

## Chapter 6

### **Outcome Expectations of Total Knee Arthroplasty Patients: The Influence of Demographic Factors, Pain, Personality Traits, Physical and Psychological Status.**

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## **Abstract**

### *Introduction*

Unfulfilled preoperative expectations have a strong influence on the outcome after total knee arthroplasty (TKA). More insight into determinants of the level of expectations is useful in identifying patients at risk for having expectations of the treatment result that are too high or too low. This information can be used in optimizing pre-operative expectation management. The aim of the current study was to analyze to what extent pre-operative outcome expectations of TKA patients are affected by psychological factors, demographic factors, pain, physical function and general health status.

### *Methods*

We performed a cross-sectional analysis of 204 patients with symptomatic and radiographic knee OA, scheduled for primary TKA. Outcome expectations were measured using the Hospital for Special Surgery knee replacement expectations survey. Independent variables included were age, sex, body mass index and patient reported outcome measures for pain, physical function, quality of life, anxiety, depression, catastrophizing, optimism and pessimism. Multiple linear regression analyses were used to evaluate associations between these variables and pre-operative outcome expectations.

### *Results*

Female sex, higher age, higher depression score and duration of complaints > 50 months showed to be significant predictors of lower expectations for the treatment outcome after TKA. Baseline pain and function scores were not related to the level of pre-operative expectations.

### *Conclusion*

The present study aids in identifying patients at risk for having either too high or too low expectations. This knowledge can be utilized in individualized expectation management interventions.

## **Introduction**

Symptomatic knee osteoarthritis (OA) can severely diminish quality of life and physical function.<sup>1</sup> Although, total knee arthroplasty (TKA) is generally considered an effective treatment option, still up to 20% of patients are not fully satisfied after surgery.<sup>2,3</sup> Unmet preoperative expectations have been reported as a strong factor influencing patient satisfaction after TKA.<sup>2-4</sup>

Several studies have shown that expectations can be modified by pre-operative education<sup>5</sup>, but the best education strategy has not yet been identified<sup>3,6</sup>. In this education process patients with expectations of the treatment result that are too high or too low, have to be identified in order to be able to adjust their expectations accordingly.<sup>7</sup> If these patients can be specifically targeted, with an individualized education strategy, they are likely to benefit most from improved expectation management.

Previous research has not been able to consistently identify factors associated with pre-operative expectations of TKA patients. Expectations do not appear to be influenced by preoperative knee pain or patient-reported function scores.<sup>8-10</sup> It is suggested that psychological factors and personality traits may play significant roles in outcome expectations, but the available evidence on the effect of psychological factors on expectations of patients awaiting TKA is limited.<sup>9</sup>

The aim of the current study was to analyze the relationship between pre-operative factors and pre-operative outcome expectations in TKA patients. We hypothesized that psychological factors such as depressive symptoms, catastrophizing and optimism have a stronger relationship with the level of pre-operative expectations than demographic factors, pain, physical function and general health.

## **Methods**

We performed a cross-sectional analysis of 204 patients scheduled for TKA between July 2016 and April 2018. Inclusion and exclusion criteria are described in Table 1. The present study is part of a trial on expectation management.<sup>7</sup> The [Blinded Manuscript] Medical Ethics Committee approved the study (registration code 15.108), and all patients signed an informed consent form.

Between July 2016 to April 2018 459 primary TKA were performed at [Blinded manuscript]. Of these patients, 204 could be included in the present study. Participation in the study was refused by 82 patients and 173 patients were excluded. Reasons for exclusion were contralateral TKA in 129 cases, indication for TKA other than OA in 11 cases, insufficient command of the Dutch language in 21 cases and planned staged or bilateral TKA in 12 cases.

After enrollment, all patients completed a series of self-administered questionnaires. Demographic data, outcome expectations, health status, psychological status and personality traits were scored.

#### *Demographic data*

Patient demographics included age, sex, education level, body mass index (BMI), duration of complaints in months, status regarding employment for monetary reimbursement (yes/no), and co-morbidity scored using the Functional Comorbidity Index (FCI)<sup>11</sup>. Radiological OA severity was scored according to Kellgren & Lawrence (KL) grading system.<sup>12</sup> For use in the regression analysis the score was dichotomised into limited (KL grade 1 and 2) and evident radiological OA (KL grade 3 and 4).

#### *Outcome expectations*

We measured probability-based outcome expectations using the Dutch version of the Hospital for Special Surgery Knee Replacement Expectations Survey (HSS-KRES).<sup>13</sup> This 19-item self-administered survey measures probability-based outcome expectations in domains of pain, function, activities, and psychological well-being.<sup>5,14</sup> The expected improvement on each item is scored on a 5-point scale ranging from 0 (this expectation does not apply to me / I do not have this expectation) to 4 (complete improvement or return to normal). A total score can be calculated ranging from 0 to 100, with a higher score representing more positive expectations.<sup>5,13</sup> The survey is shown to be reliable and valid for the measurement of outcome expectations in TKA patients.<sup>5,13-15</sup>

#### *Health status*

The Dutch version of the Knee injury and Osteoarthritis Outcome Score - Physical Function Short Form (KOOS-PS) is a patient-reported measure of physical function. The score consists of 7 questions scored a 5-point Likert. A normalized score can be calculated ranging from 0 indicating extreme symptoms to 100 indicating no symptoms.<sup>16</sup> The KOOS-PS has good reliability, validity and ability to detect change over time in knee OA patients.<sup>16,17</sup>

The Dutch version of the Oxford Knee Score (OKS) is a self-reported measure of pain and function. The questionnaire consists of 12 items on a 5-point Likert scale, of which the total score ranges from 12 to 60, with higher scores representing worse functional status.<sup>18</sup> The OKS is reproducible, valid and sensitive to clinically important changes.<sup>17,18</sup>

Generic health status is measured using the Dutch version of the EuroQol 5D-3L (EQ-5D).<sup>19</sup> The EQ-5D consists of 5 questions and a visual analogue scale (EQ-VAS). The questions are scored on a 3-point Likert scale, and a total score can be calculated. The lowest score indicates the worst health state possible and a score of 1 represents the best possible health state.<sup>19</sup> The EQ-VAS is scored from 0 ('Worst imaginable health state') to 100 ('Best imaginable health state'). The EQ-5D has good reliability and validity in knee OA patients.<sup>20</sup>

Pain during activity and rest is scored using an 11-point Numerical Rating Scale (NRS pain). Zero represents 'no pain' and a score of 10 represents 'worst imaginable pain'. The NRS pain has good reliability and responsiveness.<sup>21</sup>

#### *Psychological status and personality traits*

The Dutch version of the Hospital Anxiety and Depression Scale (HADS) is a valid and reliable measure of anxiety and depressive symptoms.<sup>22,23</sup> Seven 4-point scale questions that relate to anxiety and seven questions related to depression are rated. A 0 to 21 sum score for both subscales can be calculated, with 0 meaning no symptoms to 21 meaning severe symptoms.<sup>22,23</sup> The optimal cut-off score for the presence of both anxiety and depressive symptoms is  $\geq 8$ .<sup>22,23</sup>

Catastrophizing is measured using the Dutch version of the Pain Catastrophizing Scale (PCS).<sup>24</sup> The PCS consists of 13 questions, with subscales for rumination, magnification and helplessness. Possible scores range from 0 (no catastrophizing) to 52 (extreme catastrophizing). The PCS is a reliable and valid self-reported measure of catastrophizing.<sup>24,25</sup> The Dutch version of the Life Orientation Test - Revised (LOT-R) assesses optimism and pessimism.<sup>26</sup> This questionnaire has 10 items; three questions assess optimism, three pessimism, and the remaining four are filler items. Subscale scores can be calculated, and the total score is the result of adding the optimism to the inverted pessimism score. The LOT-R has satisfactory psychometric properties.<sup>26</sup>

#### *Statistical Analysis*

For descriptive statistics means with standard deviations (SD) for continuous variables were calculated and for discrete variables counts and percentages. To identify individual determinants of pre-operative outcome expectations we performed a multiple linear regression analysis. The dependent variable was the HSS-KRES score. As independent variables we included age, sex, education level, BMI, duration of complaints, co-morbidity (FCI), radiological OA, and the preoperative scores of KOOS-PS, OKS, NRS pain, EQ-5D, HADS, PCS and LOT-r. For potential predictors showing a non-linear relationship with the HSS-KRES score, the presence of a suitable cut-off value was explored. In the first step univariable regression analysis was performed with significance set at  $p=0.15$ . Potential predictors identified in the univariable analysis were entered into the multivariable model. The significance level in the multivariable analyses was set at a  $p$ -value of 0.05. Goodness-of-fit is reported using adjusted  $R^2$ . Statistical analysis was performed with SPSS statistics version 24.0 (IBM corporation).

#### **Results**

All 204 patients under study completed the HSS knee replacement expectations survey. Patient characteristics, patient-reported function, pain score, general health score and measures of psychological status are reported in Table 2. Missing data accounted for less

than 5% of cases for a limited number of independent variables (Table 2). Therefore we performed a complete case analysis.<sup>27</sup>

The mean overall survey score on the HSS-KRES was 70.9 (SD 17.9) with a range of 17.1 – 100.0. Distribution of expectation scores is shown in Figure 1. Highest expectations were scored for pain relief and improvement of the ability to walk of short and medium distances. Patients had the lowest expectations for improvement in kneeling, squatting, psychological well-being sexual activity and the ability to have paid work.

The univariate linear regression analysis showed 6 factors to be significant predictors of HSS-KRES score (Table 3). Duration of complaints could be included as a significant predictor using 50 months as cut-off value. In the multivariable analysis, 4 factors remained as shown in table 3. Male sex, lower age, duration of complaints  $\leq 50$  months, and HADS depression score  $< 8$  were predictive of higher HSS-KRES scores. The model containing these 4 predictors had an adjusted R<sup>2</sup> of 0.165.

## **Discussion**

The most important finding of the present study is that female sex, higher age, HADS depression score  $\geq 8$  and duration of complaints  $> 50$  months are predictive for lower expectations for the treatment outcome after TKA. This only partly confirms our hypothesis that psychological factors are important predictors for level of expectations, because other items showed to be predictive as well and most psychological measures included in the analysis were shown not to be individual predictors of expectations.

Previous literature on the relationship between patient characteristics and expectations resulted in conflicting reports. This variation can for a large part be accounted for by the variation in patient cohorts and difference in definition and terminology.<sup>8,28</sup> Especially the distinction between value-based (what does a patient consider important); and probability-based expectations which we used for the present study (what does the patient think is the most likely result of treatment) has been the reason for confusion on this subject.<sup>28,29</sup> For studies reporting on predictors of probability-based outcome expectations, age and sex are reported as significant independent predictors of expectations.<sup>9,28</sup> Quite consistently preoperative patient-reported function scores are reported not to be related to the level of expectations.<sup>9,30–32</sup> Thus, the findings of the present study supports evidence from previous reports on determinants of probability-based outcome expectations.

In the present study, the HADS depression score was the only psychological factor that showed to be predictive of expectations. The finding that patients with more depressive symptoms have lower expectations is not surprising. These low expectations might be justified, as higher depression scores predict lower outcome after surgery.<sup>33,34</sup> On the other hand, the low expectations themselves might be partly responsible for the treatment

outcome. Higher expectations are related to higher postoperative outcome,<sup>8</sup> and suggested explanations for this are anxiety reduction, better cooperation with treatment and beneficial coping mechanisms.<sup>35,36</sup> These positive effects are probably inversely related to the presence of depressive symptoms.<sup>33,36</sup> Therefore, the depressive symptoms, as well as the preoperative expectations, are a potential target for an intervention aimed at increasing the postoperative result in this group of patients. Future research should focus on developing an effective treatment strategy in this regard.

The present study showed that shorter duration of complaints significantly predicts higher outcome expectations, although the predictive value seems limited. To the authors' knowledge, this relation has not been described previously. It is known from previous work that patients with a shorter duration of complaints, have lower postoperative satisfaction scores.<sup>2,37</sup> As an explanation, Dunbar et al suggest that patients with a relatively short duration of complaints base their expectations of a TKA on their relatively high pre-diseased functional status.<sup>2</sup> Patients with long-standing complaints, might be more likely to accept a lower quality of health for themselves as this fits the frame of reference they have developed over time.<sup>2</sup> Expectation fulfillment, with subsequently a higher degree of postoperative satisfaction, can therefore be presumed more likely in the group of patients with longer duration of complaints.

The present study found no relation between preoperative knee pain or function scores and expectations. These findings reflect results from previous reports, where no relation of preoperative pain,<sup>9,30,31</sup> and function scores,<sup>9,30-32</sup> with the height of expectations is described. Given the known strong relationship between pre- and postoperative pain and function scores, these findings question the realism of patient expectations<sup>9,38</sup>. The previously posed suggestion that patients do not modulate their expectations on their personal functional situation and disease severity is supported by these findings.<sup>9</sup> This highlights the potential of improved expectation management to achieve more realistic expectations and subsequently a higher degree of expectation fulfillment.

A strength of the present study is the relatively large patient cohort and the wide range of potential predictors of patient expectations included in the analysis. Most previous studies identifying predictors for patient expectations are less concise, especially regarding psychological factors and duration of complaints.<sup>8,9,28</sup> Therefore the present study provides a clear overview of which factors do and do not play a role in influencing the level of patient expectations.

A possible limitation of the present study is that the study only identifies factors predicting higher or lower expectations for outcome after TKA. These patients might be at risk for having too high or too low expectations, but if this is actually the case cannot be directly drawn from the current study. Longitudinal follow-up is warranted to determine if these

factors are related to expectation fulfillment and patient satisfaction. Furthermore, the current study was conducted in a Dutch setting and only osteoarthritis patients with an indication for primary TKA were included. It is known that patients from different countries have different expectations regarding TKA.<sup>32</sup> It is therefore possible that determinants of expectations show cross-cultural differences as well. This limits the generalizability of the results presented to some extent.

Not all patients that had a total knee replacement in our hospital during the study period could be included in the present analysis. The participation rate of eligible patient was 71.3%. This is an acceptable participation rate and baseline demographic and PROM scores did not show important difference to other populations of TKA patients.<sup>39</sup> Therefore, selection bias probably has not importantly influenced our conclusions. The results of the present study can be considered accurate for the group of patients scheduled for unilateral, primary TKA for symptomatic knee osteoarthritis. Generalizability to for example for revision TKA patients or patients with another indication than osteoarthritis, should be done with caution, as these patients might have a different pattern of expectations and determinants thereof.

### **Conclusions**

Female sex, higher age, HADS depression score  $\geq 8$  and duration of complaints  $>50$  months predict lower expectations for the treatment outcome after TKA. The present study aids in identifying patients at risk for having either too high or too low expectations. This knowledge can be utilized in individualized expectation management interventions.



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**Table 1. Inclusion and exclusion criteria**

Inclusion criteria	<ul style="list-style-type: none"><li>• Symptomatic and radiographic knee osteoarthritis indicated for a primary TKA</li></ul>
Exclusion criteria	<ul style="list-style-type: none"><li>• Presence of TKA of the contralateral side</li><li>• Unicompartmental knee arthroplasty</li><li>• Staged or bilateral knee arthroplasty</li><li>• Insufficient command of the Dutch language</li><li>• Legally incompetent adults</li><li>• Presence of a medical illness that results in a life expectancy shorter than 1 year</li></ul>

**Table 2. Patient characteristics**

	Score	Cases included in the analysis
Age (years)	68.6 (9.3)	204
Sex, male [n (%)]	82 (40.2)	204
Side affected, right [n (%)]	106 (52)	204
BMI (kg/m <sup>2</sup> )	29.0 (5.0)	204
Radiological OA severity [n (%)]		204
KL 0	0 (0)	
KL 1	0 (0)	
KL 2	27 (13.2)	
KL 3	82 (40.2)	
KL 4	95 (46.6)	
Evident radiological OA, KL 3 or 4 [n (%)]	177 (86.8)	
Duration of complaints	45.0 (67.1)	203
<i>Duration of complaints &gt; 50 months [n (%)]</i>	28 (13.7)	
Education level [n (%)]		202
<i>Primary school</i>	12 (5.9)	
<i>Lower vocational education</i>	67 (33.2)	
<i>Pre-vocational secondary education</i>	38 (18.8)	
<i>Senior general secondary education</i>	8 (4.0)	
<i>Secondary vocational education</i>	38 (18.8)	
<i>Higher professional education</i>	32 (15.8)	
<i>University education</i>	7 (3.5)	
Working status, yes [n (%)]	59 (28.9%)	204
FCI	2.5 (1.3)	204
<b>Health status</b>		
NRS pain		204
<i>At rest</i>	4.9 (2.4)	
<i>During activity</i>	7.9 (1.2)	
EQ-5D		204
<i>Health scale</i>	69.5 (20.7)	
<i>Questions</i>	0.54 (0.28)	
KOOS-PS	54.7 (12.9)	202
OKS	37.9 (6.3)	202
<b>Psychological status and personality traits</b>		
HADS		202
<i>Depression score</i>	4.1 (3.1)	
<i>Depression score ≥ 8 [n (%)]</i>	29 (14.2)	
<i>Anxiety score</i>	4.2 (3.3)	
	27 (13.4)	

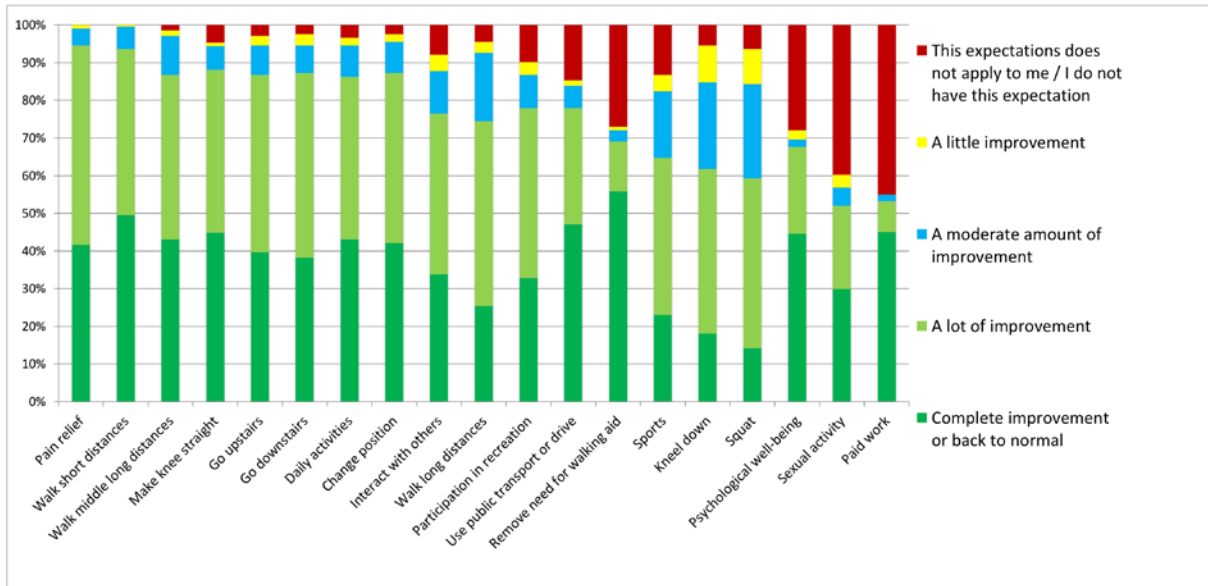
<i>Anxiety score <math>\geq 8</math> [n (%)]</i>		
PCS		197
<i>Rumination subscale</i>	6.6 (3.7)	
<i>Magnification subscale</i>	1.9 (2.0)	
<i>Helplessness subscale</i>	6.6 (5.1)	
<i>Total score</i>	15.1 (9.8)	
LOTr		201
<i>Optimism subscale</i>	9.2 (2.3)	
<i>Pessimism subscale</i>	4.1 (2.9)	
<i>Total score</i>	17.1 (3.8)	
<p>Data are presented as mean and standard deviation between parentheses or reported otherwise as mentioned. BMI; Body Mass Index, KL; Kellgren and Lawrence, FCI; Functional Comorbidity Index, NRS; Numerical Rating Scale, KOOS-PS; Knee injury and Osteoarthritis Outcome Score - Physical Function Short Form, OKS; Oxford Knee Score, <i>HADS</i>; Hospital Anxiety and Depression Scale, LOT-R; Life Orientation Test – Revised.</p>		

**Table 3. Regression analysis with HSS knee replacement expectation survey score.**

	Univariable analysis				Multivariable analysis	
	R <sup>2</sup>	B	95% CI	p-value	B	p-value
Age (years)	0.03	-0.3	(-0.60 - -0.08)	0.011	-0.3	0.023
Sex, female	0.03	6.2	(1.20-11.15)	0.015	-6.0	0.019
Duration of complaints >50 months	0.02	-7.2	(-14.3 - -0.1)	0.047	-9.8	0.006
Working status, yes	0.03	7.0	(1.59 – 12.35)	0.011	-	-
HADS Depression score $\geq$ 8	0.05	-12.1	(-19.00- -5.17)	0.001	-10.4	0.003
LOTr Optimism	0.02	1.2	(0.09 - 2.24)	0.033	-	-

HSS; Hospital for Special Surgery, CI; confidence interval, HADS; Hospital Anxiety and Depression Scale, LOT-R; Life Orientation Test – Revised.

*Note: Only predictors that were significant in the univariate analysis are shown.*



**Figure 1.** Response to the Hospital for Special Surgery Knee Replacement Expectations Survey, questions are ordered by mean expectation score.