The Virtue of Optimistic Realism- Expectation Fulfillment Predicts Patient-Rated Global Effectiveness of Total Hip Arthroplasty

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Abstract

Background: Emerging evidence highlights the importance of preoperative expectations in predicting patient-reported outcomes of orthopedic surgeries. To date, it is still a matter of controversy whether patient satisfaction can be maximized by promoting either optimistic or realistic outcome expectations before surgery. Adjusting overly optimistic outcome expectancies in favor of a more realistic outlook on the limitations of total hip arthroplasty could reduce the risk of disappointment and lead to greater satisfaction with surgery outcomes. Our prospective cohort study was aimed at comparing the relative predictive influence of baseline expectations, expectation fulfillment and symptomatic improvement on the global effectiveness of total hip arthroplasty.

Methods: Ninety patients (49 female, 41 male; mean age: 63±12.87 years) fulfilled inclusion criteria and completed a comprehensive preoperative assessment comprising sociodemographic, clinical, functional and psychological phenotypes. Moreover, the strengths of preoperative expectations for improvements in eight pain-related and functional domains were recorded on a 5-point Likert-scale. At 12 months after surgery, patients were asked to rate perceived improvements in each of these domains as well as the global effectiveness of the total hip replacement on a 5-point Likert-scale. To evaluate the relative impact of preoperative expectations, symptom improvement and the fulfillment of expectations on the global effectiveness of surgery, a hierarchical multiple linear regression analysis was performed.

Results: Compared with the actual improvement at 12 months follow-up, prior expectations had been overly optimistic in about 28% of patients for hip pain, in about 45% for walking ability and around 60% for back pain, physical exercise, general function, social interactions and mental well-being. An optimistic hip pain expectation and the fulfillment of expectations for walking ability and independence in everyday life were found to independently predict global effectiveness ratings.

Conclusions: In line with many authors investigating the relationship between the fulfillment of expectations and satisfaction with medical interventions, we suggest that professionals should explicitly address their patients’ expectations during the preoperative education and consultation. While for hip pain, high expectations seem to be beneficial, a realistic outlook encouraging self-efficacy expectancies should be conveyed for complex functional domains.

Background

Osteoarthritis is the most common degenerative joint disease among the elderly worldwide [1–3]. Owing to population ageing, prevalence rates are expected to continue rising generating considerable costs for the healthcare system [4]. Accordingly, utilization rates of total hip arthroplasty (THA) have been increasing over the last two to three decades in industrialized countries [5–7].

THA is indicated in patients suffering from end-stage osteoarthritis of the hip, inflammatory arthritis, fracture or dysplasia who do not respond to conservative therapies [5]. It is recognized as an effective surgical intervention for alleviating pain and improving mobility and quality of life in these patients [8, 9]. Yet, about one third suffer from persistent postoperative pain after THA and 3 to 16% report being dissatisfied with the outcome [10–14]. Several preoperative risk factors for dissatisfaction with surgical outcomes have been identified with high consistency across studies: higher age, female gender, co-morbidities, associated conditions affecting walking capacity, mental distress, higher pain, and lower socioeconomic status [13, 15–18].

The willingness to return to an institution for postoperative monitoring or other surgical procedures strongly depends on the patients' evaluation of treatment effectiveness and their satisfaction with postoperative outcomes [19, 20]. Important technical progress has already been made in the area of THA which reduces the chances of future major breakthroughs in this field [21]. Thus, for quality management in competitive healthcare systems as well as better defining clinical needs, understanding and influencing modifiable determinants of patient satisfaction has become increasingly important [9].

If not for the expectation of symptomatic improvement, few people would opt for having elective surgery. Scientific interest in preoperative expectations modulating patient-reported outcomes has been increasing over the last years producing largely inconsistent results [17].

Owing to the low methodological study quality and heterogeneity of construct definitions and measurements [17, 22–24], the exact nature of the relationship between expectations and outcome still remains a matter of controversy [22]. Some studies find patient satisfaction to be mainly predicted by postoperative improvement in symptoms and function, irrespective of prior expectations or expectation fulfillment [23]. Others state that high expectations *per se* favor better outcomes [25–27], possibly reflecting the influence of dispositional optimism and placebo effects [28–30]. Yet other findings emphasize the importance of the fulfillment of preoperative expectations, regardless of them being optimistic or pessimistic [23].

Evidently, it is crucial for surgeons to know whether to promote optimistic attitudes in their patients or whether to correct those in favor of a more realistic perspective on potential postoperative outcomes, given the individual constellation of risk factors present [22, 23]. Unfortunately, however, it is still not possible to derive consistent recommendations for the preoperative doctor-patient communication from the existing body of literature [22].

Consequently, there is a strong need for prospective investigations simultaneously addressing symptomatic improvement, expectations and expectation fulfillment in multivariate models while controlling for a comprehensive set of possible confounders. Applying a hierarchical multiple linear regression model, Mannion et al. [23], among others [21, 24, 31] provided convincing evidence for the fulfillment of expectations as an independent predictor of the patient-rated global effectiveness of spinal surgery.

The aim of this observational cohort study was to translate the methodological approach of Mannion et al. to the field of total hip arthroplasty [23]. By use of a hierarchical multivariate analysis approach, we intended to examine the relative importance of three potential predictors of patient-rated treatment effectiveness: Preoperative outcome expectations (1), symptom relief/ functional improvement (2) and the fulfillment of outcome expectations (3). To ensure maximum comparability with Mannion et al., the same kind of operationalization for all three predictors was used. Moreover, we made sure to employ psychometrically sound instruments, widely applied and relevant to patients with hip osteoarthritis [9]. As suggested by Haanstra et al. in their review article [24], we additionally included psychological factors like catastrophizing and depression potentially confounding the association between expectations and outcome.

Methods

Participants

The study complies with the Declaration of Helsinki and the STROBE guidelines [32]. The Ethics Committee of the University Hospital Goettingen (No. 5 /4 /12) and the Ethics Committee of the Hannover Medical School (No. 1483–2012) approved the protocol. All patients gave written informed consent.

From July to November 2012, N = 172 consecutive patients scheduled to undergo total hip arthroplasty at the Orthopedic Clinic of the Hannover Medical School were screened for eligibility. Inclusion criteria were: (a) age ≥ 19, (b) fluent German literacy skills, (c) the mental and legal ability to give written consent and (d) the agreement to participate in the 12-month follow-up survey and to provide contact details. Patients suffering from dementia, planned spinal anesthesia (all included patients received balanced general anesthesia), drug addiction and post-surgical delirium syndrome were not eligible. We further excluded patients suffering from peri- and postoperative complications (such as post-operative delirium, and prosthetic joint infection) from the 12-month follow-up analysis (for an overview of the study protocol see Fig. 1). In total, n = 82 patients had to be excluded from the study or the statistical analysis (see Fig. 1 for further information). The baseline characteristics of the study participants (n = 90) are shown in Table 1.

Table 1
Sociodemographic, pain-related, functional and psychological variables at baseline

Sociodemographic variables and Body Mass Index	
Gender, *No.*	49 women; 41 men
Age at examination, years, *mean ± SD*	63 ± 12.87
Degree of school education, *No. (%)* No graduation „Haupt-/Volksschule“ [a] „Realschule/mittlere Reife“[b] „„Fachhochschule, Abitur, allg. Hochschule“[c]	1 (1%) 36 (40%) 27 (30%) 26 (29%)
Body Mass Index (BMI), kg/m^2; *mean ± SD*	27.57 ± 4.66
Pain characteristics	
Average hip pain in the last 3 months before surgery, Numeric Rating Scale (0–10), *median (1st ; 3rd quartile)*	6 (4; 7)
Overall severity of chronic pain condition, Chronic Pain Grade (von Korff), *No. (%)* Grade 1 Grade 2 Grade 3 Grade 4	15 (17) 20 (23) 17 (18) 38 (42)
Pain chronicity, MPSS[d], No. *(%)* Stage I (low) Stage II (medium) Stage III (high)	36 (40%) 37 (41%) 17 (19%)
Duration of hip pain, time intervals, No. *(%)*	
1 to 12 months	18 (20.1%)
12 to 24 months	22 (24.4%)
2 to 5 years	31 (34.4%)
More than 5 years	19 (21.1%)
Pressure pain threshold (PPT), kPa, *mean ± SD*	391.55 ± 179.35
Functional capacity	

Sociodemographic variables and Body Mass Index	
Walking ability, Timed up and go test score, *median level, (1st ; 3rd quartile)*	2 (2; 2)
Hip function and mobility, WOMAC[e] score, *mean ± SD*	53.09 ± 20.82
Psychological variables	
Health-related quality of life, SF-12[f], *mean ± SD*	
SF-12 Physical	29.89 ± 7.85
SF-12 Mental	49.23 ± 12.35
Psychological distress, DASS[g], *median (1st ; 3rd quartile)*	
DASS Depression	3 (1; 5)
DASS Anxiety	1 (0; 3)
DASS Stress	5 (2; 8)
Somatization, PHQ-15[h], *median (1st ; 3rd quartile)*	5 (4; 8)
Kinesiophobia, TSK[i], *median (1st ; 3rd quartile)*	36 (31; 41)
Cognitive appraisal of pain, KPI[j], *median (1st ; 3rd quartile)*	
Catastrophizing thought scale	2 (0.47; 3.11)
Helplessness scale	0.4 (0; 1.20)
Thought suppression scale	2.75 (1.25; 3.75)
Fear of surgery, Numeric Rating Scale (0–10), *median (1st ; 3rd quartile)*	3 (1; 6)
Fear of pain after surgery, Numeric Rating Scale (0–10), *median (1st ; 3rd quartile)*	2 (1; 5)

Descriptive statistics are based on N = 76–90 subjects due to varying numbers of missing data per variable; [a] "Hauptschule" in Germany refers to the final examination at grade 9; [b] "Realschule" finishes after grade 10 with the degree "mittlere Reife"; [c] "Gymnasium" finishes with the final examination called "Abitur" after grade 13; [d] MPSS=Mainz Pain Staging System (Gerbershagen et al., 2008); [e] WOMAC=Western Ontario and McMaster Universities Osteoarthritis Index (Stucki et al., 1996); [f] SF-12 = short form of the Health Survey Questionnaire (Jenkinson et al., 1997); [g] DASS=Depression, Anxiety, Stress Scales (Nilges und Essau, 2015); [h] PHQ-15 = Patient Health Questionnaire (Kroenke et al. 2002); [i] TSK= Tampa Scale for Kinesiophobia (Roelofs et al. 2004); [j] KPI=Kiel Pain Inventory (Hasenbring, 1994)

Study design

Preoperative procedure (assessment at baseline)

On the preoperative day, patients were interviewed and physically examined by the study physicians with the aim of recording basic sociodemographic and clinical data. Tests of hip mobility and function and the pressure pain threshold were conducted. A comprehensive questionnaire booklet was administered at baseline addressing potential relevant predictors of patient-reported global effectiveness of THA. In addition to the phenotypes detailed in the left-hand column of Table 1, the booklet included questions concerning outcome expectations (see Table 2) and the single most important change for the surgery to be judged as successful by the patients.

Table 2
Comparison of patients' expectations at baseline and respective outcomes 12 months after total hip arthroplasty (THA)

	Percentage of patients (N = 90) in each category at baseline (*pre*) and 12 months (*12 m*) after THA											
	Much better		Better		Somewhat better		Unchanged		Worse		Uncertain	
	pre	*12 m*	*pre*	*12 m*	*pre*	*12 m*	*pre*	*12 m*	*pre*	*12 m*	*pre*	*12 m*
Hip pain	79	66	21	30	-	2	-	2	-	-	-	-
Back pain	37	6	34	30	7	30	9	33	-	1	13	-
Walking ability	83	48	15	36	1	14	-	1	-	1	1	-
Independence	67	33	25	46	2	19	2	2	-	-	4	-
Physical exercise	44	15	35	28	9	27	7	30	-	-	5	-
General function	59	21	37	42	1	29	3	8	-	-	-	-
Social interactions	32	2	30	20	5	40	27	38	-	-	6	-
Mental well-being	39	5	36	31	2	40	21	23	-	1	2	-

Pain characteristics

The average hip pain intensity in the last 3 months before surgery was assessed on an 11-point Numeric Rating Scale (NRS; 0 = no pain to 10 = worst pain imaginable) [33]. The severity of chronic pain was operationalized by use of the Chronic Pain Grade (CPG) which models the relationship between pain intensity and disability [34]. The CPG grades pain severity into four hierarchical categories: Grade 1: Low disability and low pain intensity; Grade 2: Low disability and high pain intensity; Grade 3: High disability, moderately limiting and Grade 4: High disability, severely limiting.

Pain chronicity stages (I-III, acute to chronic pain) were derived using the validated Mainz Pain Staging System (MPSS) [35, 36]. The classification is based on a 10-item-questionnaire rated by the study physicians. It takes into account temporal and spatial dimensions of pain (over a 4-week recall period), the history of medication usage and the life-time utilization of the health care system [35].

As a measure of overall pain sensitivity, the pressure pain threshold (PPT) was recorded using an electronic pressure algometer (Somedic Production, Stockholm, Sweden) bilaterally over five sites (thumb, lateral epicondylus, upper division of the trapezius, quadriceps femoris, and tibialis anterior). The algometers' probe tip (1 cm^2) was applied to each site. Patients were advised to indicate when first perceiving pain during pressure stimulation with slowly increasing intensity (50 kPa/s). Pressure stimulation stopped at the patients' report of pain or when maximum pressure intensity (1000 kPa) was reached. Analyses are based on the average threshold (kPa) over all 10 testing sites.

Reasons for surgery

In accordance with Mannion et al. [23], patients were asked to choose their 3 most important reasons for undergoing THA from the following options: Other therapies were ineffective, something must be done, fear of worsening of my situation, to retain my independence, to improve everyday functioning, to improve walking capacity, to reduce pain, my physician recommended the surgery.

Functional capacity

In order to measure the patients' individual mobilization ability, the psychometrically well evaluated Timed up and Go test was employed [37]. The time it takes for a person to stand up from a sitting position, walk three meters, turn around, walk back to the chair and sit down again is recorded. According to the time taken to complete the task, patients were assigned to 5 levels of mobility: Level 1: independent mobility (< 10 seconds); Level 2: mostly independent mobility (< 20 seconds); Level 3: variable mobility (20–29 seconds); Level 4: impaired mobility (> 30 seconds); Level 5: unable to walk or to fulfill the task.

To evaluate the preoperative functional capacity of the patients, the German version of the „Western Ontario and McMaster Universities Osteoarthritis Index" (WOMAC) was employed [38]. The WOMAC is a reliable and valid, self-administered instrument. It comprises 24 questions scored on a 4-point-Likert scale to measure pain (5 items), stiffness (2 items) and physical functioning (17 items) of patients suffering from knee or hip osteoarthritis. The total WOMAC score ranges from 0 to 94 with higher scores representing more pronounced functional disability.

Psychological variables

Health-related quality of life was assessed using the German version of the Short-Form Health Survey (SF-12) [39, 40]. It reproduces two essential dimensions of quality of life (6 items each) and has satisfactory psychometric properties [41]: The Physical Component Summary Score (PCS) represents general health perception, physical role functioning, and pain. The Mental Health Component Summary Score (MCS) reflects emotional role functioning, mental well-being, negative affectivity, and social functioning. The SF-12 summary scores are based on scoring algorithms, which are composites of weighted item responses. Summary scores range between 0 and 100 for both PCS and MCS. A value of about 50 represents the mean of a standard population, higher values represent better health-related quality of life [40], a value difference of 10 represents a standard deviation.

Psychological distress in terms of depression, anxiety and stress was measured employing the German version of the Depression, Anxiety, Stress Scales (DASS) [42–44]. The DASS has acceptable psychometric properties and is made up of three subscales, each comprising 7 items to be rated on a 4-point Likert-type scale with higher values indicating higher psychological distress.

Somatization has previously been associated with substantial functional impairment and healthcare utilization [45, 46]. In our study, somatization was evaluated by means of the German version of the Patient Health Questionnaire (PHQ) [47]. The PHQ-15 inquires about the severity of 15 somatic symptom clusters which include 14 of the 15 most prevalent DSM-IV somatization disorder somatic symptoms on a 3-point scale (0 = not bothered at all, 1 = bothered a little and 2 = bothered a lot). The PHQ-15 total score represents the sum of the individual items ranging from 0 to 30.

Movement-related fear ("kinesiophobia") has been increasingly recognized as a crucial predictor of the maintenance of pain and disability [48, 49]. We used the German version of the "Tampa Scale for Kinesiophobia" (TSK) which has good psychometric properties [50, 51]. It contains 17 questions rated on a 4-point Likert-type scale (total score range 17 to 68). The fear of surgery and of postoperative pain was additionally measured on an 11-point NRS (0 = no fear and 10 = worst fear imaginable).

The cognitive appraisal of pain was assessed using the Kiel Pain Inventory (KPI) [52]. It contains three independent self-rating instruments for the standardized assessment of the cognitive, emotional and behavioral processing of pain: The Catastrophizing Thought Scale (CTS; 5 items), the Thoughts of Helplessness Scale (THS; 9 items) and the Thought Suppression Scale (TSS; 4 items). Items are rated on a 7-point Likert-type scale and the subscale scores represent the mean of the respective items.

Expectations regarding pain-related and functional outcomes of the surgery

Expectations of the surgery outcomes were evaluated at baseline using a modified version of the "Expectation Scale" from the North American Spine Society (NASS) Lumbar Spine Questionnaire [53]. Patients were asked to report their expectations regarding the following pain-related and functional surgery outcomes on a 6-point scale (I don't know; worse = 1; unchanged = 2; somewhat better = 3; better = 4; much better = 5): Hip pain, back pain, walking capacity, independence, physical exercise, everyday functioning, social interaction and mental well-being.

Single most important outcome

The single most important individual outcome occurring after the surgery in order for patients to judge the THA as successful was also recorded before surgery. Answer possibilities were: Improvements in hip pain, back pain, walking capacity, independence, physical exercise, everyday functioning, social interaction and mental well-being.

Postoperative procedure (assessment at 12 months follow-up)

At 12 months after surgery, average hip pain intensity in the last 3 months (NRS), overall severity of chronic pain (CPG), functional capacity (WOMAC) and a psychological outcome variables (health-related quality of life, psychological distress and kinesiophobia) were recorded again using the respective standardized questionnaires (SF-12, DASS and TSK) in a telephone interview. In addition, the following outcome parameters were assessed according to a standardized protocol:

Pain-related and functional outcomes of surgery (see Table 2*)*

Patients were asked to rate the actual improvements regarding the 8 outcome parameters asked for in the preoperative examination booklet (expectations regarding pain-related and functional outcomes of surgery) on a 5-point scale (1 = worse, 2 = same, 3 = somewhat better, 4 = better and 5 = much better).

Fulfillment of expectations

The fulfillment of expectations, i.e. the degree to which the outcome met the expected improvement, was then evaluated in two ways: First, patients were asked whether their expectations regarding a particular outcome had been met (answer possibilities: “yes”, “partly” or “no”; Fig. 2A). Second, an expectations-actuality discrepancy score was obtained by subtracting the preoperative expectation score for each outcome parameter from the respective postoperative outcome score. The resulting expectations-actuality discrepancy scores ranged from − 5 to 5 points. A negative expectations-actuality discrepancy score indicated less improvement than expected and was termed “expectations not met”. A score of zero indicates an outcome as expected and was termed “expectations met”. A positive expectations-actuality discrepancy represents a greater improvement than expected and was named “expectations exceeded” (Fig. 2B).

Self-reported global effectiveness of the study

At follow-up, the patients rated the global effectiveness of the surgery (“How did the surgery help you overall?”) on a 5-point scale (made it worse, did not help, helped a bit, helped, and helped a lot).

Single most important positive outcome after surgery

Patients were additionally asked to state the single most important positive outcome they experienced as a result of the THA (response categories: Improvements in hip pain, back pain, walking capacity, independence, physical exercise, everyday functioning, social interaction and mental well-being).

Statistical analyses

Statistical analyses were carried out using SPSS software (IBM SPSS Statistics for Windows, version 21.0; IBM Corp, Armonk, NY). Continuous variables were described by mean and standard deviation. Discrete variables were presented as frequencies (nominal data) or median with first and third quartiles (ordinal data). The distribution of continuous data was tested for normality using the Kolmogorov-Smirnov-Test.

Associations of baseline characteristics, preoperative expectations, symptom change scores and the fulfillment of expectations with the patient-rated global effectiveness of surgery, were explored by correlation analyses (Supplementary Tables 1 and 2). Multiple testing was accounted for by Bonferroni correction. Cohen's Kappa (κ) was used to determine the agreement between identical rating (e.g. preoperative expectations and postoperative change). For metric data, Pearson's r and for dichotomous variables (i.e. gender) phi correlation coefficient (Chi-squared test of Pearson) was used. Ordinal data were correlated using the non-parametric rank test Kendall Tau-B (τB) as it has been shown to be more robust and slightly more efficient than Spearman rank-order correlation coefficient [54, 55].

To evaluate the relative predictive influence of preoperative expectations, symptom change scores and the fulfillment of expectations on the patient-rated global effectiveness of surgery (dependent variable) a hierarchical multiple linear regression analysis was performed adjusting for multiple baseline characteristics (Table 3). Displayed regression coefficients were mutually adjusted for the respective other predictors. Variables significantly correlated with the dependent variable after Bonferroni-adjustment for multiple testing in prior correlation analyses (see Supplementary Tables 1 and 2) were entered into the multiple linear regression model in a stepwise approach. The gain in explained variance (R^2) from one step to the next is reported. In a first step of the hierarchical linear regression, potentially confounding baseline characteristics were entered: Degree of school education, average hip pain in the last 3 months before surgery, overall severity of chronic pain (CPG), hip function and mobility (WOMAC), walking ability (Timed up and go score). In a second step, hip pain expectation at baseline was added. In a third step, symptom change scores (quotient of outcome measures at 12 months follow-up and preoperative scores) for the following variables were fed into the model: Average hip pain in the last 3 months, hip function and mobility (WOMAC) and health-related quality of life (SF-12 physical). In a fourth step, expectations-actuality scores for walking ability, independence, physical exercise, general function and social interactions were added. All reported p-values are two-sided and the level of significance was set to $p < 0.05$.

Table 3

Results of the hierarchical multiple regression analysis: Variance explained in the global effectiveness of total hip arthroplasty at 12 months follow-up by sociodemographic and medical variables, change in symptoms and the expectations-actuality discrepancy

Steps and variables entered upon each step	**R^2**	**R^2_{change} (p-value)**	**β in final model (only significant predictor variables shown)**	**p-value of final β**
Step 1 (N = 72): Degree of school education, average hip pain in the last 3 months before surgery, overall severity of chronic pain (CPG), hip function and mobility (WOMAC), walking ability (Timed up and go score)	0.332	-	-0.363 (Timed up and go score)	0.002
Step 2 (N = 68): Hip pain expectation prior to surgery	0.417	0.085 (< 0.001)	-0.363 (Timed up and go score) 0.276 (Hip pain expectation)	0.002 0.006
Step 3 (N = 62): Change in symptoms for: Average hip pain in the last 3 months, hip function and mobility (WOMAC), health-related quality of life (SF-12 physical)	0.473	0.056 (< 0.0001)	-0.308 (Timed up and go score) 0.327 (Hip pain expectation)	0.010 0.003
Step 4 (N = 52): Calculated expectations-actuality discrepancies for walking ability, independence, physical exercise, general function and social interactions	0.733	0.260 (< 0.00001)	0.504 (Hip pain expectation) 0.407 (Expectation fulfillment walking ability) 0.407 (Expectation fulfillment independence)	< 0.0001 0.004 0.025
Adjusted R^2 for final model (N = 82; hip pain expectation, expectations-actuality discrepancy walking ability and independence)	0.402	-	-	-

Steps and variables entered upon each step	R^2	R^2_{change} (p-value)	β in final model (only significant predictor variables shown)	p-value of final β
Due to varying numbers of missing data per variable, sample sizes vary. Predictor variables individually significantly associated with global effectiveness of THA (see Supplementary Tables 1 and 2) were entered in four steps. The significant predictors in the final model were: Hip pain expectation and the calculated expectations-actuality discrepancy fulfilments of walking ability and independence in everyday life. *β in final model = β regression coefficient after all listed variables have been entered; R^2_{change} = Increase in explained variance by step; adjusted R^2, = R^2-(k-1)/ (n-k)*(1- R^2) where n = no. observations, k = no. independent variables. Level of significance was set to p < 0.05.*				

Results

Description of the study sample

Data analyses were based on 90 patients (N=49 female, N= 41 male) admitted to the hospital for total hip replacement surgery (right side: N=46; left side= N=44). Their mean age was 63±12.87 years and 67% were unemployed or retired. The most frequent indication for surgery was primary osteoarthritis of the hip (77%), followed by hip dysplasia (15%), femoral head necrosis (5%) and posttraumatic osteoarthritis (3%). On average, patients reported moderate pain intensities. Only one third of patients were classified as patients with a high level of chronicity. The majority of the cohort still had independent mobility skills. Symptom load for psychological parameters such as depression, somatization, kinesiophobia, catastrophizing, helplessness and fear of surgery or pain was rather low (below the cut-offs of clinical relevance). For a comprehensive sociodemographic and clinical characterization, see Table 1.

Reasons for surgery

The most common reason for deciding to undergo surgery was “to improve walking capacities” (25%), followed by “to reduce pain” (21%), “to retain my independence” (18%), to “improve everyday functioning” (15%), “other treatments were ineffective” (9%), “fear of worsening of my situation” (8%) and “my physician recommended it” (4%).

Importance of the expected positive outcomes

To evaluate the surgery as a success, 47% of the participants found improvement in hip pain to be the most important expected positive outcome (walking ability: 30%, general function: 14%, independence in everyday life: 7%, back pain and physical exercise 1%). This preoperative rating correlated significantly (p = 0.006, κ=0.188) with the patients’ follow-up rating of the most important positive outcome that had occurred after the surgery (hip pain: 59%, walking ability: 24%, general function: 7%, independence in everyday life: 6%, back pain: 3% and physical exercise: 1%).

Preoperative expectations and postoperative outcomes

The domain-specific preoperative expectations and respective postoperative outcomes after 12 months are shown in Table 2. Consistent with the most important reasons for undergoing surgery, expectations for improvements in hip pain and physical functioning were rather high. The majority of the patients expected to benefit (either “much better”, “better” or “somewhat better”) from surgery in terms of hip pain (100%), walking ability (99%), general function (97%), independence in in everyday life (94%) and physical exercise (89%). With respect to back pain, social functioning and mental well-being, expectations were slightly less optimistic (81, 78 and 60%, respectively). Accordingly, at 12 months follow-up, 98% of the patients reported an improvement (“much better”, “better” or “somewhat better”) in hip pain and walking ability and independence in everyday life. General function was found to be improved in 92% of the patients. The largest discrepancy between baseline expectations and postoperative outcome was reported for back pain (postoperative improvement in 66%) and physical exercise (postoperative improvement in 70%) Social interactions showed an improvement in only 62% of the participants.

Fulfillment of expectations

Interestingly, when asked at 12 months follow-up whether their preoperative expectations had become true, patients had a more favorable look on expectation fulfillment as compared to the calculated expectations-actuality discrepancies (compare Figures 2A and 2B). For hip pain, walking ability and independence in everyday life, only 3% reported that their expectations had not been met. Least positive self-reports of expectation fulfillment were found for back pain, social interactions, physical exercise and mental well-being (Figure 2A). For the calculated discrepancy scores, with the exceptions of hip pain and walking ability, the percentage of patients falling into the group “expectations not met” ranged around 52 to 65% (Figure 2B).

Relationships between both measures of expectation fulfillment are displayed in Figure 3. For all eight domains, a high correspondence of retrospective self-reports and calculated scores were found (for all items p £ 0.001, $_B$ = 0.355 - 0.538).

Patient-rated global effectiveness of surgery at 12 months follow-up

When asked for the degree to which the total hip arthroplasty helped overall, responses were as follows: Helped a lot: 60%, helped: 38%, helped somewhat: 1%, did not help: 1%. No one thought that the surgery “made it worse”.

Predictors of the patient-rated global effectiveness ofsurgery

To evaluate the relative predictive influence of preoperative expectations, symptom change and the fulfillment of expectations on the global effectiveness of surgery (dependent variable), a hierarchical multiple linear regression was performed. Results are shown in Table 3. Baseline variables found to significantly correlate with the dependent variable (Supplementary Table 1) were included as confounders in the first step of the model. At step 1, walking ability at baseline (Timed up and go test score) appeared as a significant predictor of the global effectiveness of surgery. As a next step, preoperative expectations significantly associated with the dependent variable were added (only hip pain expectation, Supplementary Table 2). At step 2, in addition to walking ability, preoperative hip pain expectation was found to significantly contribute to the model. Then, changes in symptoms (quotient of outcome measures at 12 months follow-up and preoperative scores of the same variable) significantly associated with the outcome was added (Supplementary Table 2). None of the symptom change scores resulted to be independent predictors of the patient-rated global effectiveness. As a last step, the domain-specific expectation fulfillment scores (calculated expectations-actuality discrepancy) for walking ability, independence, physical exercise, general function and social interactions were entered. These lead to the highest change in explained variance. At this step of the hierarchical model, walking ability prior to surgery no longer contributed to the model. Importantly, in addition to the hip pain expectation prior to surgery, expectation fulfillment in walking ability and independence in everyday life appeared as independent predictors of the patient-rated global effectiveness of THA. Unfortunately, due to varying numbers of missing data for the different measures, samples sizes decreased with increasing number of variables. Therefore, in the final model, we only included the three significant predictors. Based on 82 subjects, this model explained about 40% of the variance in the patient-rated global effectiveness of surgery.

Discussion

The present study was designed in analogy to Mannion et al. [23] with the aim of delineating to which extent patient self-ratings of treatment effectiveness were explained by preoperative outcome expectations, the fulfillment of these expectations or the improvement in core symptoms of hip osteoarthritis. A hierarchical multiple linear regression analysis was performed adjusting for a comprehensive set of baseline characteristics significantly correlated with the global outcome rating (education, severity grade of chronic pain, walking ability and hip function).

We essentially reproduced the key results of Mannion et al. [23] by revealing that patients undergoing total hip replacement surgery base their global effectiveness ratings mostly on the fulfillment of their preoperative outcome expectations. Interestingly, in our study, this was only observed for functional parameters like walking ability and independence in everyday life. For the more fluctuating sensory-affective experience of hip pain, however, an optimistic expectations *per se* appeared to be most beneficial for evaluating the surgery as a success- independent of its fulfilment (the expectations-actuality discrepancy for hip pain was not significantly associated with the global effectiveness of surgery).

This finding gives reason to assume that expectancy effects work differently for non-volitional experiences like pain and more complex functional parameters like walking capacity. Experimental research on placebo effects has contributed convincing evidence for non-volitional responses being mostly modulated by the expectancy of their occurrence [56]. Thus, positive expectations about pain and pain-mitigating treatments have the potential to attenuate the subjective experience of pain by influencing attentional processes as well as affective appraisals leading to an activation of descending control systems [57, 58]. Expectations of functional recovery, such as walking ability and independence, are part of a much broader and abstract concept, which pertains more strongly to self-efficacy expectations and motivational mechanisms [56, 59, 60]. Functional recovery after THA depends on a multitude of factors presumably less subject to non-volitional processes [60]. It may rather be influenced by the surgical intervention itself increasing the mobility of the hip joint, the quality of the postoperative rehabilitation and, most importantly, motivational factors and self-efficacy expectations of the patients [56, 59].

As a consequence, conveying realistic information about the benefits and limitations of THA could be especially important with regard to the functional recovery process. Indeed, before surgery, about 60 to 70% of our study participants had exaggerated expectations for improvements in functional domains not part of the actual indication of THA (e.g. back pain, social interactions and mental well-being). For physical exercise, general function, social interactions and mental well-being this brought about 60% of unfulfilled expectations.

It has been commonly noted in orthopedic surgeries, that more than 50% of patients have higher expectations than their surgeons [61]. Surgeons' expectations, in contrast, seem to be more reliable and accurate [62]. Professionals tend to rate their expectations based on the patient's pre-operative functional state and general health, while patients' expectations are often nurtured by their hopes, mental well-being and trust in their surgeon [62].

In coming to terms with disconfirmed experiences, people make psychological adjustments which lead to non-linear patterns of satisfaction [63]. One of the more influential theories modelling the relationship between expectations and satisfaction with a certain product originated in the context of marketing psychology [64]. In light of the assimilation-contrast theory [64], a low expectation-actuality discrepancy leads people to further displace their outcome perceptions towards their expectations (assimilation effect) resulting in higher satisfaction with a certain product or service [63]. With increasing incongruity between expectations and outcome perceptions, the contrast between both is exaggerated (contrast effect) [63, 65] and disappointment ensues. Thus, the assimilation-contrast theory strongly supports transmitting a realistic picture of the aims and limitations of total hip replacement surgery to avoid contrast effects and dissatisfaction with the outcomes.

A more optimistic outlook on surgery outcomes, places priority on facilitating positive affective states and reducing stress with positive implications for pain perception and possibly postoperative rehabilitation [30]. As has been consistently demonstrated, optimists report fewer physical symptoms, better health habits and coping strategies [29]. Thus, dispositional optimism and optimistic attribution styles have positive implications for pain perception and mental health in general [28].

First insight into the benefits of educational courses before THA was provided by Mancuso et al. [66]. The results of their randomized controlled trial showed that educational courses could in effect modulate patient expectations leading to greater satisfaction with the surgery outcomes. Similar results were obtained by Thomas and Sethares [67] by providing patients with an interdisciplinary teaching course which lead to a greater understanding of what to expect from the surgical intervention. More randomized controlled trials are needed in order to examine the relative effectiveness of nurturing either optimistic or realistic expectations regarding surgery outcomes.

Our findings concur with a recent review on the role of expectation fulfillment in knee and hip arthroplasty [68]. It concludes that in only half of the studies preoperative expectations were associated with the level of satisfaction, while in 93% of the studies the fulfillment of expectations was shown to independently predict satisfaction with a hip or knee replacement surgery [68]. As Haanstra et al. [24] point out, the strengths of associations between expectations and patient-rated outcomes, among other methodological factors, seem to vary as a function of the timing of preoperative expectation measurement ranging between six weeks and one day before surgery. The authors posit that the amount of information provided by the physician has a major impact on outcome expectations. They assume that the later expectations are assessed, the more realistic they are which would be reflected in higher associations with outcome ratings. In our study, expectations were assessed one day before surgery which suggests that most of the patients had been informed about the procedure, associated risks and possible outcomes by their physician. Notwithstanding, expectations for improvements in hip pain and walking ability, representing the main indications for THA, were rather high in our study. This could be either explained by expectation ratings reflecting realistic outcome predictions based on prior personal experiences or the preoperative patient education promoting overly optimistic outcome expectations or by patients projecting more general wishes and desires for overall improvements in pain, functional capacity and well-being on the total hip arthroplasty alone.

Limitations

Despite many salient features like the prospective nature, the use of standardized outcome measures and the comprehensive clinical characterization of the sample, the results of the present study have to be interpreted in the light of some limitations.

A central limitation in our investigation, like in many others, concerns the assessment of preoperative outcome expectations. Between 2012 and 2020 several review articles summarizing the available evidence on the predictive influence of preoperative expectations on patient satisfaction with THA have been published [17, 22, 24, 69]. All of them emphasize the need for a theoretical framing of the construct “patient expectations” and a consistent use of valid measurements. Several definitions of “expectations” relevant to the context of healthcare have been derived from theoretical developments in marketing psychology (“consumer satisfaction”) and biomedical research on placebo effects [63, 70]. Thompson and Suñol [63], for example, differentiate between predicted, ideal and normative expectations. A similar framework was proposed by Kravitz [71]. In the context of orthopaedic surgery, “predicted expectations” can be defined as a patient’s likelihood estimation of symptom relief based on the information provided by the physician in the shared decision-making process before surgery [63, 70]. “Ideal expectations” reflect the patients’ wishes and desires while partly neglecting the odds of a good outcome. “Normative expectations” are defined as socially endorsed evaluations of what should be received from health services [25, 70]. Obviously, dependent on the exact wording of the question for measuring outcome expectations, different dimensions of the multifaceted construct can be preferentially targeted [63]. By employing the question “What changes in the following items do you expect to experience as a result of the surgery?” it is not clear which aspect of expectations (predicted, ideal or normative) we addressed in our study which limits construct validity and complicates the interpretation of results. Mannion et al. [17] explicitly asked patients not to report their hopes and wishes but realistic expectations. Moreover, in accordance with Mannion et al. [23] we used a non-validated questionnaire to assess expectations and outcomes (modified version of the NASS Lumbar Spine Questionnaire) and adapted it for hip arthroplasty patients. Alternatively, we could have employed the validated Hospital for Special Surgery (HSS) Hip and Knee Replacement Expectations Survey comprising 18 items informed by the ICF-framework [72, 73]. However, the German, culturally adapted version of this questionnaire had not been validated until 2016 and was not available at the time of the planning and data collection of our study [74]. Future investigations should make use of the existing validated surveys of expectations and define which aspect of the construct they would like to address in order to obtain more reliable, comparable and accurate results.

Additionally, some methodological issues have to be acknowledged. We lost 8% of the study cohort to follow-up for unknown reasons. Compared to other prospective cohort studies, the drop-out rate in our case was rather low [20]. Still, we cannot exclude the risk of attrition bias due to a selective drop-out of non-responders which would lead to a slight overestimation of outcome evaluations and global effectiveness ratings.

Then, the questionnaires used for the follow-up assessment were not validated for telephone interviews. To exclude inter-rater reliability biases, they were performed by the same study physician following a standardized protocol.

Another criticism concerns the varying numbers of missing data for the different dependent variables included in the hierarchical multiple regression analysis. Upon stepwise addition of increasing amounts of potential predictors, the number of observations decreased. The model at step 4 (containing 14 independent variables) was only based on 52 individuals and might have been underpowered for detecting small effects. Importantly, however, in the final model including only the significant predictors from step 4, the number of observations (N = 82) was more than 10 times the number of independent variables (N = 3) in the analysis, as recommended to ensure sufficient statistical power by Haanstra et al. [24].

Clinical implications

The improvement of patient satisfaction with surgery outcomes has important economic implications. Thus, paying more attention to the refinement of the preoperative patient education is indispensable [31, 75]. In the context of hip replacement surgeries or other medical interventions, there is no exact truth about realistic outcome scenarios. These rather vary inter-individually as a function of many factors such as progression of the medical condition, comorbidities and sociodemographic status [17]. In view of these unresolved uncertainties, how to go about communicating with the patients before surgery? Especially for those medical services people do not have prior experience with, expectations are often unformed and represented on a subconscious level [63]. Consequently, surgeons should explicitly inquire about expectations for different areas of daily functioning relevant to quality of life. Moreover, as can be derived from our findings and the literature [68], overly optimistic expectations with respect to hip pain do not have to be dampened as they resulted as an independent predictor of the patient-rated global effectiveness of surgery. As hip pain is a non-volitional and fluctuating experience, we believe that it is more susceptible to assimilation effects than more complex behavioral phenotypes [63, 64]. Given the large expectations-actuality discrepancies for back pain, physical exercise and associated functions, we strongly suggest adjusting unrealistic expectations. At the same time, self-efficacy expectancies should be instigated in patients by teaching multimodal, self-effective strategies to promote functional recovery and by highlighting the importance of complying with the physical therapy regimen [59, 76].

Conclusion

As a conclusion, while the intricacies of the underlying mechanisms still need further research, expectations and the fulfillment of expectations are clearly pivotal factors in predicting the effectiveness of an intervention in a clinical setting. It is therefore critical for medical professionals to not only give detailed information about the process, results and risks of a medical intervention, but also to explicitly address expectations. Our data provide evidence for the beneficial effect of promoting an attitude of realistic optimism during the shared decision-making process before surgery. According to an essay by Schneider [77], “realistic optimism involves hoping and searching for positive experiences while acknowledging what we do not know and accepting what we cannot know.” Making a case for nurturing self-efficacy expectancies, Schneider further assumes that the aspirations associated with realistic optimism instigate a focus on “possible opportunities to increase the likelihood of desirable and personally meaningful outcomes” within the constraints of ambiguous reality.

Abbreviations

THA

Total Hip Arthroplasty; NRS:Numeric Rating Scale; CPG:Chronic Pain Grade; MPSS:Mainz Pain Staging System; PPT:Pressure Pain Threshold; WOMAC:Western Ontario and McMaster Universities Osteoarthritis Index; SF-12:Short-Form Health Survey; DASS:Depression, Anxiety, Stress Scales; PHQ:Patient Health Questionnaire; TSK:Tampa Scale for Kinesiophobia; KPI:Kiel Pain Inventory; CTS:Catastrophizing Thought Scale; THS:Thoughts of Helplessness Scale; TSS:Thought Suppression Scale; NASS:North American Spine Society; τB:Kendall Tau-B

Declarations

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Ethics approval and consent to participate

The Ethics Committee of the University Hospital of Goettingen (No. 5 /4 /12) and the Ethics Committee of the Hannover Medical School (No. 1483-2012) approved the

Authors’ contributions

JE, MP and FP participated in the design of the study and revised the manuscript for intellectual content. JE, SB, MP and MM collected the data. AK and VL performed the statistical analyses, interpreted the data and drafted the manuscript. All authors read and approved the final manuscript.

Authors' information

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Availability of data and materials

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Consent for publication

Participants provided verbal consent to the publication of data; no personal information in included in the manuscript.

Competing interests

The authors declare that they have no competing interests.

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References

1. Postler A, Ramos AL, Goronzy J, Gunther KP, Lange T, Schmitt J, Zink A, Hoffmann F. Prevalence and treatment of hip and knee osteoarthritis in people aged 60 years or older in Germany: an analysis based on health insurance claims data. Clin Interv Aging. 2018;13:2339–49.
2. Damen J, van Rijn RM, Emans PJ, Hilberdink W, Wesseling J, Oei EHG, Bierma-Zeinstra SMA. Prevalence and development of hip and knee osteoarthritis according to American College of Rheumatology criteria in the CHECK cohort. Arthritis Res Ther. 2019;21(1):4.
3. Kloppenburg M, Berenbaum F. Osteoarthritis year in review 2019: epidemiology and therapy. Osteoarthritis Cartilage. 2020;28(3):242–8.
4. Palazzo C, Nguyen C, Lefevre-Colau MM, Rannou F, Poiraudeau S. Risk factors and burden of osteoarthritis. Ann Phys Rehabil Med. 2016;59(3):134–8.

5. Singh JA. Epidemiology of knee and hip arthroplasty: a systematic review. Open Orthop J. 2011;5:80–5.
6. Johnson VL, Hunter DJ. The epidemiology of osteoarthritis. Best Pract Res Clin Rheumatol. 2014;28(1):5–15.
7. Vina ER, Kwoh CK. Epidemiology of osteoarthritis: literature update. Curr Opin Rheumatol. 2018;30(2):160–7.
8. Ponnusamy KE, Vasarhelyi EM, McCalden RW, Somerville LE, Marsh JD. Cost-Effectiveness of Total Hip Arthroplasty Versus Nonoperative Management in Normal, Overweight, Obese, Severely Obese, Morbidly Obese, and Super Obese Patients: A Markov Model. J Arthroplasty. 2018;33(12):3629–36.
9. Collins NJ, Roos EM. Patient-reported outcomes for total hip and knee arthroplasty: commonly used instruments and attributes of a "good" measure. Clin Geriatr Med. 2012;28(3):367–94.
10. Wylde V, Jeffery A, Dieppe P, Gooberman-Hill R. The assessment of persistent pain after joint replacement. Osteoarthritis Cartilage. 2012;20(2):102–5.
11. Wylde V, Hewlett S, Learmonth ID, Dieppe P. Persistent pain after joint replacement: prevalence, sensory qualities, and postoperative determinants. Pain. 2011;152(3):566–72.
12. Singh JA, Lewallen DG. Predictors of activity limitation and dependence on walking aids after primary total hip arthroplasty. J Am Geriatr Soc. 2010;58(12):2387–93.
13. Singh JA, Lewallen D: **Predictors of pain and use of pain medications following primary Total Hip Arthroplasty** (**THA**): **5**,**707 THAs at 2-years and 3**,**289 THAs at 5-years**. *BMC Musculoskelet Disord* 2010, **11**:90.
14. Erlenwein J, Muller M, Falla D, Przemeck M, Pfingsten M, Budde S, Quintel M, Petzke F. Clinical relevance of persistent postoperative pain after total hip replacement - a prospective observational cohort study. J Pain Res. 2017;10:2183–93.
15. Smith GH, Johnson S, Ballantyne JA, Dunstan E, Brenkel IJ. Predictors of excellent early outcome after total hip arthroplasty. J Orthop Surg Res. 2012;7:13.
16. Quintana JM, Escobar A, Aguirre U, Lafuente I, Arenaza JC. Predictors of health-related quality-of-life change after total hip arthroplasty. Clin Orthop Relat Res. 2009;467(11):2886–94.
17. Hofstede SN, Gademan MG, Vliet Vlieland TP, Nelissen RG, Marang-van de Mheen PJ. Preoperative predictors for outcomes after total hip replacement in patients with osteoarthritis: a systematic review. BMC Musculoskelet Disord. 2016;17:212.
18. Halket A, Stratford PW, Kennedy DM, Woodhouse LJ. Using hierarchical linear modeling to explore predictors of pain after total hip and knee arthroplasty as a consequence of osteoarthritis. J Arthroplasty. 2010;25(2):254–62.
19. Schaal T, Schoenfelder T, Klewer J, Kugler J. Determinants of patient satisfaction and their willingness to return after primary total hip replacement: a cross-sectional study. BMC Musculoskelet Disord. 2016;17:330.
20. Gonzalez Saenz de Tejada M, Escobar A, Bilbao A, Herrera-Espineira C, Garcia-Perez L, Aizpuru F, Sarasqueta C. A prospective study of the association of patient expectations with changes in health-

related quality of life outcomes, following total joint replacement. BMC Musculoskelet Disord. 2014;15:248.

21. Palazzo C, Jourdan C, Descamps S, Nizard R, Hamadouche M, Anract P, Boisgard S, Galvin M, Ravaud P, Poiraudeau S. Determinants of satisfaction 1 year after total hip arthroplasty: the role of expectations fulfilment. BMC Musculoskelet Disord. 2014;15:53.
22. Waljee J, McGlinn EP, Sears ED, Chung KC. Patient expectations and patient-reported outcomes in surgery: a systematic review. Surgery. 2014;155(5):799–808.
23. Mannion AF, Junge A, Elfering A, Dvorak J, Porchet F, Grob D. Great expectations: really the novel predictor of outcome after spinal surgery? Spine (Phila Pa 1976). 2009;34(15):1590–9.
24. Haanstra TM, van den Berg T, Ostelo RW, Poolman RW, Jansma EP, Cuijpers P, de Vet HC. Systematic review: do patient expectations influence treatment outcomes in total knee and total hip arthroplasty? Health Qual Life Outcomes. 2012;10:152.
25. Mahomed NN, Liang MH, Cook EF, Daltroy LH, Fortin PR, Fossel AH, Katz JN. The importance of patient expectations in predicting functional outcomes after total joint arthroplasty. J Rheumatol. 2002;29(6):1273–9.
26. Flood AB, Lorence DP, Ding J, McPherson K, Black NA. The role of expectations in patients' reports of post-operative outcomes and improvement following therapy. Med Care. 1993;31(11):1043–56.
27. Engel C, Hamilton NA, Potter PT, Zautra AJ. Impact of two types of expectancy on recovery from total knee replacement surgery (TKR) in adults with osteoarthritis. Behav Med. 2004;30(3):113–23.
28. Scheier MF, Carver CS. Dispositional optimism and physical health: A long look back, a quick look forward. Am Psychol. 2018;73(9):1082–94.
29. Scheier MF, Carver CS. Dispositional optimism and physical well-being: the influence of generalized outcome expectancies on health. J Pers. 1987;55(2):169–210.
30. Geers AL, Wellman JA, Seligman LD, Wuyek LA, Neff LA. Dispositional optimism, goals, and engagement in health treatment programs. J Behav Med. 2010;33(2):123–34.
31. Tilbury C, Haanstra TM, Leichtenberg CS, Verdegaal SH, Ostelo RW, de Vet HC, Nelissen RG, Vliet Vlieland TP. Unfulfilled Expectations After Total Hip and Knee Arthroplasty Surgery: There Is a Need for Better Preoperative Patient Information and Education. J Arthroplasty. 2016;31(10):2139–45.
32. von Elm E, Altman DG, Egger M, Pocock SJ, Gotzsche PC, Vandenbroucke JP, Initiative S. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. J Clin Epidemiol. 2008;61(4):344–9.
33. Ferreira-Valente MA, Pais-Ribeiro JL, Jensen MP. Validity of four pain intensity rating scales. Pain. 2011;152(10):2399–404.
34. Von Korff M, Ormel J, Keefe FJ, Dworkin SF. Grading the severity of chronic pain. Pain. 1992;50(2):133–49.
35. Gerbershagen HU, Lindena G, Korb J, Kramer S. [Health-related quality of life in patients with chronic pain]. Schmerz. 2002;16(4):271–84.

36. Frettloh J, Maier C, Gockel H, Huppe M. [Validation of the German Mainz Pain Staging System in different pain syndromes]. Schmerz. 2003;17(4):240–51.
37. Podsiadlo D, Richardson S. The timed "Up & Go": a test of basic functional mobility for frail elderly persons. J Am Geriatr Soc. 1991;39(2):142–8.
38. Stucki G, Meier D, Stucki S, Michel BA, Tyndall AG, Dick W, Theiler R. [Evaluation of a German version of WOMAC (Western Ontario and McMaster Universities) Arthrosis Index]. Z Rheumatol. 1996;55(1):40–9.
39. Wirtz MA, Morfeld M, Glaesmer H, Brähler E. Association of Physical Morbidity and Health-Related Quality of Life in a Representative Sample of Older German People. European Journal of Health Psychology. 2018;25:140–51.
40. Jenkinson C, Layte R, Jenkinson D, Lawrence K, Petersen S, Paice C, Stradling J. A shorter form health survey: can the SF-12 replicate results from the SF-36 in longitudinal studies? J Public Health Med. 1997;19(2):179–86.
41. Gandhi SK, Salmon JW, Zhao SZ, Lambert BL, Gore PR, Conrad K. Psychometric evaluation of the 12-item short-form health survey (SF-12) in osteoarthritis and rheumatoid arthritis clinical trials. Clinical therapeutics. 2001;23(7):1080–98.
42. Nilges P, Essau C. [Depression, anxiety and stress scales: DASS−A screening procedure not only for pain patients]. Schmerz. 2015;29(6):649–57.
43. Lovibond SH, Lovibond PF. Manual for the Depression Anxiety Stress Scales. 2nd. Ed edn. Sydney: Psychology Foundation; 1995.
44. Lovibond PF, Lovibond SH. The structure of negative emotional states: comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. Behav Res Ther. 1995;33(3):335–43.
45. Fink P, Sorensen L, Engberg M, Holm M, Munk-Jorgensen P. Somatization in primary care. Prevalence, health care utilization, and general practitioner recognition. Psychosomatics. 1999;40(4):330–8.
46. Lowe B, Spitzer RL, Williams JB, Mussell M, Schellberg D, Kroenke K. Depression, anxiety and somatization in primary care: syndrome overlap and functional impairment. Gen Hosp Psychiatry. 2008;30(3):191–9.
47. Kroenke K, Spitzer RL, Williams JB. The PHQ-15: validity of a new measure for evaluating the severity of somatic symptoms. Psychosom Med. 2002;64(2):258–66.
48. Vlaeyen JWS, Kole-Snijders AMJ, Rotteveel AM, Ruesink R, Heuts PHTG. The role of fear of movement/(re)injury in pain disability. J Occup Rehabil. 1995;5:235–52.
49. Vlaeyen JW, Linton SJ. Fear-avoidance and its consequences in chronic musculoskeletal pain: a state of the art. Pain. 2000;85(3):317–32.
50. Rusu AC, Kreddig N, Hallner D, Hulsebusch J, Hasenbring MI. Fear of movement/(Re)injury in low back pain: confirmatory validation of a German version of the Tampa Scale for Kinesiophobia. BMC Musculoskelet Disord. 2014;15:280.
51. Roelofs J, Goubert L, Peters ML, Vlaeyen JW, Crombez G. The Tampa Scale for Kinesiophobia: further examination of psychometric properties in patients with chronic low back pain and fibromyalgia. Eur J

Pain. 2004;8(5):495–502.

52. Hasenbring M. The Kiel Pain Inventory-Manual. Three questionnaire scales for assessment of pain-related cognitions, emotions and copying strategies. Bern: Huber; 1994.
53. Daltroy LH, Cats-Baril WL, Katz JN, Fossel AH, Liang MH. The North American spine society lumbar spine outcome assessment Instrument: reliability and validity tests. Spine. 1996;21(6):741–9.
54. Bonett DG, Wright TA. Sample size requirements for Pearson, Kendall, and Spearman correlations. Psychometrika. 2010;65:23–8.
55. Croux C, Dehon C. Influence functions of the Spearman and Kendall correlation measures. Stat Methods Appl. 2010;19:497–515.
56. Kirsch I. Response Expectancy and the Placebo Effect. Int Rev Neurobiol. 2018;138:81–93.
57. Koyama T, McHaffie JG, Laurienti PJ, Coghill RC. The subjective experience of pain: where expectations become reality. Proc Natl Acad Sci U S A. 2005;102(36):12950–5.
58. Johnston NE, Atlas LY, Wager TD. Opposing effects of expectancy and somatic focus on pain. PLoS One. 2012;7(6):e38854.
59. Bandura A. Self-efficacy: toward a unifying theory of behavioral change. Psychol Rev. 1977;84(2):191–215.
60. Sullivan M, Tanzer M, Reardon G, Amirault D, Dunbar M, Stanish W. The role of presurgical expectancies in predicting pain and function one year following total knee arthroplasty. Pain. 2011;152(10):2287–93.
61. Ghomrawi HM, Franco Ferrando N, Mandl LA, Do H, Noor N, Gonzalez Della Valle A. How Often are Patient and Surgeon Recovery Expectations for Total Joint Arthroplasty Aligned? Results of a Pilot Study. HSS J. 2011;7(3):229–34.
62. Jourdan C, Poiraudeau S, Descamps S, Nizard R, Hamadouche M, Anract P, Boisgard S, Galvin M, Ravaud P. Comparison of patient and surgeon expectations of total hip arthroplasty. PLoS One. 2012;7(1):e30195.
63. Thompson AG, Sunol R. Expectations as determinants of patient satisfaction: concepts, theory and evidence. Int J Qual Health Care. 1995;7(2):127–41.
64. Ross CK, Frommelt G, Hazelwood L, Chang RW. The role of expectations in patient satisfaction with medical care. J Health Care Mark. 1987;7(4):16–26.
65. Thompson DA, Yarnold PR. Relating patient satisfaction to waiting time perceptions and expectations: the disconfirmation paradigm. Acad Emerg Med. 1995;2(12):1057–62.
66. Mancuso CA, Graziano S, Briskie LM, Peterson MG, Pellicci PM, Salvati EA, Sculco TP. Randomized trials to modify patients' preoperative expectations of hip and knee arthroplasties. Clin Orthop Relat Res. 2008;466(2):424–31.
67. Thomas KM, Sethares KA. An investigation of the effects of preoperative interdisciplinary patient education on understanding postoperative expectations following a total joint arthroplasty. Orthop Nurs. 2008;27(6):374–81.
68. Hafkamp FJ, Gosens T, de Vries J, den Oudsten BL. Do dissatisfied patients have unrealistic expectations? A systematic review and best-evidence synthesis in knee and hip arthroplasty patients.

EFORT Open Rev. 2020;5(4):226–40.
69. Swarup I, Henn CM, Gulotta LV, Henn RF. 3rd: **Patient expectations and satisfaction in orthopaedic surgery: A review of the literature**. J Clin Orthop Trauma. 2019;10(4):755–60.
70. Uhlmann RF, Inui TS, Carter WB. Patient requests and expectations. Definitions and clinical applications. Med Care. 1984;22(7):681–5.
71. Kravitz RL. Patients' expectations for medical care: an expanded formulation based on review of the literature. Med Care Res Rev. 1996;53(1):3–27.
72. Mancuso CA, Jout J, Salvati EA, Sculco TP. Fulfillment of patients' expectations for total hip arthroplasty. J Bone Joint Surg Am. 2009;91(9):2073–8.
73. Mancuso CA, Sculco TP, Salvati EA. Patients with poor preoperative functional status have high expectations of total hip arthroplasty. J Arthroplasty. 2003;18(7):872–8.
74. Balck F, Kirschner S, Jeszenszky C, Lippmann M, Gunther KP. [Validity and Reliability of the German Version of the HSS Expectation Questionnaire on Hip Joint Replacement]. Z Orthop Unfall. 2016;154(6):606–11.
75. Padilla JA, Feng JE, Anoushiravani AA, Hozack WJ, Schwarzkopf R, Macaulay WB. Modifying Patient Expectations Can Enhance Total Hip Arthroplasty Postoperative Satisfaction. J Arthroplasty. 2019;34(7S):209–14.
76. Bandura A. The assessment and predictive generality of self-percepts of efficacy. J Behav Ther Exp Psychiatry. 1982;13(3):195–9.
77. Schneider SL. In search of realistic optimism. Meaning, knowledge, and warm fuzziness. Am Psychol. 2001;56(3):250–63.

Figures

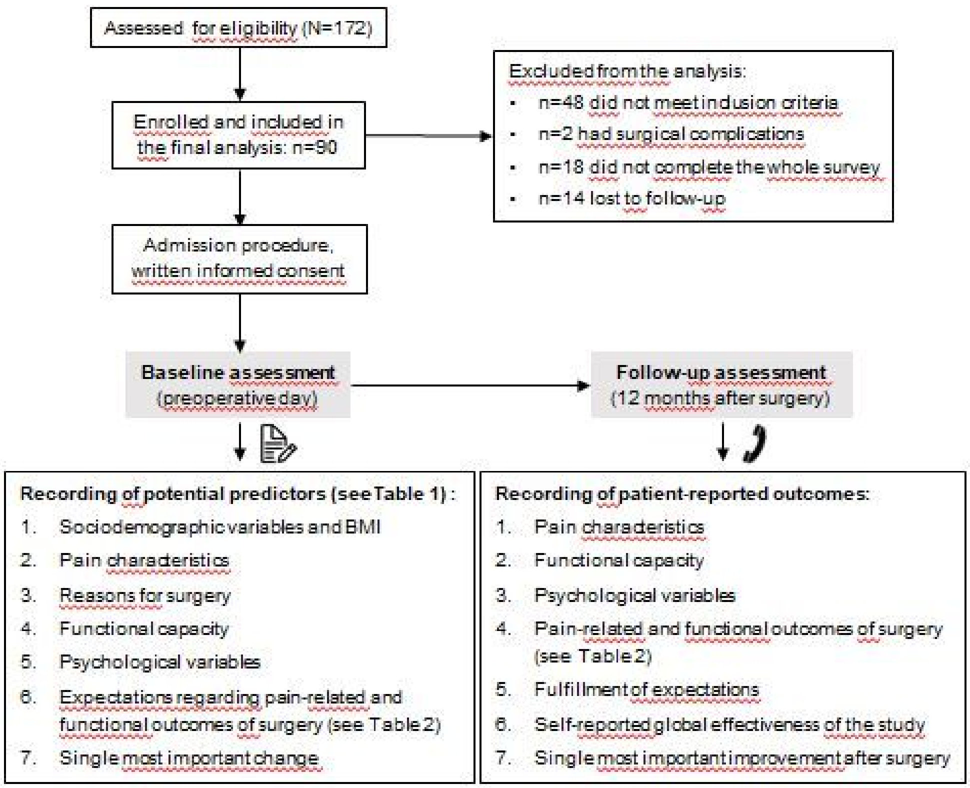

Figure 1

Kästner et al. BMC Musculoskeletal Disorders

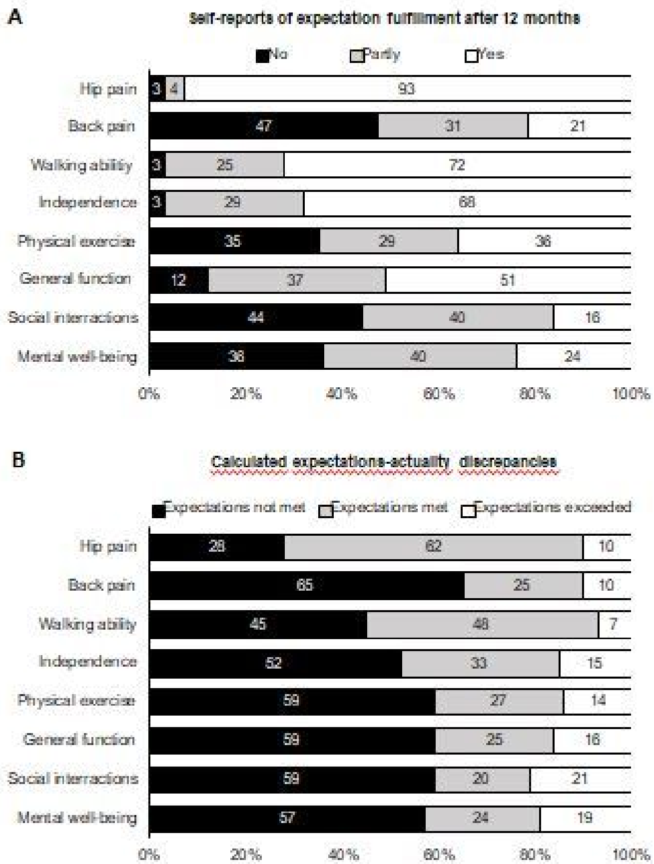

Figure 2

Kästner et al. BMC Musculoskeletal Disorders

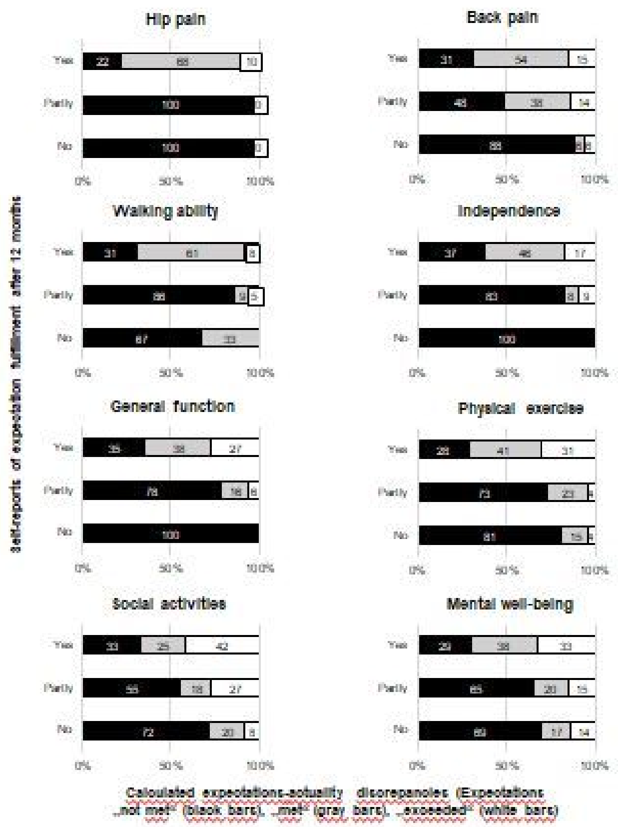

Figure 3

Kästner et al. BMC Musculoskeletal Disorders

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