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A prospective study of the association of patient expectations with changes in health-related quality of life outcomes, following total joint replacement

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Abstract

Background: Patient expectations regarding surgery may be related to outcomes in total joint replacement (TJR). The aim of this study was to determine the association of patient expectations with health related quality of life (HRQoL) outcomes measured by Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) and Short Form 12 (SF-12) and satisfaction with current symptoms measured on a 4-point Likert scale, one year after surgery, adjusting for Body Mass Index (BMI), age, gender, joint, education, previous intervention and baseline scores.

Methods: Consecutive patients preparing for TJR of the knee or hip due to primary osteoarthritis (OA) in 15 hospitals in Spain were recruited for the study. Patients completed questionnaires before surgery and 12 months afterwards: five questions about expectations before surgery; an item to measure satisfaction; two HRQoL instruments—WOMAC and SF-12; as well as questions about sociodemographic information. To determine the association of patient expectations at baseline, with changes in HRQoL 12 months after surgery and with satisfaction, general linear models and logistic regression analysis were performed.

Results: A total of 892 patients took part in the study. Patients who had higher pain relief or ability to walk expectations improved more in HRQoL at 12 months. Moreover, patients with high daily activity expectations were more satisfied.

Conclusions: Patients with higher baseline expectations for TJR, improved more in HRQoL at one year and had more likelihood to be satisfied than patients with lower expectations, adjusted for BMI, age, gender, joint, education, previous intervention and HRQoL baseline scores.

Keywords: Expectations, Satisfaction, Osteoarthritis, Total joint replacement

Background

Osteoarthritis (OA) is a chronic degenerative joint disease and a major source of disability in the elderly [1]. The rapid increase in the prevalence of this disease suggests that OA will have a growing impact on health care and public health systems in the near future [2]. Total joint replacement (TJR) for the management of OA is

considered to be one of the most cost-effective operations performed [3-5], with well-documented improvements in health related quality of life (HRQoL) and patient benefits, reducing pain and improving physical function [1,6,7].

Nowadays, the impact of patient expectations on outcomes measured by HRQoL is gaining attention [8-10]. Patient expectations have generally been defined in terms of desires, needs, or requests [11]. Other definitions differentiate between expectations and desires, such as the definition by Uhlmann *et al.* which describes patient expectations as anticipation that given events are likely to occur during, or as a result of, medical care, in contrast to

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patient desires, which reflect the patient's wishes that a given event occur [8,9]. Following the expectation' definitions carried out by Haanstra *et al.* [12] for this study, expectations are defined as outcome expectations: beliefs that certain actions will achieve particular outcomes. One reason for the growing interest in the relationship between expectations and HRQoL outcomes after TJR is that psychological factors in patients, such as expectations of outcome, have been found to be important contributors to the success of rehabilitation [13] and are linked to levels of postoperative pain and functional recovery [14,15].

Some researches explain that patient expectations are strongly associated with the physician's expectations. For TJR surgery, health professionals can play important roles in positively influencing patient expectations. Providing appropriate expectations for patients helps them to develop attainable aims about their recovery and the support strategies to achieve it [16].

The study and measurement of patients' expectations are necessary to provide more focused clinical care, highlight areas for patient education and promote shared decision-making when several treatment options are available [17]. With regard to treatment outcomes, patient expectations are important considerations for orthopedic surgery, particularly for elective procedures such as TJR [18]. Moreover, preoperative patients' expectations are potentially important determinants of clinical outcomes and satisfaction [8,19]. Several studies have shown that patients have multiple expectations about hip, knee, back, and shoulder arthroplasty that encompass symptom relief, improvement in physical function, and improvement in psychological well-being [10,20]. In addition, OA patients with high expectations for the benefits of TJR and those who fulfilled expectations, have greater gains in HRQoL and are associated with higher satisfaction with the surgery results [10,21].

Patients' satisfaction is an important measure of outcome for a variety of reasons [22,23]. Satisfaction has been related to increased patient compliance [24] and patients who are satisfied also tend to return for follow-up care and monitoring [21,24]. A number of patients are not entirely satisfied with the surgery results [25,26]. This may be because the patients' satisfaction with the outcome of a TJR is a complex concept and is affected by many factors such as incomplete relief from pain, residual functional disability or unmet expectations. Some studies have shown that patients' expectations were the most important factor influencing patient satisfaction [27,28].

For any procedure and particularly for those that are widely utilized, validated tools should be used to determine the success of the procedure from the patient's perspective. The HRQoL instruments most utilized in OA had been the generic instruments Medical Outcomes Study Short

Form 36 (SF-36) and Medical Outcomes Study Short Form 12 (SF-12) and the disease-specific, Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) [29].

Previously indicated studies pointed out the important association of baseline expectation with surgical outcomes and satisfaction [8,19]. Nevertheless, these investigations in joint replacement have inconclusive findings, in part due to the retrospective nature of the studies or failure to use multivariable models to identify the relative importance of predictors [8,21,30-32]. In a recent systematic review, Haanstra *et al.* showed that in general there is limited evidence for an association between patient expectations and treatment outcomes in TJR and highlighted the need for more research in this area [12].

The objective of this study was to determine the association of baseline patient expectations with change on HRQoL outcomes measured by WOMAC and SF-12, and with satisfaction with current symptoms measured on a 4-point Likert scale, at one year post-intervention, adjusting for confounding variables such as, joint, gender, age, education, Body Mass Index (BMI), previous intervention and baseline HRQoL scores.

Methods

This study was conducted in 15 hospitals in three Spanish regions: three in Andalusia, three in the Canary Islands, and nine in the Basque Country. The institutional review board of the Basurto University Hospital in Bilbao approved the study, code PI04/0938 (September 15, 2004). Written informed consent was obtained from participant patients. Our research has adhered to the STROBE guidelines [33].

Consecutive patients, scheduled to undergo TJR because of primary knee or hip OA in one of the hospitals between October 2005 and October 2006 and who received post-operative management in the participant hospitals, were eligible for the study. Patients with cancer or severe organic or psychiatric diseases were excluded because these conditions could prevent them from completing all the questionnaires included in the study. Besides patients underwent of revision TJR were excluded. All patients were sent a letter informing them about the study and asking for their voluntary participation. We mailed questionnaires to each patient at baseline. The mean time that patients waited since they responded to were underwent was 21.20 days (standard deviation (SD), 42.77). Reminder letters were sent 15 days after each mailing to patients who had not replied promptly. The baseline questionnaire included items about expectations and about HRQoL measured by the SF-12 and WOMAC questionnaires, plus questions requesting sociodemographic information such as gender, age, affected joint, education level, previous intervention and weight and height (for the calculation of BMI). The 12-month mailing included the SF-12 and WOMAC

instruments and one question about satisfaction. The data used in this study comprise a subset of patients who have completed preoperative and postoperative HRQoL questionnaires, expectations and satisfaction items.

SF-12 is a generic instrument for measuring HRQoL [34]. Scores for the SF-12 scales range from 0 to 100, where a higher score indicates better health status. There are two summary scores: the physical component summary (PCS) and the mental component summary (MCS). The SF-12 has been translated and validated in Spanish populations, and the measurement properties were published elsewhere [35].

WOMAC is a disease-specific, self-administered questionnaire developed to study patients with hip or knee OA [29]. It has a multidimensional scale made up of 24 items grouped into three dimensions: pain (5 items), stiffness (2 items), and physical function (17 items). Scores range from 0 (none) to 4 (extreme). The data were standardized to a range of values from 0 to 100, where 0 represents the best health status and 100 the worst. The WOMAC has been translated and validated into Spanish [36,37].

Questions in the baseline survey regarding patients' preoperative expectations for TJR covered five main areas taken from Mancuso's instrument [21,38]: pain relief, improved ability to perform daily activities, improved ability to walk, improved ability to interact with others, and improved psychological well-being. Our version is an adaptation of Mancuso's instrument because this author asked about how important expectations were in the treatment for OA; however we asked about how many expectations they have on treatment outcomes because this was more closely adjusted with our environment. Example: "How many expectations do you have to improve ability to walk?" Responses were graded on a five-point Likert scale: no expectations; low expectations; moderate expectations; high expectations, and very high expectations. Responses to the preintervention questions about expectations were highly skewed, so we combined the three lowest groups ("no expectations", "low expectations", and "moderate expectations") into a "low expectations" group. For example, the response distribution for the preintervention expectation of ability to walk was 0.1% for "no expectations", 1.5% for "low expectations", 7.8% for "moderate expectations", 40.4% for "high expectations", and 50.2% for "very high expectations". These responses were categorized into three groups with the following distribution: low expectations, 9.4%; high expectations, 40.4%; and very high expectations, 50.2%. The remaining items followed a similar distribution.

Patient satisfaction was assessed 12 months after surgery with a single question asking "If you had to be the rest of your life with the symptoms you have now, how would you feel?". As we have seen in the literature [21,39,40],

most of the patients were satisfied one year after the intervention, so responses of "very dissatisfied" and "somewhat dissatisfied" were collapsed into a dissatisfied group and responses of "very satisfied" and "somewhat satisfied" were collapsed into a satisfied group.

Statistical methods

Descriptive data are expressed as frequency and percentages, and means with SD. SF-12 changes were calculated by the difference between 12 months scores and baseline scores, and a reverse procedure for WOMAC, with a positive result indicating a gain in HRQoL. We used the *t* test or the nonparametric Wilcoxon test for quantitative variables and chi-square test or the Fisher's exact test for qualitative variables to assess the differences in baseline patients' characteristics between responders and non-responders at 12 months.

To determine the association of patient level of expectations at baseline with changes in HRQoL 12 months after surgery, general linear models (GLM) were performed. First, we studied the association of each of the patient expectation items with changes in HRQoL in individual analyses considering the change in HRQoL 12 months after surgery as dependent variable, and each patient expectation as independent variables. Because of the importance of the baseline scores in change in HRQoL [41,42] we have adjusted for the corresponding baseline HRQoL scores. Then, we determined the association of baseline patient expectations jointly with changes in HRQoL 12 months after surgery, adjusting for the corresponding baseline HRQoL scores and possible confounding variables. Change in HRQoL was considered as a dependent variable, and patient expectations, baseline HRQoL scores and confounding variables, joint, gender, age, education, BMI, and previous intervention were considered as independent. The interaction between each patient expectation item and the joint were also considered. Only variables with a statistically significant results remained in the final models. The results of the GLM are reported as beta parameter, which represents the improvement on changes in HRQoL for each unit increase in the independent variable, if it is continuous. If the covariate is categorical, the beta parameter represents the difference in changes in HRQoL of a category with respect to the reference category. The predictive accuracy for each final model was determined by the R^2 . Further, multilevel analysis with mixed models was also performed to test whether the effect of the participating hospital changed the results of the final adjusted models.

In addition, after determining the baseline patient expectations which were associated with changes in WOMAC domains 12 months after surgery in the multivariate models, with the aim to measure whether the observed associations were important in size we compared the

minimal clinically important difference (MCID) proportion according to expectation categories (“low”, “high” and “very high” expectation). The MCID has been defined as the smallest difference between the scores in a questionnaire that the patient perceives to be beneficial [43]. For this purpose, we classified patients according to the cut-off points of the MCID established for this type of procedure [44,45]. Then, we estimated the MCID proportion (MCID%), which is the proportion of the sample with a change in scores exceeding the MCID, and we compared the MCID% according to expectation categories.

To analyze the association of patient level of expectations at baseline with patients’ satisfaction 12 months after surgery, logistic regression analysis was performed, following the same steps as before. First, we studied the association of each patient expectation individually with satisfaction 12 months after surgery considering satisfaction as a dependent variable, and each patient expectation as independent variables. Then, we determined the association of baseline patient expectations jointly with satisfaction 12 months after surgery, adjusting for possible confounding variables. Satisfaction was considered as a dependent variable, and patient expectations, and confounding variables such as, joint, gender, age, education, BMI, and previous intervention were considered as independent. The interaction between each patient’s expectations and joint were also considered. Only those variables with a statistically significant result were remained in the final models. The results of the models are reported as odds ratios (OR) and 95% confidence interval (CI). The predictive accuracy for the final model was determined by the area under the receiver operating characteristic (ROC) curve (AUC) [46]. Furthermore, multilevel analysis with generalized estimated equations was also carried out to determine if the effect of the participating hospital changed the results of the final adjusted models.

All effects were considered statistically significant at $p < 0.05$. All statistical analyses were performed using SPSS (SPSS Inc., Chicago, IL) version 18.0, and SAS for Windows statistical software, version 9.2 (SAS Institute Inc., Cary, NC).

Results

A total of 1681 patients on waiting lists for TJR who fulfilled the inclusion criteria and were not excluded by the exclusion criteria agreed to participate in the study and completed the baseline questionnaire before surgery. After the intervention, 892 (53.6%) completed the follow-up questionnaire at 12 months. This is the sample included in the study. The mean age was 68.74 years ($SD = 9.92$), 59.37% were women, 40.92% underwent total hip replacement, 63.6% had not had a previous intervention, the mean BMI was 29.37 ($SD = 4.61$) and 59.21% had primary education. Baseline SF-12 and WOMAC HRQoL data, as

well as a comparison with the data from non-responders, are included in Table 1. Nonresponders had slightly worse scores in the three WOMAC domains and in the MCS SF-12 domain than responders. In expectation items there were baseline statistically significant differences between responders and non-responders. Responders had higher expectations than non-responders.

Patients’ preoperative expectations were quite high (Table 1). If we take into account the “high expectations” and “very high expectations”, the areas in which patients had the highest expectations of improvement were ability to walk after surgery, and improved pain relief, with 90.6% and 89.7%, respectively. They were followed closely by doing more daily activities (81.1%), improved psychological well-being (79.6%), and improved capacity to interact with others (73.9%).

Patients’ expectations and change in HRQoL

Regarding associations between each of the expectation questions and change in HRQoL from baseline to 12 months (Table 2), patients’ expectations showed, in general, a statistically significant association in all HRQoL domains, so, the higher patients’ expectations, the more they improved. Therefore, patients with high or very high pain relief or daily activities expectations improved more in all HRQoL domains except SF-12 MCS domain, than patients with low expectations. With regard to ability to walk, interact with others and psychological wellbeing expectations, patients with very high expectations showed more improvement in all WOMAC domains than patients with low expectations, and patients with high or very high expectations showed more improvement in SF-12 PCS domain than patients with low expectations.

Table 3 shows the results of multivariate general linear models to determine the association of baseline patient expectations jointly with changes in WOMAC and SF-12 domains 12 months after surgery, adjusting for confounding covariables and baseline HRQoL scores. Patients with higher expectations were associated with higher improvements in HRQoL at 12 months. There were two the expectations associated regarding WOMAC pain and function domains: patients with high or very high pain relief expectations improved more than patients with low expectations and patients with very high ability to walk expectations improved more than patients with low or high expectations. Expectations associated with WOMAC stiffness were pain relief. Regarding SF-12 PCS domain patients with very high ability to walk expectations were associated with more improvements than patients with low or high expectations. Finally patients with high or very high pain relief expectations improved more in SF-12 MCS than those with low expectations. The covariables that showed association with change in HRQoL at 12 months were baseline HRQoL scores, joint, BMI, education and previous intervention.

Table 1 Baseline patients' characteristics of responders and non-responders to the 12-month follow-up questionnaire

	Responders (N = 892)	Non-responders (N = 789)	<i>p</i> value
Age in years: mean (SD)	68.74 (9.92)	69.07 (9.65)	0.505
Joint: hip: n (%)	365 (40.92%)	289 (36.26%)	0.051
Gender: female: n (%)	529 (59.37%)	507 (63.77%)	0.71
BMI: mean (SD)	29.37 (4.61)	29.98 (4.71)	0.012
WOMAC: mean (SD)			
Pain	55.26 (18.17)	58.60 (19.54)	<0.001
Stiffness	56.92 (24.24)	60.70 (24.46)	0.002
Function	62.53 (17.28)	66.65 (17.28)	<0.001
SF-12: mean (SD)			
PCS	29.80 (7.08)	29.69 (7.46)	0.787
MCS	43.34 (14.23)	41.21 (14.40)	0.006
Higher education: n (%)			
Secondary education/University	176 (20.39%)	121 (15.71%)	<0.001
Primary education	511 (59.21%)	419 (54.42%)	
None	176 (20.39%)	230 (29.87%)	
Previous intervention: n (%)			
Yes	311 (36.4%)	287 (37.18%)	0.758
No	543 (63.6%)	485 (62.82%)	
Expectation items			
Pain relief: n (%)			
Low	89 (10.31%)	135 (17.26%)	<0.001
High	287 (33.26%)	282 (36.06%)	
Very high	487 (56.43%)	365 (46.68%)	
Daily activities: n (%)			
Low	165 (18.94%)	215 (27.53%)	<0.001
High	407 (46.73%)	326 (41.74%)	
Very high	299 (34.33%)	240 (30.73%)	
Ability to walk: n (%)			
Low	82 (9.40%)	130 (16.71%)	<0.001
High	352 (40.37%)	329 (42.29%)	
Very high	438 (50.23%)	319 (41.00%)	
To interact with others: n (%)			
Low	221 (26.06%)	257 (33.68%)	0.002
High	330 (38.92%)	330 (38.92%)	
Very high	297 (35.02%)	221 (28.96%)	
Psychological well-being: n (%)			
Low	171 (20.38%)	200 (26.49%)	0.015
High	355 (42.31%)	290 (38.41%)	
Very high	313 (37.31%)	265 (35.10%)	

Score direction: WOMAC, higher scores indicating worse HRQoL; SF-12, higher scores indicating better HRQoL.

SD, Standard deviation; BMI, Body Mass Index; WOMAC, Western Ontario and McMaster Universities Osteoarthritis Index; SF-12, Short Form 12; PCS, physical component summary of the SF-12; MCS, mental component summary of the SF-12.

Explanatory ability of the models, in the case of change in WOMAC and SF-12 domains at 12 months, were from 35% to 57%, apart from SF-12 PCS ($R^2 = 0.24$). Multilevel analysis showed that the previous results remained after adjusting for the effect of the participating hospital.

Taking into account that after adjustments, the two expectations which were associated with change in WOMAC domains were those related to pain relief and ability to walk, we compared the MCID% for each WOMAC change score according to expectation categories. Among patients with low pain relief expectations, the patients exceeding the MCID in WOMAC domains after surgery varied from 53.4% to 58.4%, while this range was higher for patients with high or very high expectations, which varied from 75.0% to 79.2%, except for WOMAC stiffness domain which was 62.8% and 69.2% for high and very high expectations, respectively. Regarding ability to walk expectations, the percentage of patients with low expectations exceeding the MCID after surgery ranged from 58.2% to 64.2%, whereas this range was higher for patients with high or very high expectations, which varied from 70.7% to 81.0%, apart from WOMAC stiffness domain with a percentage of 61.1%.

Expectation and Satisfaction

In Table 4 we can observe the unadjusted association of level of expectations with satisfaction 12 months after surgery. In the univariate logistic model expectations related to satisfaction were pain relief, daily activities and ability to walk, but in the multivariate logistic model only daily activities expectations remained significantly associated with satisfaction after surgery. So, we do not show results of the multivariate logistic model because these are the same that appeared in the univariate logistic model. Thus, patients with high or very high daily activities expectations had more likelihood to be satisfied than patients with low expectations. No adjusting covariable was associated with satisfaction at 12 months in the multivariate logistic model. The AUC of the model was 0.57. Multilevel analysis showed that the previous results remained with the adjustment for the effect of the participating hospital.

Discussion

Our prospective study of a sample of consecutive patients with knee or hip OA undergoing TJR offers insight into the association of patient expectations with HRQoL outcomes and satisfaction at one year post-intervention. We observed that patients with higher expectations improved more in HRQoL, measured by SF-12 and WOMAC questionnaires, and had more likelihood to be satisfied, adjusted for BMI, age, gender, joint, education, previous intervention and HRQoL baseline

Table 2 Association of patient expectations individually with change in HRQoL at 12 months by general linear models (N = 892)

Expectations	Change in WOMAC						Change in SF-12			
	Pain		Stiffness		Function		PCS		MCS	
	β	<i>p</i> value	β	<i>p</i> value	β	<i>p</i> value	β	<i>p</i> value	β	<i>p</i> value
Pain Relief										
Low	Ref.	—	Ref.	—	Ref.	—	Ref.	—	Ref.	—
High	11.29	<0.001	9.41	0.012	9.10	0.001	6.30	0.001	4.51	0.066
Very high	14.43	<0.001	15.64	<0.001	12.10	<0.001	9.46	<0.001	4.584	0.049
Daily activities										
Low	Ref.	—	Ref.	—	Ref.	—	Ref.	—	Ref.	—
High	5.47	0.012	6.96	0.015	5.13	0.017	3.82	0.008	0.35	0.849
Very high	8.11	<0.001	10.95	<0.001	7.37	0.001	7.79	<0.001	0.10	0.957
Ability to walk										
Low	Ref.	—	Ref.	—	Ref.	—	Ref.	—	Ref.	—
High	3.41	0.235	4.21	0.267	4.28	0.129	4.53	0.017	1.58	0.515
Very high	10.90	<0.001	13.87	<0.001	11.01	<0.001	9.50	<0.001	4.08	0.084
Interact with others										
Low	Ref.	—	Ref.	—	Ref.	—	Ref.	—	Ref.	—
High	4.02	0.050	1.21	0.651	3.88	0.055	3.29	0.013	2.62	0.116
Very high	5.31	0.012	8.82	0.001	6.74	0.001	6.20	<0.001	0.58	0.726
Psychological well-being										
Low	Ref.	—	Ref.	—	Ref.	—	Ref.	—	Ref.	—
High	2.97	0.176	0.55	0.848	1.75	0.419	3.68	0.011	0.70	0.701
Very high	8.39	<0.001	10.17	0.001	8.33	<0.001	6.67	<0.001	3.09	0.093

Ref: reference group.

This general linear models have been adjusted for the corresponding HRQoL baseline scores.

WOMAC, Western Ontario and McMaster Universities Osteoarthritis Index; SF-12, Short Form 12; PCS, physical component summary of the SF-12; MCS, mental component summary of the SF-12.

Changes are calculated so that a positive value indicates improvement and a negative value, worsening in all questionnaires.

scores. In spite of the existence of several studies that have measured the association between patients expectations and treatment outcomes in TJR, in general there is limited evidence for this association. Haanstra *et al.* in a systematic review about it highlighted the need for more research in this field [12]. The strengths of our study include the relatively large sample size, the use of valid and responsive instruments for assessing outcomes in TJR and the use of multivariate analyses adjusting for confounding variables.

Patients in our study had higher expectations for improvements in physical or functional symptoms than in social or psychological capacities. The two areas where patients had the highest expectations were pain relief and ability to walk, which are traditional reasons for performing TJR. Physical and functional expectations are more closely related to the direct effects of the intervention [12]; therefore, patients might look forward to potential benefits that are more closely related to their basal symptoms such as pain or ability to walk.

These expectations were also the ones with the most association with changes in HRQoL at 12 months after surgery, even after adjusting for covariables. This change, besides being statistically significant, was clinically relevant because there was higher percentage of patients who exceeded MCID as expectations increases. Therefore, the areas where patients place more trust in improving, are the ones more associated with change. This could be due to the fact that our patients had realistic expectations of surgery and correctly anticipated the outcome of the intervention. As in previous studies [12,47], our findings show that patients with worse baseline HRQoL are more likely to improve, so high expectations of surgery are realistic, and might explain the association, adjusting for covariables.

Another potential explanation about observed association of greater expectations being related with improved outcomes is that patients with higher preintervention expectations interpreted their gains more optimistically and participated more intensely in their rehabilitation

Table 3 Association of patients expectations jointly with changes in HRQoL at 12 months adjusting for baseline HRQoL scores and other covariables by general linear models (n = 892)

Covariables and expectations	Changes in WOMAC						Changes in SF-12			
	Pain		Stiffness		Function		PCS		MCS	
	β	<i>p</i> value	β	<i>p</i> value	β	<i>p</i> value	β	<i>p</i> value	β	<i>p</i> value
Baseline HRQoL	0.82	<0.0001	0.94	<0.0001	0.72	<0.0001	-0.75	<0.0001	-0.69	<0.0001
BMI							-0.25	0.0175		
Joint										
Knee	Ref.	—	Ref.	—	Ref.	—				
Hip	4.16	0.0013	5.65	<0.0001	3.24	0.0207				
Highest degree										
Secondary education/ University	6.60	0.0011					3.91	0.0011		
Primary education	3.09	0.0517					*Ref.	—		
None	Ref.	—								
Previous intervention										
Yes					-3.91	0.0064				
No					Ref.	—				
Expectations										
Pain Relief										
Low	Ref.	—	Ref.	—	Ref.	—			Ref.	—
High	10.52	<0.0001	6.63	0.0079	11.14	<0.0001			4.96	0.0081
Very high	10.22	<0.0001	7.95	0.0009	11.99	<0.0001			6.97	<0.0001
Ability to walk										
Low or High	Ref.	—			Ref.	—	Ref.	—		
Very high	3.32	0.0370			3.78	0.0248	3.89	<0.0001		
R²		0.45		0.57		0.35		0.24		0.42

Ref: reference group.

*In this case there has been grouped the reference group (primary and none education).

Baseline Score direction: WOMAC, higher scores indicating worse HRQoL; SF-12, higher scores indicating better HRQoL.

BMI, Body Mass Index; WOMAC, Western Ontario and McMaster Universities Osteoarthritis Index; SF-12, Short Form 12; PCS, physical component summary of the SF-12; MCS, mental component summary of the SF-12. Ref: reference group.

Changes are calculated so that a positive value indicates improvement and a negative value, worsening in all questionnaires.

process, which in turn may affect their recovery, as suggested by some studies [8,47].

Keeping this in mind, it would be important to analyse why some patients have low expectations, which could prevent them from improving. It has been found that unrealistically low expectations may not provide the motivation necessary to progress with the recovery, and thus may result in patients not deriving full benefit from TJR [48,49].

There are many studies in TJR about expectations that have pointed out the importance of baseline patients' realistic expectations so they could be sufficiently fulfilled [10,20,48-50]; however, these studies usually do not emphasize the importance of building up patients' expectations. So, an alternative point of view is that patients' higher expectations contributed to outcomes by acting as a psychological factor, which ultimately could have an influence on post-intervention HRQoL [19,51]. Hence as Judge et al. [47] pointed out, it could

be argued that surgeons should explain to patients with low expectations that the TJR will be quite successful, building up appropriate expectations.

To our knowledge, there are a few comparable studies that explore the association between pre-operative expectations and change in HRQoL for TJR [12]. In our study we found that all analyzed baseline patient expectations were associated with change in HRQoL 12 months after surgery. However, in our study, like others [8], independent expectations associated with improvement in pain and function domains were pain relief and improved ability to walk, measured by WOMAC and SF-36, after adjusting for covariables. So, patients who have higher pain relief or ability to walk expectations may have perceived less pain, less stiffness, and better functional and mental outcomes than patients with less expectations.

Along the same line, Judge et al. [47] in a study of 1327 primary total hip replacement (THR) explored whether pre-operative expectations predict surgical outcomes in

Table 4 Univariate logistic regression analysis for the association of patients' expectations on satisfaction at 12 months (n = 892)

Expectations	Satisfaction (univariate)	
	Odds ratio (95% CI)	p value
Pain relief		
Low	Ref.	—
High	2.31 (1.34 – 4)	0.003
Very high	2.29 (1.37 – 3.80)	0.001
Daily activities		
Low	Ref.	—
High	1.73 (1.13 – 2.65)	0.012
Very high	2.21 (1.38 – 3.54)	0.001
Ability to walk		
Low	Ref.	—
High	1.60 (0.92 – 2.80)	0.099
Very high	1.96 (1.13 – 3.41)	0.018
Interact with others		
Low	Ref.	—
High	1.38 (0.91 – 2.11)	0.132
Very high	1.55 (1 – 2.40)	0.052
Psychological well-being		
Low	Ref.	—
High	1.22 (0.77 – 1.91)	0.397
Very high	1.34 (0.84 – 1.24)	0.222

Ref: reference group;
 CI: Confidence interval.

terms of pain and function measured by WOMAC 12 months post THR. They found that the more the preoperative expectations of a patient, the more likely they were to improve at 12 months.

On the other hand, one study of 112 patients who underwent total knee replacement (TKR) [19] examined which was the most important unique determinant of global outcome/satisfaction after surgical management: baseline expectations, fulfillment of expectations or current symptoms and function. Bivariate analyses showed that baseline expectations were associated with change in pain and in functional limitations. Similar outcomes were reported by other studies [8,30]. However, these results did not retain significance in the multivariable model predicting the overall global outcome or satisfaction. A previous study for TKR [52] also found that pain scores were significantly better for patients who had expected to have no pain and/or had expected they would not need a walking aid. However, although it was significant in this large cohort of 598 patients, the magnitude of this difference (5 points) may not be clinically meaningful. Moreover, for TJR a more recent study [20] found that expectations of time to fully recover from surgery and level of

function were not predictors of WOMAC change scores. However, having expectations of pain relief was a significant predictor.

Satisfaction is a complex item, which is affected by many factors, especially expectations before the surgery [24]. Like Noble *et al.* [28] we found that some preoperative expectations were associated with satisfaction after TJR. Having higher pain relief, daily activities and ability to walk expectations seem to be related to more satisfaction than patients with low expectations. However, these differences only persist for daily activities expectations after adjusting for the other covariables. Therefore, in our study, patients who have significant expectations to improve their ability to perform daily activities had more likelihood to be satisfied than patients who had low expectations. Pain and ability to walk could be associated with the ability to perform daily activities. Thus, the less the pain and difficulty in walking the patients have, the greater their ability to perform daily activities; which seems to be associated directly with satisfaction. Patients seem to see more easily the relationship of their ability to perform daily activities with satisfaction, however, this ability could probably be related to pain relief and ability to walk. Following this trend Noble *et al.* [28] suggest that patient's expectations will strongly influence their interpretation of the outcome of their TJR and their satisfaction. On the other hand, a US study by Mancuso *et al.* [21] in 180 THR looked at whether preoperative expectations were associated with satisfaction with surgery. They concluded that expectations were not associated with satisfaction. Finally, it should be noted that we would have to take into account that this relationship between expectations and satisfaction is likely to be mediated by a larger improvement in those with high expectations.

Limitations

A possible limitation of our study is the percentage of non-responders or missing values. Only 53.06% patients completed questionnaires at 12 months. Probably owed to our questionnaire extension, the patient's burden to complete the questionnaire could be important. However our sample keeps on being large enough comparing with others similar studies. Besides, TJRs performed in total during the recruitment period are unknown because there were fifteen hospitals of different autonomous community participating and not all of these hospitals did collect this information. As well as owed to large sample size we found differences between responders and non-responders, nevertheless this differences despite being statistically significant were not clinically relevant, although could cause a bias in the results. Another limitation is that we did not evaluate patients' knowledge of TJR, coming from their clinical or their social/familiar settings about the procedure, recovery process, complications and so on,

as potential covariables associated with functional outcomes and which could strongly influence expectations. Besides, like in other studies [53] in order to estimate the score for satisfaction at one year we used a single anchoring question on patient satisfaction with the surgical outcome. This is a similar concept to widely used Patient Acceptable Symptom State (PASS) [53-57]. The difference is that our item asked about satisfaction with surgery that included aspects of patients' current symptoms, but also their baseline level of symptoms, in addition to their response and expectations of surgery. Furthermore, we did not use a validated expectation questionnaire that could ensure comparability for future research or an open-ended free text question allowing other types of expectations to be identified. However, these kinds of questions may pose problems regarding how to code answers, and differences in verbosity or fluency could affect the findings [47]. Finally, these questions did not measure the importance of different expectations expressed by individual patients. Therefore future studies need other possible factors that influence expectations.

Conclusions

In conclusion, this prospective study showed that patients preparing for TJR had high expectations for the surgery, and patients with high or very high baseline expectations for TJR improved more in HRQoL at one year and had more likelihood to be satisfied than patients with low expectations. Given that having high expectations seems to be beneficial to surgical outcomes, surgeons should talk with their patients to providing them with appropriate expectations, which act as a psychological factor that could improve HRQoL outcomes.

Abbreviations

OA: Osteoarthritis; TJR: Total joint replacement; HRQoL: Health related quality of life; SF-36: Short form 36; SF-12: Short form 12; WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index; BMI: Body mass index; SD: Standard deviation; PCS: Physical component summary; MCS: Mental component summary; GLM: General linear models; MCID: Minimal clinically important difference; OR: Odds ratio; CI: Confidence interval; ROC: Receiver operating characteristic; AUC: Area under curve.

Competing interests

There are no conflicts of interest.

Authors' contributions

MG, carried out the acquisition of data, involved in design of the study, analysis, interpretation and composition of the manuscript. AE conceived of the study, and participated in its design and coordination and helped to draft the manuscript. AB participated in the draft of the manuscript and performed the statistical analyses. CH, LG, FA, and CS were involved in conception and design of the study. All authors read and approved the final manuscript.

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