	11.7
Walk 5 blocks without a cane	2 (4)	33 (73)	69 (154)	91 (204)	100 (223)	100 (224)	10.6

\*Results depicted as cumulative percentage (cumulative *n*).  
VMR: variance-to-mean ratio.

**Table 3** Differences in participant baseline characteristics by short- vs. long-term expectations<sup>†,‡</sup>

	Short-term expectations (N = 121)	Long-term expectations (N = 115)	P value
Age	64.5 (8.2)	65.6 (9.3)	0.32
Gender			
Female	67 (55)	87 (76)	<0.01*
Male	54 (45)	28 (24)	
Ethnicity			
Whites	90 (74)	75 (65)	0.12
Non-whites	31 (26)	40 (35)	
Education			
Less than high school	6 (5)	12 (10)	0.22
High school	17 (14)	19 (17)	
Greater than high school	98 (81)	84 (73)	
Retirement status			
Retired	53 (44)	56 (49)	0.45
Not retired	68 (56)	59 (51)	
Marital status			
Single/widowed/separated/divorced	39 (32)	41 (37)	0.49
Married/common law/significant Other	82 (68)	73 (63)	
Household members			
None/live alone	23 (19)	28 (24)	0.32
One or more	98 (81)	87 (76)	
BMI	33.0 (7.1)	33.4 (6.2)	0.71
WOMAC			
Pain	50.4 (19.2)	60.0 (17.0)	<0.01*
Function	49.7 (19.4)	59.6 (17.8)	<0.01*
SF-36			
Role-physical	35.0 (11.3)	30.6 (8.9)	<0.01*
Bodily pain	34.3 (7.6)	31.0 (6.7)	<0.01*
General health perceptions	47.6 (9.6)	44.0 (9.5)	<0.01*
Vitality	45.8 (10.9)	42.9 (10.1)	0.04*
Social functioning	41.2 (12.7)	37.1 (11.8)	<0.01*
Role-emotional	44.1 (13.3)	39.0 (14.1)	<0.01*
Mental health	51.1 (10.8)	47.8 (10.9)	<0.01*
PCS	30.5 (7.9)	27.3 (7.2)	<0.01*
MCS	53.1 (12.7)	49.2 (12.6)	0.02*
DASS			
Depression	3.3 (5.5)	4.2 (5.4)	0.06
Anxiety	2.5 (4.2)	4.2 (5.9)	0.01*
Stress	7.1 (7.5)	8.2 (7.8)	0.22
MOS	82.6 (18.2)	79.6 (18.9)	0.15

\*Statistically significant differences at  $P \leq 0.05$  noted using chi-square test for categorical variables, independent sample *t*-test for continuous variables and Wilcoxon's rank-sum for variable not normally distributed.

<sup>†</sup>Expectations defined by expectation index score (generated from mean of each activity per individual, in weeks, then dichotomized).

<sup>‡</sup>Results depicted as mean (standard deviation) or *n* (%).

studies have demonstrated a great influence of education regarding recovery on generating expectations of surgery.<sup>27</sup> Identifying potential pre-operative characteristics that influence patient expectations may assist in creating realistic expectations regarding TKA, increasing patient satisfaction. The objective of our study was to evaluate patients' pre-operative

expectations of time to recovery after TKA. We used an activity-based expectation index derived by a multidisciplinary team of experts. Overall, we found patients were optimistic regarding their time to functional recovery. We also noted wide variability of expectations of time to functional recovery within the patient group and between activities: for one particular activity,

**Table 4** Odds ratios relating pre-operative participant characteristics to expectations index score<sup>†</sup>

Independent variables	Univariate logistic regression		Multivariable logistic regression with SF-36 subscales		Multivariable logistic regression with SF-36 composite scores	
	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value
Age	1.02 (0.99–1.04)	0.32	1.03 (1.00–1.07)	0.05*	1.03 (1.00–1.06)	0.08
Gender						
Female	Referent					
Male	0.40 (0.23–0.70)	<0.01*	0.50 (0.28–0.92)	0.02*	0.52 (0.29 – 0.93)	0.03*
Ethnicity						
Whites	Referent					
Non-whites	1.55 (0.88–2.71)	0.13	1.21 (0.65–2.24)	0.55	1.21 (0.67–2.23)	0.54
BMI	1.01 (0.97–1.05)	0.71	–	–	–	–
Co-morbidities						
Current	1.26 (0.98–1.63)	0.07	–	–	–	–
Past	1.15 (0.81–1.62)	0.41	–	–	–	–
WOMAC						
Pain	1.03 (1.01–1.04)	<0.01*	1.02 (1.01–1.04)	0.01*	1.02 (1.01–1.04)	0.01*
Function	1.03 (1.01–1.04)	<0.01*	–	–	–	–
SF-36						
Role-physical	0.96 (0.93–0.98)	<0.01*	–	–		
Bodily pain	0.94 (0.90–0.97)	<0.01*	–	–		
General health	0.96 (0.94–0.99)	<0.01*	0.96 (0.94 – 1.00)	0.02*		
Vitality	0.97 (0.95–1.00)	0.04*	–	–		
Social functioning	0.97 (0.95–0.99)	0.01*	–	–		
Role-emotional	0.97 (0.96–0.99)	<0.01*	–	–		
Mental health	0.97 (0.95–1.00)	0.02*	–	–		
PCS	0.95 (0.91–0.98)	<0.01*				
MCS	0.98 (0.96–1.00)	0.02*				
DASS						
Depression	1.03 (0.98–1.08)	0.22	–	–	–	–
Anxiety	1.07 (1.01–1.14)	0.02*	–	–	–	–
Stress	1.02 (0.99–1.06)	0.26	–	–	–	–
MOS	0.99 (0.98–1.00)	0.22	–	–	–	–

WOMAC: Higher score indicates worse pain and/or function; SF-36: Higher score indicates better HRQoL; DASS: Higher score indicates worse depression, anxiety and/or stress; MOS: Higher score indicates more social support.

<sup>†</sup>Expectations defined by expectation index score (generated from mean of each activity per individual, then dichotomized).

\*Statistically significant at  $P \leq 0.05$ .

some patients expected to be able to perform within 1 week, while others expected to be able to perform it within 1 year. In our cohort, older, female patients with higher knee pain and lower perception of their general health were more likely to expect to take longer time to recover from TKA.

Like others, we found pre-operative characteristics to be important in the development of expectations of surgery.<sup>7,8,28,29</sup> Our results are generally consistent with two previously published studies of expectations of TKA, one in Europe and the other one in Australia, in which

patients also had high expectations of the outcome of the surgery.<sup>25,30</sup> Our participants were optimistic, expecting to be able to perform usual daily activities within 6 weeks of surgery. A multicentre cohort study found that younger patients and male patients had higher expectations for walking 12 months after surgery. In addition, those with better pre-operative health status measured by the WOMAC and SF-36 (less pain and more function) had higher expectations, regarding post-operative pain and functional status 12 months after surgery.<sup>28</sup> Mancuso *et al.*<sup>7</sup> used the Hospital for Special Surgery Knee Surgery

Expectations Survey and found that females and older patients expected walking ability improvement, while younger males expected improvement in more rigorous activities. Those with higher HRQoL (measured by PCS scores from the SF-36) were more likely to expect functional improvement for rigorous activities compared to those with lower scores. On the other hand, Mahomed *et al.* reported no correlation between pre-operative function and expectations in patients undergoing total knee and total hip arthroplasty.<sup>8</sup> The differences noted in previously published studies might be related to differences in expectation measurement. Mancuso and colleagues measured expectations using questions related to the importance of pain, physical function and psychological expectations. Mahomed and colleagues utilized a self-reported questionnaire including questions quantifying expected relief of pain, limitations of daily activities, overall success of the surgery and likelihood of joint complications. Clement *et al.*<sup>29</sup> used prevalence of expectations measured using 17 items including pain and functional activities and similarly found patients were optimistic about improvement in walking and pain relief. Outcomes, however, were assessed at 1 year and evaluated what was most important to the patient. In contrast, we utilized specific functional activity measures with a time frame response scale, generating more information regarding when patients expected specific outcomes. Our outcome provides insight into all expectations that are important to patients and in addition provides a timeline that can be translatable to success and satisfaction with the surgery.

Our study has inherent limitations. This study was conducted at a single orthopaedic referral centre. Most participants were Whites and highly educated; therefore, results may not be generalizable to other settings. Patient education and surgical procedures have not significantly changed since the collection of these data; however, changes in these areas may directly affect patient expectations and generalizability of these results to current practice. Studies have revisited perioperative and post-operative pain management, and the patient

experience is expected to improve.<sup>31</sup> Modest changes to length of stay have impacted initial physical therapy approaches; however, there have not been significant shifts in specific treatment. Rehabilitation after TKA has not changed substantially in the past 7 years.<sup>32,33</sup> Other unmeasured confounder or mediator variables might have influenced patients' expectations. Lastly, large variability in patient perceptions of time to functional recovery existed among particular activities, such as kneeling and being able to walk 5 blocks. Generation of an index that does not take into account this variability can ignore residual differences among participants which are therefore not accounted for in the multivariate analysis. Utilization of median split inherently reduces the power of the sample. Although the outcome was originally measured using ordinal time points, in order to better interpret and link to patient outcomes and clinical significance, short- and long-term expectations were defined. The median split in this case was 7.8 weeks. This seamlessly ties with the 7-8 week time point that has been and continues to be utilized in research studies as one of the post-operative TKA recovery time points.<sup>34-36</sup> The use of short- and long-term benchmarks allows for tangible interpretation and comparability among existing research.

Our data show that patient expectations of time to functional recovery after TKA are generally optimistic, and possibly unrealistic with respect to some activities such as kneeling or walking large distances. The expectations for recovery were variable, showing that not all patients have similar expectations. Older age, being female and worse pain predicted longer recovery expectations. Future educational programmes regarding TKA recovery and functional outcomes should include personalized assessments of expectations so that patients can receive realistic information about their expectations, and, ultimately, be satisfied after their surgery.

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### Significance and innovation

It is critical for patients undergoing TKA to understand the risks and benefits of TKA in order to create realistic expectations, maximizing satisfaction with TKA results.

We found patients were optimistic regarding their time to functional recovery.

We also found wide variability of expectations of time to functional recovery within the patient group and between activities.

Future educational programmes regarding TKA recovery and functional outcomes should include personalized assessments of expectations so that patients can receive realistic information about their expectations, and, ultimately, be satisfied after their surgery.

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