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The mind matters: Psychological factors influence subjective outcomes following unicompartmental knee arthroplasty—A prospective study

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Abstract

Purpose: This study aimed to investigate how psychological factors, including pain catastrophizing (PC), anxiety and depression affect preoperative and postoperative subjective outcomes in patients undergoing unicompartmental knee arthroplasty (UKA).

Methods: A prospective comparative study was performed among 150 patients undergoing medial or lateral UKA for isolated unicompartmental osteoarthritis. Patients were categorized based on their preoperative PC and Hospital Anxiety and Depression Scale, stratifying them into groups with PC, anxiety or depression, and those without these psychological factors. Patient-reported outcomes, including the Knee Injury and Osteoarthritis Outcome Score-Physical function Short form (KOOS-PS), 5-level EQ5D Visual Analogue Scale (EQ5D-VAS), Forgotten Joint Score (FJS) and Numeric Rating Scale for pain (NRS-pain) were compared between groups preoperatively and at 6-, 12-, and 24-month follow-up.

Results: At 24 months, PC patients had inferior outcomes in KOOS-PS (66.9 ± 16.5 vs. 77.6 ± 14.7, $p = .008$), EQ5D-VAS (63.5 ± 19.9 vs. 78.9 ± 20.1, $p = .003$) and FJS (73.7 ± 14.3 vs. 84.6 ± 13.8, $p = .003$). Anxiety was associated with inferior KOOS-PS (65.4 ± 15.2 vs. 78.2 ± 14.5, $p = <.001$), EQ5D-VAS (64.2 ± 23.2 vs. 79.3 ± 19.4, $p = .002$), FJS (75.7 ± 16.8 vs. 84.6 ± 13.4, $p = .008$) and NRS-pain (27.4 ± 24.6 vs. 13.7 ± 19.3, $p = .023$) at 24 months. Depression consistently resulted in inferior outcomes in KOOS-PS, EQ5D-VAS, FJS and NRS-pain across all follow-up assessments ($p = <.05$). Additionally, patients with anxiety and depression experienced longer length of hospital stay compared to those without these psychological factors (anxiety: 2.3 ± 2.3 vs. 0.8 ± 0.8 days, $p = .006$; depression: 2.3 ± 2.4 vs. 0.8 ± 0.8 days, $p = .017$).

Conclusions: Preoperative PC, anxiety and depression are associated with inferior subjective outcomes both prior to and following UKA. Among these factors, depression seemed to exert the most substantial adverse impact on outcomes following UKA. Patients with anxiety and depression

Abbreviations: EQ5D-VAS, 5-level EQ5D Visual Analogue Scale; FJS, Forgotten Joint Score; HADS, Hospital Anxiety and Depression Scale; KL, Kellgren–Lawrence; KOOS-PS, Knee Injury and Osteoarthritis Outcome Score-Physical function Short form; MCIDs, Minimal Clinically Important Differences; NRS, Numeric Rating Scale; OA, osteoarthritis; PC, pain catastrophizing; PCS, Pain Catastrophizing Scale; PROMs, patient-reported outcome measures; TKA, total knee arthroplasty; UKA, unicompartmental knee arthroplasty.

had an extended duration of hospitalization lasting over twice as long as patients without these psychological factors. It seems that inferior outcomes primarily stem from the suboptimal preoperative condition rather than an inherent inability to benefit from UKA.

Level of Evidence: Level II, prospective study.

KEYWORDS

anxiety, depression, hospitalization, pain catastrophizing, patient-reported outcomes, unicompartmental knee arthroplasty

INTRODUCTION

Emotional well-being and pre-existing psychological factors, such as the phenomenon of pain catastrophizing (PC), anxiety and depression, consistently emerge as crucial determinants influencing the overall success of total knee arthroplasty (TKA) and other orthopaedic surgical interventions [6, 12, 29]. PC, characterised by an exaggerated adverse response to actual or anticipated pain, anxiety, and depression have been associated with less satisfactory outcomes in subjective function, increased postoperative pain and extended hospitalization following TKA [5, 13, 24].

However, while extensively studied in the context of TKA, there remains a lack of sufficient evidence regarding the extent to which psychological factors influence surgical outcomes of unicompartmental knee arthroplasty (UKA). Recognizing the substantial impact of presurgical psychological factors on surgical outcomes and identifying predictors for dissatisfaction and suboptimal patient-reported outcomes can refine preoperative risk assessments. This, in turn, could lead to more targeted and effective psychological interventions tailored to specific individual needs, potentially improving the outcomes of UKA.

Therefore, this study aimed to assess how psychological factors, including PC, anxiety, and depression affect subjective function, quality of life, joint awareness and pain both prior to and following UKA. We hypothesized that preoperative PC, anxiety and depression may be associated with inferior patient-reported outcomes prior to and following UKA.

METHODS

This prospective cohort study was conducted in a Dutch high-volume university hospital between November 2020 and December 2021. Institutional Review Board (#L019-075) approval and written informed consent of all patients were obtained prior to data collection. Patients were eligible for inclusion in this study if they underwent medial or lateral UKA for isolated compartment knee osteoarthritis (OA), had complete preoperative anteroposterior knee radiographs, were proficient in Dutch to complete questionnaires, and had at least 2-year follow-up. Patients were excluded if they had incomplete or poor-quality radiographic records or incomprehensive or insufficient patient-reported outcome measures (PROMs). Within the specified timeframe, a total of 215 patients underwent medial or lateral UKA for isolated compartment OA. Of these, 64 were considered lost to follow-up, and one individual did not complete the Pain Catastrophizing Scale (PCS) preoperatively, resulting in a final cohort of 150 patients. A detailed flowchart of patient selection and lost to follow-up is provided in Figure 1.

Surgical procedure

All patients received the same mobile bearing medial UKA implant (Oxford, Zimmer Biomet) and fixed bearing lateral UKA implant (Oxford, Zimmer Biomet). Surgical procedures were performed employing conventional manual techniques by a team comprising of four highly experienced senior orthopaedic surgeons. Procedures involved either the medial parapatellar or subvastus approach. Postoperative care followed a standardized protocol, which included antithrombotic prophylaxis (low-molecular-weight heparin) administered for a duration of 4 weeks postoperatively, alongside mobilization and physical therapy. Patients were considered eligible for discharge if they were able to ambulate independently, with the assistance of crutches or a walker if necessary, exhibited an absence of any wound-related problems or signs of infection, and if their pain was under control, as indicated by a Numeric Rating Scale (NRS) for pain score of less than 4.

Radiographic evaluation

The Kellgren–Lawrence (KL) grading system [15] was used to describe the severity of OA on preoperative radiographs. The operative compartment of the joint was assigned a KL grade from 0 to 4, classifying the severity of OA from absence of OA (grade 0) to severe OA (grade 4).

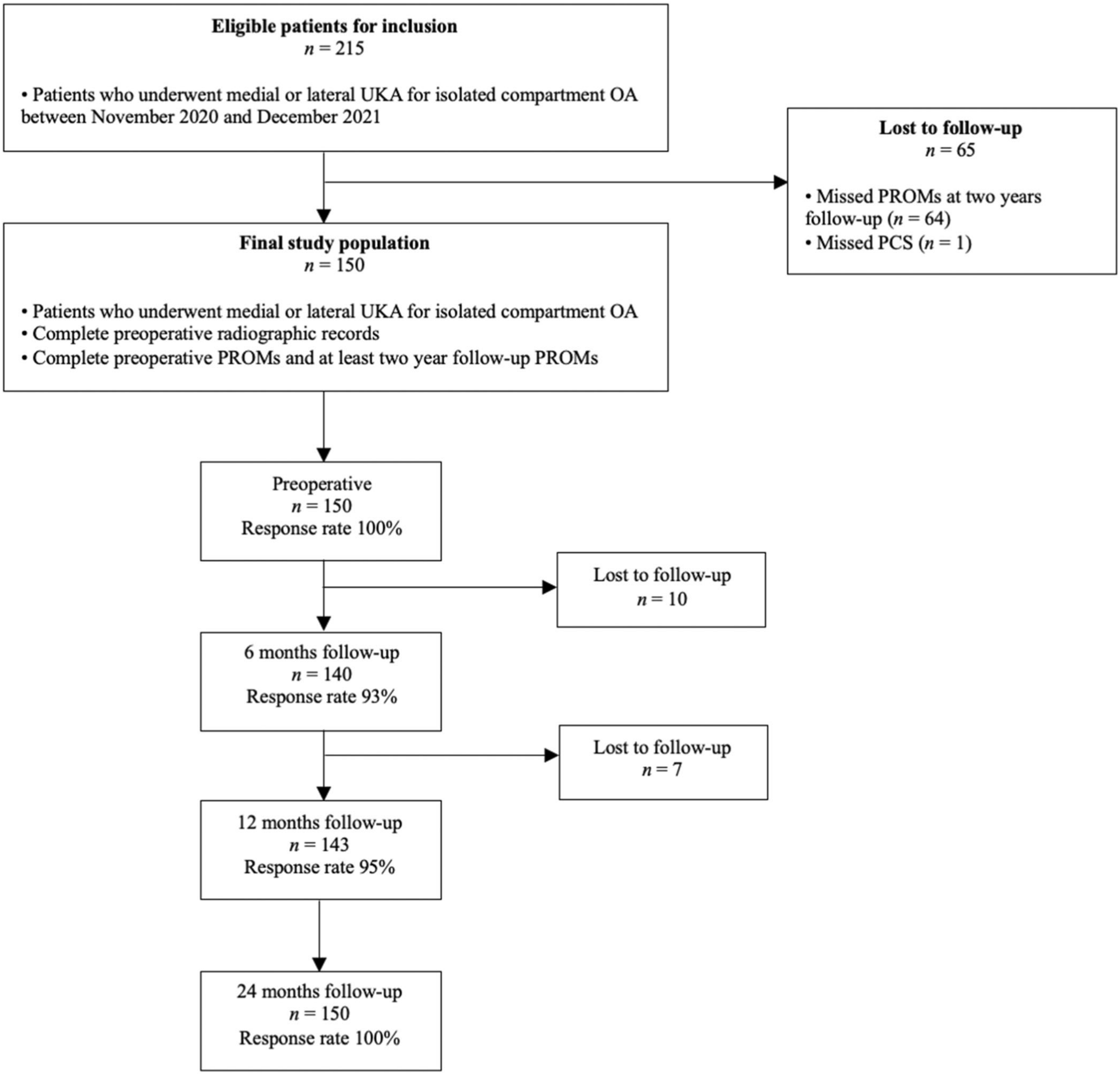

FIGURE 1 Flowchart of patient selection and lost to follow-up. OA, osteoarthritis; PCS; pain Catastrophizing Score; PROMs, patient-reported outcome measures; UKA, unicompartmental knee arthroplasty.

PC

Preoperatively, all patients completed the validated PCS [26]. This scale evaluates how individuals respond mentally and emotionally when experiencing pain, covering elements such as magnification, rumination and feelings of helplessness [27]. It comprises 13 specific items rated on a five-point Likert-type scale, with 0 representing no engagement in catastrophizing behaviour and 4 indicating consistent engagement. A total score of ≥ 30 (range 0–52) indicates a clinically relevant level of PC [26]. Therefore, patients were classified into a PC group (PCS ≥ 30) and a non-PC group (PCS < 30) based on their preoperative PCS.

Anxiety and depression

The Hospital Anxiety and Depression Scale (HADS) [37] was used to evaluate preoperative anxiety and depression through two distinct subscales, each consisting of seven questions rated on a four-point Likert-type scale. The two scales were evaluated separately. Higher scores indicate an increased probability or severity of anxiety or depression. Scores ranging from 0 to 7 are considered normal, scores of 8–10 suggest mild manifestations, scores between 11 and 14 moderate levels and scores ranging from 15 to 21 severe manifestations of either anxiety or depression [37]. Patients were classified into anxiety or non-anxiety groups (HADS ≥ 8 or HADS < 8, respectively) based on their preoperative HADS scores for anxiety. The same methodology was used for the classification of depression. PCS and HADS questionnaires were assessed approximately 3 weeks before the procedure, with an average of 20.8 days preceding the surgical intervention.

Patient-reported outcomes

Patient-reported outcomes were assessed preoperatively and at 6-, 12- and 24 months postoperatively using standardized questionnaires through email, accompanied by two automated reminders to prompt questionnaire completion. These comprised of the Knee Injury and Osteoarthritis Outcome Score-Physical function Short form (KOOS-PS), 5-level EQ5D Visual Analogue Scale (EQ5D-VAS), Forgotten Joint Score (FJS) and Numeric Rating Scale for pain (NRS-pain). The KOOS-PS assesses the physical function of patients experiencing knee problems on a scale from 0 (indicating extreme difficulty in physical function) to 100 (representing no difficulty in physical function) [20]. The EQ5D-VAS assesses the overall self-rated quality of life on a scale from 0 (the worst health you can imagine) to 100 (the best health you can imagine) [22]. The FJS assesses the ability of patients to mentally 'forget' about their joint following knee arthroplasty, ranging from 0 (high joint awareness) to 100 (no joint awareness) [1]. The NRS-pain, quantifying pain intensity on a scale from 0 (no pain) to 100 (worst imaginable pain), was separately assessed during physical activity and rest [34]. Subsequently, the collective average of these scores was utilized to present the overall pain experience among patients undergoing UKA. Utilization of these specific outcome measures collectively contributes to a comprehensive understanding of various facets of a patient's status, offering insights into pre- and postoperative subjective functionality, quality of life, the extent of joint awareness and pain levels.

Minimal clinically important differences

To evaluate the clinical significance of improvement following UKA, incidence rates of patients who exceeded the Minimal Clinically Important Differences (MCIDs) for knee OA were calculated based on delta scores (Δ; i.e., the difference between initial and follow-up evaluations). The MCID values were 10 for the KOOS-PS [2, 16, 31], 6.4 for the EQ5D-VAS [36] and 18 for the NRS-pain [17, 31].

Statistical analyses

All analyses were performed in IBM SPSS Statistics for Macintosh (Version 28.0.1.1, IBM Corp.), with a predetermined significance level set at 0.05. Patient and pre-, intra- and postoperative demographics and PROMs were presented using descriptive statistics across the entire patient cohort and stratified by PCS and HADS subgroups. The normality of continuous variables was assessed using the Shapiro–Wilk test. Comparisons of means between two independent samples were carried out using either the Mann–Whitney *U* test or independent *t*-test, depending on the distribution. Comparison of discrete variables and the proportion of patients exceeding the MCID were performed using the χ^2 test or Fisher's exact test as appropriate.

RESULTS

The demographic data of the 150 included patients stratified by PCS and HADS subgroups are presented in Tables 1 and 2, respectively. Preoperative PC, anxiety and depression were observed in 17 (11.3%), 21 (14.0%) and 20 patients (13.3%), respectively. The overall 2-year implant survival rate following UKA was 98.7% (148 patients). Two patients (1.3%), both without pre-existing conditions of PC, anxiety, or depression underwent partial revision surgery within the initial 6 months following surgery. Both revisions involved an exchange of the polyethylene insert due to complications related to infection and pain.

PC

Preoperatively, PC patients had significantly inferior outcomes in subjective function, quality of life and pain levels compared with those without PC (KOOS-PS: 39.2 ± 13.9 vs. 55.8 ± 13.5, p = <.001; EQ5D-VAS: 56.4 ± 19.1 vs. 75.7 ± 17.3, p = <.001; NRS-pain: 71.8 ± 15.5 vs. 57.1 ± 18.1, p = .002). Postoperatively, PC patients demonstrated inferior outcomes in subjective function at 12- and 24 months follow-up (12 months: 66.7 ± 15.4 vs. 76.6 ± 14.9, p = .016; 24 months: 66.9 ± 16.5 vs. 77.6 ± 14.7, p = .008) and joint awareness at 24 months (73.7 ± 14.3 vs. 84.6 ± 13.8, p = .003) compared to non-PC patients. Additionally, patients with PC reported lower quality of life at 6- and 24 months follow-up, while at 12 months,

TABLE 1 Pre-, intra-, and postoperative patient demographics stratified by Pain Catastrophizing Score.

Demographics	Total ($n = 150$)	PCS < 30 ($n = 133$)	PCS ≥ 30 ($n = 17$)	p Value[a]
Age (y)	66.6 ± 8.9	67.1 ± 8.9	62.6 ± 8.8	n.s.
Females	77 (51.3%)	70 (52.6%)	7 (41.2%)	n.s.
BMI (kg/m^2)	29.0 ± 4.7	28.7 ± 4.5	31.1 ± 5.9	n.s.
Smoking	7 (4.7%)	5 (3.8%)	2 (11.8%)	n.s.
KL-grade IV	118 (78.7%)	104 (78.2%)	14 (82.4%)	n.s.
Medial UKA	145 (96.7%)	130 (97.7%)	15 (88.2%)	n.s.
ASA I/II	114 (76.0%)	101(75.9%)	13 (76.5%)	n.s.
Length of stay (days)	1.0 ± 1.2	0.9 ± 1.0	1.7 ± 2.2	n.s.
All-cause revision	2 (1.3%)	2 (1.5%)	0 (0.0%)	n.s.

Note: Patient demographics are given in mean ± SD or numbers and frequencies (%) for the entire cohort and stratified by PCS.

Abbreviations: ASA, American Society of Anesthesiologists; BMI, body mass index; KL, Kellgren–Lawrence; n.s., non significant; PCS, Pain Catastrophizing Score; UKA, unicompartmental knee arthroplasty.

[a]Comparison of patient demographics by PCS.

TABLE 2 Pre-, intra-, and postoperative patient demographics stratified by Hospital Anxiety and Depression Scale.

Demographics	Nonanxiety HADS < 8 ($n = 129$)	Anxiety HADS ≥ 8 ($n = 21$)	p Value[a]	Nondepression HADS < 8 ($n = 130$)	Depression HADS ≥ 8 ($n = 20$)	p Value[a]
Age (years)	66.6 ± 8.9	66.4 ± 9.2	n.s.	66.8 ± 8.8	65.0 ± 9.6	n.s.
Females	65 (50.4%)	12 (57.1%)	n.s.	67 (51.5%)	10 (50.0%)	n.s.
BMI (kg/m^2)	28.9 ± 4.8	29.5 ± 4.1	n.s.	28.7 ± 4.7	30.5 ± 4.4	n.s.
Smoking	4 (3.1%)	3 (14.3%)	n.s.	3 (2.3%)	4 (20.0%)	.006[b]
KL-grade IV	101 (78.3%)	17 (81.0%)	n.s.	102 (78.5%)	16 (80.0%)	n.s.
Medial UKA	126 (97.7%)	19 (90.5%)	n.s.	127 (97.7%)	18 (90.0%)	n.s.
ASA I/II	99 (76.7%)	15 (71.4%)	n.s.	98 (75.4%)	16 (80.0%)	n.s.
Length of stay (days)	0.8 ± 0.8	2.3 ± 2.3	.006[b]	0.8 ± 0.8	2.3 ± 2.4	.017[b]
All-cause revision	2 (1.6%)	0 (0.0%)	n.a.	2 (1.5%)	0 (0.0%)	n.a.

Note: Patient demographics are given in mean ± SD or numbers and frequencies (%) and stratified by HADS.

Abbreviations: ASA, American Society of Anesthesiologists; BMI, body mass index; HADS, Hospital Anxiety and Depression Scale; KL, Kellgren–Lawrence; n.s., non significant; UKA; unicompartmental knee arthroplasty.

[a]Comparison of patient demographics by HADS.

[b]Indicates statistical significance.

their reported quality of life was comparable to non-PC patients (Table 3). Pain levels were comparable between PC and non-PC patients following UKA (Table 4). Moreover, PC patients had significantly more clinical improvement in the KOOS-PS from baseline to 6 months compared with non-PC patients (Table 5). Nonetheless, both groups exhibited comparable proportions of patients reaching the MCID across all time intervals. A detailed overview of the progression of patient-reported outcomes among patients with and without PC tendencies is presented in Figure 2.

Anxiety

Patients with anxiety exhibited significantly inferior outcomes in subjective function and quality of life before surgery in contrast to patients without anxiety (KOOS-PS: 43.5 ± 16.9 vs. 55.6 ± 13.3, $p = <.001$; EQ5D-VAS: 59.6 ± 18.0 vs. 76.0 ± 17.5, $p = .001$). Quality of life remained consistently lower in patients with anxiety following UKA, while subjective function solely remained lower at 12- and 24 months follow-up (Table 6). Additionally, patients with anxiety reported to have higher pain levels at 24 months follow-up

TABLE 3 Patient-reported outcomes stratified by Pain Catastrophizing Score.

Outcome variables	Total (*n* = 150)	PCS < 30 (*n* = 133)	PCS ≥ 30 (*n* = 17)	*p* Value[a]
KOOS-PS				
Preoperative	53.9 ± 14.5	55.8 ± 13.5	39.2 ± 13.9	<.001[b]
6 months	74.3 ± 14.9	74.7 ± 15.0	70.7 ± 14.6	n.s.
12 months	75.6 ± 15.2	76.6 ± 14.9	66.7 ± 15.4	.016[b]
24 months	76.4 ± 15.2	77.6 ± 14.7	66.9 ± 16.5	.008[b]
EQ5D-VAS				
Preoperative	73.7 ± 18.4	75.7 ± 17.3	56.4 ± 19.1	<.001[b]
6 months	76.9 ± 21.1	79.0 ± 19.0	56.8 ± 30.1	.022[b]
12 months	77.1 ± 20.1	77.8 ± 20.5	72.1 ± 15.5	n.s.
24 months	77.1 ± 20.6	78.9 ± 20.1	63.5 ± 19.9	.003[b]
FJS				
6 months	80.3 ± 13.3	80.9 ± 13.1	75.1 ± 14.2	n.s.
12 months	82.2 ± 13.4	83.0 ± 13.4	76.0 ± 12.7	n.s.
24 months	83.3 ± 14.2	84.6 ± 13.8	73.7 ± 14.3	.003[b]

Note: Patient-reported outcomes are given in mean ± SD for the entire cohort and stratified by PCS.

Abbreviations: EQ5D-VAS, 5-level EQ5D Visual Analogue Scale; FJS, Forgotten Joint Score; KOOS, Knee Injury and Osteoarthritis Outcome Score; n.s., non significant; PCS, Pain Catastrophizing Score.

[a]Comparison of patient demographics by PCS.

[b]Indicates statistical significance.

TABLE 4 Patient-reported outcomes of the Numeric Rating Scale for pain stratified by Pain Catastrophizing Score.

Outcome variables	Total (*n* = 150)	PCS < 30 (*n* = 133)	PCS ≥ 30 (*n* = 17)	*p* Value[a]
NRS-Pain				
Preoperative	58.8 ± 18.4	57.1 ± 18.1	71.8 ± 15.5	.002[b]
6 months	18.3 ± 20.5	17.9 ± 20.7	21.8 ± 19.1	n.s.
12 months	14.9 ± 20.4	13.8 ± 19.5	24.3 ± 25.9	n.s.
24 months	15.6 ± 20.6	14.6 ± 20.2	24.1 ± 22.0	n.s.

Note: Outcomes are given in mean ± SD for the entire cohort and stratified by PCS. The NRS-pain represents the average pain experienced during both physical activity and rest.

Abbreviations: NRS, Numeric Rating Scale; n.s., non significant; PCS, Pain Catastrophizing Score.

[a]Comparison of patient demographics by PCS.

[b]Indicates statistical significance.

(27.4 ± 24.6 vs. 13.7 ± 19.3, $p = .023$) and lower FJS compared to patients without anxiety at all follow-up assessments ($p < .05$) (Table 7). Moreover, patients with anxiety experienced longer lengths of hospital stay compared with patients without anxiety (2.3 ± 2.3 days vs. 0.8 ± 0.8 days, $p = .006$). There were no differences in clinical improvement and MCID across all time intervals between anxiety and non-anxiety patients (n.s.; Table 8). A detailed overview of the progression of patient-reported outcomes among patients with and without anxiety is presented in Figure 3.

Depression

Before surgery, patients with depression demonstrated significantly inferior outcomes in subjective function, quality of life, and pain levels compared to patients without depression (KOOS-PS: 42.4 ± 16.0 vs. 55.7 ± 13.4, $p = <.001$; EQ5D-VAS: 57.1 ± 15.6 vs. 76.0 ± 17.6, $p = <.001$; NRS-pain: 65.5 ± 15.2 vs. 57.7 ± 18.6, $p = .049$). Patients with depression consistently sustained these inferior outcomes and experienced more joint awareness compared to patients without depression throughout all subsequent postoperative follow-up

TABLE 5 Clinical improvement in patient-reported outcomes stratified by Pain Catastrophizing Score.

Outcome variables	Total ($n = 150$)	PCS < 30 ($n = 133$)	PCS ≥ 30 ($n = 17$)	p Value[a]
KOOS-PS				
∆ 0–6 mos	19.9 ± 17.2	18.9 ± 16.9	28.7 ± 18.1	.043[b]
∆ 0–12 mos	21.4 ± 16.0	20.7 ± 15.6	27.5 ± 18.5	n.s.
∆ 0–24 mos	22.6 ± 15.6	21.9 ± 15.4	28.5 ± 15.9	n.s.
MCID ∆ 0–6 mos	108 (76.6%)	95 (74.8%)	13 (92.9%)	n.s.
MCID ∆ 0–12 mos	109 (76.2%)	96 (75.0%)	13 (86.7%)	n.s.
MCID ∆ 0–24 mos	116 (78.4%)	102 (77.3%)	14 (87.5%)	n.s.
EQ5D-VAS				
∆ 0–6 mos	3.5 ± 21.7	3.3 ± 19.9	5.6 ± 38.9	n.s.
∆ 0–12 mos	2.9 ± 22.5	1.7 ± 22.0	15.2 ± 25.4	n.s.
∆ 0–24 mos	3.5 ± 22.9	3.4 ± 21.5	3.8 ± 33.7	n.s.
MCID ∆ 0–6 mos	42 (43.3%)	36 (40.4%)	6 (75.0%)	n.s.
MCID ∆ 0–12 mos	40 (40.0%)	34 (37.4%)	6 (66.7%)	n.s.
MCID ∆ 0–24 mos	35 (34.3%)	32 (35.2%)	3 (27.3%)	n.s.
NRS-Pain				
∆ 0–6 mos	−40.1 ± 24.9	−39.1 ± 25.1	−49.3 ± 20.9	n.s.
∆ 0–12 mos	−43.6 ± 24.4	−43.1 ± 24.1	−48.0 ± 27.7	n.s.
∆ 0–24 mos	−43.1 ± 24.0	−42.6 ± 24.2	−47.7 ± 22.6	n.s.
MCID ∆ 0–6 mos	117 (83.6%)	104 (82.5%)	13 (92.9%)	n.s.
MCID ∆ 0–12 mos	122 (85.3%)	109 (85.2%)	13 (86.7%)	n.s.
MCID ∆ 0–24 mos	127 (84.7%)	112 (84.2%)	15 (88.2%)	n.s.

Note: Outcomes are given in mean ± SD or numbers and frequencies (%) for the entire cohort and stratified by pain catastrophizing score.

Abbreviations: EQ5D-VAS, 5-level EQ5D Visual Analogue Scale; FJS, Forgotten Joint Score; KOOS, Knee Injury and Osteoarthritis Outcome Score; MCID; Minimal Clinically Important Difference; n.s., non significant; PCS, Pain Catastrophizing Score.

[a]Comparison of patient demographics by PCS.

[b]Indicates statistical significance.

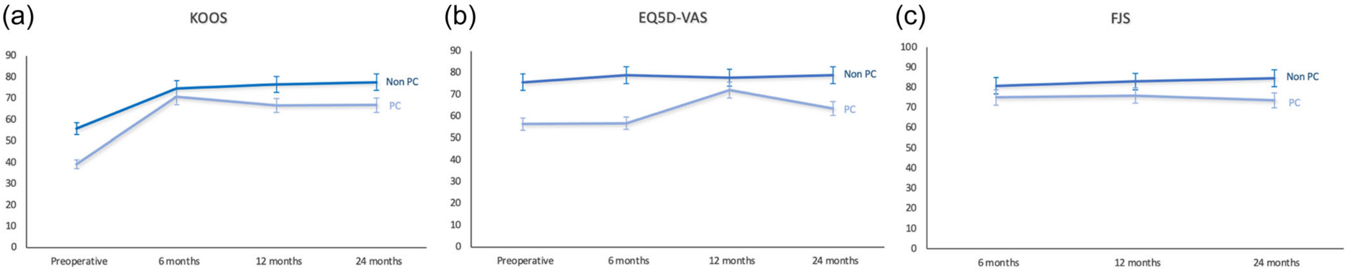

FIGURE 2 Progression of patient-reported outcomes among patients with pain catastrophizing tendencies (PCS ≥ 30) and patients without pain catastrophizing tendencies (PCS < 30). (a) Knee Injury and Osteoarthritis Outcome Score (KOOS) preoperatively and 6-, 12-, and 24 months following unicompartmental knee arthroplasty stratified by PCS. (b) EQ5D-VAS preoperatively and 6-, 12-, and 24 months following unicompartmental knee arthroplasty stratified by PCS. (c) FJS preoperatively and 6-, 12-, and 24 months following unicompartmental knee arthroplasty stratified by PCS. EQ5D-VAS, 5-level EQ5D Visual Analogue Scale; FJS, Forgotten Joint Score; KOOS, Knee Injury and Osteoarthritis Outcome Score; PCS, Pain Catastrophizing Score.

TABLE 6 Patient-reported outcomes stratified by Hospital Anxiety and Depression Scale.

	Nonanxiety HADS < 8 ($n = 129$)	Anxiety HADS ≥ 8 ($n = 21$)	p Value[a]	Nondepression HADS < 8 ($n = 130$)	Depression HADS ≥ 8 ($n = 20$)	p Value[a]
KOOS-PS						
Preoperative	55.6 ± 13.3	43.5 ± 16.9	<.001[b]	55.7 ± 13.4	42.4 ± 16.0	<.001[b]
6 months	74.6 ± 14.9	71.8 ± 15.7	n.s.	75.1 ± 14.6	67.9 ± 16.8	.044[b]
12 months	76.6 ± 14.6	68.4 ± 17.3	.033[b]	76.7 ± 14.0	66.9 ± 20.4	.011[b]
24 months	78.2 ± 14.5	65.4 ± 15.2	<.001[b]	78.3 ± 14.1	63.7 ± 16.9	<.001[b]
EQ5D-VAS						
Preoperative	76.0 ± 17.5	59.6 ± 18.0	.001[b]	76.0 ± 17.6	57.1 ± 15.6	<.001[b]
6 months	78.8 ± 19.4	63.1 ± 28.0	.038[b]	78.1 ± 21.4	67.9 ± 16.4	.049[b]
12 months	78.7 ± 20.2	66.5 ± 16.0	.015[b]	78.9 ± 19.9	64.2 ± 16.7	.004[b]
24 months	79.3 ± 19.4	64.2 ± 23.2	.002[b]	78.7 ± 20.6	67.3 ± 18.4	.020[b]
FJS						
6 months	81.2 ± 12.7	73.6 ± 15.6	.026[b]	81.5 ± 12.5	70.9 ± 15.7	.002[b]
12 months	83.1 ± 12.9	76.4 ± 15.9	.048[b]	83.5 ± 12.5	72.6 ± 16.2	.001[b]
24 months	84.6 ± 13.4	75.7 ± 16.8	.008[b]	84.9 ± 13.1	73.3 ± 17.3	<.001[b]

Note: Patient-reported outcomes are given in mean ± SD and stratified by HADS.

Abbreviations: EQ5D-VAS, 5-level EQ5D Visual Analogue Scale; FJS, Forgotten Joint Score; HADS, Hospital Anxiety and Depression Scale; KOOS, Knee Injury and Osteoarthritis Outcome Score; n.s., non significant.

[a]Comparison of patient demographics by HADS.

[b]Indicates statistical significance.

TABLE 7 Patient-reported outcomes of the Numeric Rating Scale for pain stratified by Hospital Anxiety and Depression Scale.

	Nonanxiety HADS < 8 ($n = 129$)	Anxiety HADS ≥ 8 ($n = 21$)	p Value[a]	Nondepression HADS < 8 ($n = 130$)	Depression HADS ≥ 8 ($n = 20$)	p Value[a]
NRS-Pain						
Preoperative	58.1 ± 17.9	62.9 ± 21.0	n.s.	57.7 ± 18.6	65.5 ± 15.2	.049[b]
6 months	17.6 ± 20.1	23.8 ± 23.4	n.s.	16.9 ± 19.7	29.7 ± 24.0	.018[b]
12 months	13.5 ± 18.7	24.4 ± 28.7	n.s.	13.1 ± 18.3	28.2 ± 29.5	.004[b]
24 months	13.7 ± 19.3	27.4 ± 24.6	.023[*]	12.9 ± 18.4	33.3 ± 25.1	.002[b]

Note: Outcomes are given in mean ± SD and stratified by HADS. The NRS-pain represents the average pain experienced during both physical activity and rest.

Abbreviations: HADS, Hospital Anxiety and Depression Scale; NRS, Numeric Rating Scale; n.s., non significant.

[a]Comparison of patient demographics by HADS.

[b]Indicates statistical significance.

assessments (Tables 6 and 7). Moreover, patients with depression had an extended duration of hospitalization compared with patients without depression (2.3 ± 2.4 days vs. 0.8 ± 0.8 days, $p = .017$). Patients without depression experienced significantly more clinical improvement in pain (−44.8 ± 23.5 vs. −32.3 ± 25.4, $p = .029$), and a higher proportion reached the MCID (87.7% vs. 65.0%, $p = .016$) from baseline to 24 months compared to patients with depression. Conversely, significantly more depression patients reached the MCID for EQ5D-VAS from baseline to 6 months compared to patients without depression (Table 8). A detailed overview of the progression of patient-reported outcomes among patients with and without depression is presented in Figure 4.

DISCUSSION

The main findings of the present study reveal that pre-existing psychological factors such as PC, anxiety and depression negatively influence subjective outcomes both prior to and following UKA. Depression appeared to exert the most substantial influence on postoperative outcomes, consistently correlating with inferior outcomes

TABLE 8 Clinical improvement in patient-reported outcomes stratified by Hospital Anxiety and Depression Scale.

	Nonanxiety HADS < 8 (n = 129)	Anxiety HADS ≥ 8 (n = 21)	p Value[a]	Nondepression HADS < 8 (n = 130)	Depression HADS ≥ 8 (n = 20)	p Value[a]
KOOS-PS						
∆ 0–6 mos	19.1 ± 16.8	25.5 ± 19.9	n.s.	19.5 ± 17.3	22.8 ± 16.7	n.s.
∆ 0–12 mos	21.0 ± 15.1	24.7 ± 21.4	n.s.	21.0 ± 15.8	24.4 ± 17.0	n.s.
∆ 0–24 mos	22.6 ± 15.2	22.3 ± 18.1	n.s.	22.7 ± 15.7	21.9 ± 15.3	n.s.
MCID ∆ 0–6 mos	93 (75.0%)	15 (88.2%)	n.s.	94 (75.2%)	14 (87.5%)	n.s.
MCID ∆ 0–12 mos	96 (76.8%)	13 (72.2%)	n.s.	96 (76.2%)	13 (76.5%)	n.s.
MCID ∆ 0–24 mos	102 (79.7%)	14 (70.0%)	n.s.	101 (78.3%)	15 (78.9%)	n.s.
EQ5D-VAS						
∆ 0–6 mos	3.9 ± 21.3	0.3 ± 25.6	n.s.	2.6 ± 22.2	12.3 ± 14.6	n.s.
∆ 0–12 mos	2.7 ± 23.1	4.8 ± 18.1	n.s.	3.1 ± 23.2	1.2 ± 15.3	n.s.
∆ 0–24 mos	4.0 ± 21.8	0.1 ± 29.4	n.s.	2.8 ± 22.7	7.8 ± 25.3	n.s.
MCID ∆ 0–6 mos	37 (43.0%)	5 (45.5%)	n.s.	35 (39.8%)	7 (77.8%)	.037[b]
MCID ∆ 0–12 mos	33 (37.5%)	7 (58.3%)	n.s.	35 (38.9%)	5 (50.0%)	n.s.
MCID ∆ 0–24 mos	30 (34.5%)	5 (33.3%)	n.s.	28 (31.5%)	7 (53.8%)	n.s.
NRS-Pain						
∆ 0–6 mos	−40.4 ± 24.1	−38.2 ± 30.6	n.s.	−40.7 ± 24.5	−35.6 ± 28.1	n.s.
∆ 0–12 mos	−44.2 ± 22.8	−39.2 ± 34.5	n.s.	−44.3 ± 23.4	−38.5 ± 31.5	n.s.
∆ 0–24 mos	−44.4 ± 23.3	−35.5 ± 27.5	n.s.	−44.8 ± 23.5	−32.3 ± 25.4	.029[b]
MCID ∆ 0–6 mos	104 (84.6%)	13 (76.5%)	n.s.	105 (84.7%)	12 (75.0%)	n.s.
MCID ∆ 0–12 mos	109 (87.2%)	13 (72.2%)	n.s.	110 (87.3%)	12 (70.6%)	n.s.
MCID ∆ 0–24 mos	112 (86.8%)	15 (71.4%)	n.s.	114 (87.7%)	13 (65.0%)	.016[b]

Note: Outcomes are given in mean ± SD or numbers and frequencies (%) and stratified by HADS.

Abbreviations: EQ5D-VAS, 5-level EQ5D Visual Analogue Scale; FJS, Forgotten Joint Score; HADS, Hospital Anxiety and Depression Scale; KOOS, Knee Injury and Osteoarthritis Outcome Score; MCID; Minimal Clinically Important Difference; n.s., non significant.

[a]Comparison of patient demographics by HADS.

[b]Indicates statistical significance.

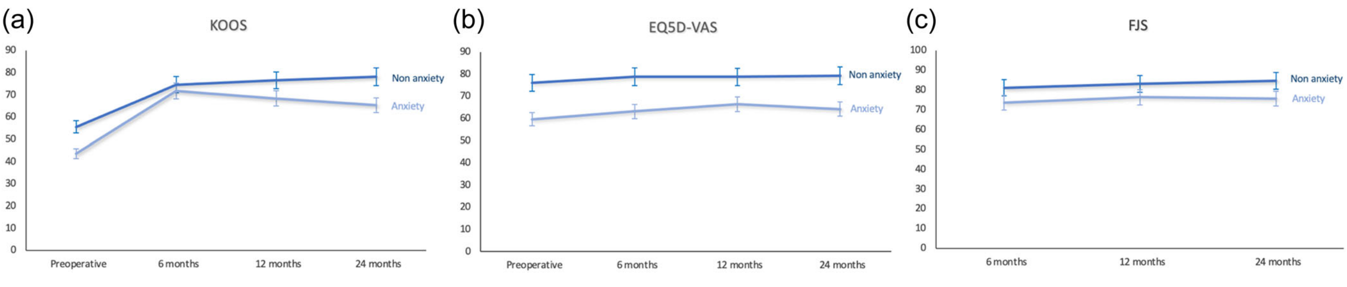

FIGURE 3 Progression of patient-reported outcomes among patients with anxiety (HADS ≥ 8) and patients without anxiety (HADS < 8). (a) KOOS preoperatively and 6-, 12-, and 24 months following unicompartmental knee arthroplasty stratified by HADS. (b) EQ5D-VAS preoperatively and 6-, 12-, and 24 months following unicompartmental knee arthroplasty stratified by HADS. (c) FJS preoperatively and 6-, 12-, and 24 months following unicompartmental knee arthroplasty stratified by HADS. EQ5D-VAS, 5-level EQ5D Visual Analogue Scale; FJS, Forgotten Joint Score; HADS, Hospital Anxiety and Depression Scale; KOOS, Knee Injury and Osteoarthritis Outcome Score.

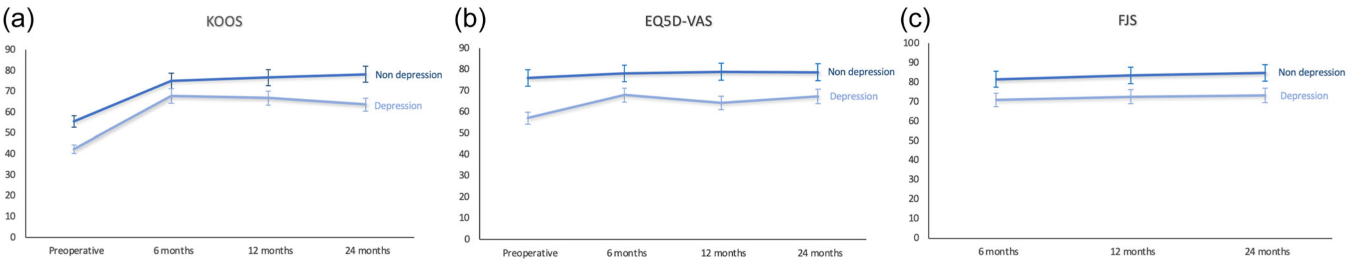

FIGURE 4 Progression of patient-reported outcomes among patients with depression (HADS ≥ 8) and patients without depression (HADS < 8). (a) KOOS preoperatively and 6-, 12-, and 24 months following unicompartmental knee arthroplasty stratified by HADS. (b) EQ5D-VAS preoperatively and 6-, 12-, and 24 months following unicompartmental knee arthroplasty stratified by HADS. (c) FJS preoperatively and 6-, 12-, and 24 months following unicompartmental knee arthroplasty stratified by HADS. EQ5D-VAS, 5-level EQ5D Visual Analogue Scale; FJS, Forgotten Joint Score; HADS, Hospital Anxiety and Depression Scale; KOOS, Knee Injury and Osteoarthritis Outcome Score.

in subjective function, quality of life, joint awareness and pain across all follow-up assessments. Additionally, patients with anxiety and depression had an extended duration of hospitalization compared to patients without these psychological factors. Nonetheless, despite experiencing inferior subjective outcomes both prior to and following UKA, patients with pre-existing psychological factors demonstrated comparable improvements in subjective outcomes compared with patients without these psychological factors. Hence, it seems that inferior outcomes primarily stem from the suboptimal preoperative condition rather than an inherent inability to benefit from UKA.

Over the past decade, considerable attention has been directed towards understanding the influence of psychological factors on the outcomes of TKA. To the best of the authors' knowledge, this study represents the first and largest cohort study with a minimum of 2-year follow-up assessing the relatively underexplored impact of PC, anxiety and depression on various patient-reported outcomes both prior to and following UKA.

PC has gained prominence as a pivotal determinant influencing the severity and persisting nature of chronic pain, potentially serving as an independent prognostic factor for unfavorable surgical outcomes [11, 19, 25]. This study identified that 11% of patients met the criteria for PC, representing a comparatively lower prevalence in contrast to similar studies on TKA, which ranged from 15% to 27.5% [3, 31]. The present study demonstrated that patients with a high degree of preoperative PC tendencies had inferior outcomes in subjective function, quality of life and pain levels prior to undergoing UKA. These findings are in accordance with the existing literature on TKA, which indicate that patients with preoperative PC tend to experience worse function and pain preceding their TKA [3, 31]. In a study pertaining to TKA, Van der List et al. [31] reported a mean preoperative NRS-pain level of 72.2 ± 15.4, which was similar to the mean preoperative pain level of 71.8 ± 15.5 observed among UKA patients with PC in the present study. While PC was associated with inferior outcomes in subjective function, quality of life and joint awareness 24 months following UKA, pain levels were comparable to those of non-PC patients throughout all follow-up assessments. This contradicts studies suggesting a long-term effect of PC on elevated postoperative pain [3, 8, 31].

The present findings show that depression appeared to have the most substantial impact on inferior outcomes following UKA. There is only one other study investigating the influence of mental health on outcomes following UKA, associating preoperative psychological distress with relatively higher pain levels, reduced fulfillment of expectations and suboptimal functional outcomes both prior to and at 2- and 10 years postoperatively [9]. The present study significantly contributes to the existing gap in the literature by specifically focusing on anxiety and depression, demonstrating their association with inferior subjective functionality, reduced quality of life, more joint awareness and higher pain levels both prior to and following UKA. Moreover, fewer patients with depression experienced a meaningful clinical improvement in pain from baseline to 24 months. These findings align with previous studies emphasizing the adverse prognostic characteristics of anxiety and depression on TKA, consistently associating these factors with suboptimal outcomes in subjective function, pain perception and postoperative patient satisfaction [7, 12, 35]. Moreover, anxiety and depression have been associated with inferior functional status at baseline in patients undergoing total hip arthroplasty [14]. Several studies have also suggested that depression serves as a risk factor for higher hospitalization costs and postoperative complications following TKA [10, 18, 23, 30]. This aligns with the findings of the present study, demonstrating that patients with anxiety and depression experienced hospitalizations lasting over twice as long as those without these psychological conditions. Additionally, a recent systematic review demonstrated that preoperative depression increased the risk of persistent pain, dissatisfaction and complications in patients undergoing total joint arthroplasty [29].

Nevertheless, despite the unfavorable outcomes associated with anxiety and depression, UKA resulted in an overall improvement in knee joint function, reduced joint pain and increased quality of life. Prior studies have indicated that the advantages and reduced pain associated with arthroplasty have the potential to alleviate symptoms and reduce the incidence of mental health problems postoperatively [6, 21]. Thus, even within the context of influential psychological risk factors such as anxiety and depression, UKA presents as a promising surgical intervention for addressing isolated compartment knee OA.

Recognizing pain as a primary determinant of dissatisfaction and failure following UKA, it is important to acknowledge the negative prognostic characteristics attributed to PC, anxiety and depression on subjective outcomes following UKA [32]. While several studies highlight that PC, anxiety and depression are modifiable factors, the efficacy of treatments such as cognitive-behavioral therapy and antidepressants in improving outcomes of arthroplasty procedures remains controversial [4, 28, 33]. Nonetheless, recognizing pre-surgical psychological risk factors and raising awareness may allow surgeons to refine preoperative risk assessments and more accurately tailor expectations, thereby potentially enhancing outcomes following UKA.

The present study has several limitations. First, patients were lost to follow-up at 6- and 12 months (7% and 5%, respectively). Nevertheless, the remaining cohort with available data at 6- and 12 months was still considerable in size, making it the largest study cohort examining the influence of psychological risk factors among patients undergoing UKA. Second, the prevalence of patients meeting the criteria for PC (11.3%), anxiety (14.0%) and depression (13.3%) were low. Yet, these percentages align reasonably with reported findings in similar studies examining the influence of these psychological factors on outcomes following TKA [6, 31]. Third, this was a single-centre study which potentially influences the generalizability of the result. Last, this study lacks multivariate analyses.

CONCLUSION

Preoperative PC, anxiety and depression are associated with inferior subjective outcomes both prior to and following UKA. Among these factors, depression seemed to exert the most substantial adverse impact on outcomes following UKA. Patients with anxiety and depression had an extended duration of hospitalization lasting over twice as long as patients without these psychological factors. Nonetheless, despite experiencing inferior subjective outcomes both prior to and following UKA, patients with pre-existing psychological factors demonstrated comparable improvements in subjective outcomes. Hence, it seems that inferior outcomes primarily stem from the suboptimal preoperative condition rather than an inherent inability to benefit from UKA.

AUTHOR CONTRIBUTIONS

Gaby V. ten Noever de Brauw: Conceptualization; data curation; formal analysis; investigation; methodology; writing—original draft. **Margot B. Aalders**: Conceptualization; writing—review and editing. **Gino M. M. J. Kerkhoffs**: Conceptualization; supervision; writing review and editing. **Hendrik A. Zuiderbaan**: Conceptualization; supervision; writing—review and editing. **Lucien C. M. Keijser**: Conceptualization; supervision; writing—review and editing. **Joyce L. Benner**: Conceptualization; data curation; supervision; writing—review and editing. All authors made substantial contributions and approved the final manuscript for submission to The Journal of Knee Surgery, Sports Traumatology, Arthroscopy.

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CONFLICT OF INTEREST STATEMENT

Prof. Gino M.M.J. Kerkhoffs is a consultant for Arthrex. Dr. Hendrik A. Zuiderbaan is a consultant for Smith & Nephew. The remaining authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

Anonymized data supporting this study may be made available upon reasonable request to the corresponding author.

ETHICS STATEMENT

Ethical approval was obtained from the Institutional Review Board (IRB #L019-075). All participants provided written informed consent prior to data collection.

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REFERENCES

1. Behrend, H., Giesinger, K., Giesinger, J.M. & Kuster, M.S. (2012) The "forgotten joint" as the ultimate goal in joint arthroplasty. *The Journal of Arthroplasty*, 27, 430–436.e1. Available from: https://doi.org/10.1016/j.arth.2011.06.035
2. Berliner, J.L., Brodke, D.J., Chan, V., SooHoo, N.F. & Bozic, K.J. (2017) Can preoperative patient-reported outcome measures be used to predict meaningful improvement in function after TKA? *Clinical Orthopaedics & Related Research*, 475, 149–157. Available from: https://doi.org/10.1007/s11999-016-4770-y
3. Bierke, S. & Petersen, W. (2017) Influence of anxiety and pain catastrophizing on the course of pain within the first year after uncomplicated total knee replacement: a prospective study. *Archives of Orthopaedic and Trauma Surgery*, 137, 1735–1742. Available from: https://doi.org/10.1007/s00402-017-2797-5

4. Birch, S., Stilling, M., Mechlenburg, I. & Hansen, T.B. (2020) No effect of cognitive behavioral patient education for patients with pain catastrophizing before total knee arthroplasty: a randomized controlled trial. *Acta Orthopaedica*, 91, 98–103. Available from: https://doi.org/10.1080/17453674.2019.1694312
5. Blackburn, J., Qureshi, A., Amirfeyz, R. & Bannister, G. (2012) Does preoperative anxiety and depression predict satisfaction after total knee replacement? *The Knee*, 19, 522–524. Available from: https://doi.org/10.1016/j.knee.2011.07.008
6. Duivenvoorden, T., Vissers, M.M., Verhaar, J.A.N., Busschbach, J.J.V., Gosens, T., Bloem, R.M. et al. (2013) Anxiety and depressive symptoms before and after total hip and knee arthroplasty: a prospective multicentre study. *Osteoarthritis and Cartilage*, 21, 1834–1840. Available from: https://doi.org/10.1016/j.joca.2013.08.022
7. Filardo, G., Merli, G., Roffi, A., Marcacci, T., Berti Ceroni, F., Raboni, D. et al. (2017) Kinesiophobia and depression affect total knee arthroplasty outcome in a multivariate analysis of psychological and physical factors on 200 patients. *Knee Surgery, Sports Traumatology, Arthroscopy*, 25, 3417–3423. Available from: https://doi.org/10.1007/s00167-016-4201-3
8. Forsythe, M.E., Dunbar, M.J., Hennigar, A.W., Sullivan, M.J. & Gross, M. (2008) Prospective relation between catastrophizing and residual pain following knee arthroplasty: two-year follow-up. *Pain Research and Management*, 13, 335–341. Available from: https://doi.org/10.1155/2008/730951
9. Goh, G.S., Zeng, G.J., Chen, J.Y., Lo, N.N., Yeo, S.J. & Liow, M.H.L. (2020) Ten-year results of unicompartmental knee arthroplasty in patients with psychological distress. *The Journal of Arthroplasty*, 35, 2830–2836.e1. Available from: https://doi.org/10.1016/j.arth.2020.05.011
10. Gold, P.A., Garbarino, L.J., Anis, H.K., Neufeld, E.V., Sodhi, N., Danoff, J.R. et al. (2020) The cumulative effect of substance abuse disorders and depression on postoperative complications after primary total knee arthroplasty. *The Journal of Arthroplasty*, 35, S151–S157. Available from: https://doi.org/10.1016/j.arth.2020.01.027
11. Granot, M. & Ferber, S.G. (2005) The roles of pain catastrophizing and anxiety in the prediction of postoperative pain intensity: a prospective study. *The Clinical Journal of Pain*, 21, 439–445. Available from: https://doi.org/10.1097/01.ajp.0000135236.12705.2d
12. Hanusch, B.C., O'Connor, D.B., Ions, P., Scott, A. & Gregg, P.J. (2014) Effects of psychological distress and perceptions of illness on recovery from total knee replacement. *The Bone & Joint Journal*, 96-b, 210–216. Available from: https://doi.org/10.1302/0301-620X.96B2.31136
13. Hirschmann, M.T., Testa, E., Amsler, F. & Friederich, N.F. (2013) The unhappy total knee arthroplasty (TKA) patient: higher WOMAC and lower KSS in depressed patients prior and after TKA. *Knee Surgery, Sports Traumatology, Arthroscopy*, 21, 2405–2411. Available from: https://doi.org/10.1007/s00167-013-2409-z
14. Kaveeshwar, S., Rocca, M.P., Oster, B.A., Schneider, M.B., Tran, A., Kolevar, M.P. et al. (2022) Depression and anxiety are associated with worse baseline function in hip arthroscopy patients. *Knee Surgery, Sports Traumatology, Arthroscopy*, 30, 3563–3569. Available from: https://doi.org/10.1007/s00167-022-06963-y
15. Kellgren, J.H. & Lawrence, J.S. (1957) Radiological assessment of osteo-arthrosis. *Annals of the Rheumatic Diseases*, 16, 494–502. Available from: https://doi.org/10.1136/ard.16.4.494
16. Lyman, S., Lee, Y.Y., McLawhorn, A.S., Islam, W. & MacLean, C.H. (2018) What are the minimal and substantial improvements in the HOOS and KOOS and JR versions after total joint replacement? *Clinical Orthopaedics & Related Research*, 476, 2432–2441. Available from: https://doi.org/10.1097/CORR.0000000000000456
17. Most, J., Hoelen, T.C.A., Spekenbrink-Spooren, A., Schotanus, M.G.M. & Boonen, B. (2022) Defining clinically meaningful thresholds for patient-reported outcomes in knee arthroplasty. *The Journal of Arthroplasty*, 37, 837–844.e3. Available from: https://doi.org/10.1016/j.arth.2022.01.092
18. Pan, X., Wang, J., Lin, Z., Dai, W. & Shi, Z. (2019) Depression and anxiety are risk factors for postoperative pain-related symptoms and complications in patients undergoing primary total knee arthroplasty in the United States. *The Journal of Arthroplasty*, 34, 2337–2346. Available from: https://doi.org/10.1016/j.arth.2019.05.035
19. Pavlin, D.J., Sullivan, M.J.L., Freund, P.R. & Roesen, K. (2005) Catastrophizing: a risk factor for postsurgical pain. *The Clinical Journal of Pain*, 21, 83–90. Available from: https://doi.org/10.1097/00002508-200501000-00010
20. Perruccio, A.V., Stefan Lohmander, L., Canizares, M., Tennant, A., Hawker, G.A., Conaghan, P.G. et al. (2008) The development of a short measure of physical function for knee OA KOOS-Physical Function Shortform (KOOS-PS)—an OARSI/OMERACT initiative. *Osteoarthritis and Cartilage*, 16, 542–550. Available from: https://doi.org/10.1016/j.joca.2007.12.014
21. Plancher, K.D., Briggs, K.K., Commaroto, S., Dotterweich, K., Wang, K. & Petterson, S.C. (2024) Unicompartmental knee arthroplasty improves mental health in patients with single compartment knee osteoarthritis. *Knee Surgery, Sports Traumatology, Arthroscopy*, 32, 1324–1331. Available from: https://doi.org/10.1002/ksa.12090
22. Rabin, R. & Charro, F. (2001) EQ-SD: a measure of health status from the EuroQol Group. *Annals of Medicine*, 33, 337–343. Available from: https://doi.org/10.3109/07853890109002087
23. Rasouli, M.R., Menendez, M.E., Sayadipour, A., Purtill, J.J. & Parvizi, J. (2016) Direct cost and complications associated with total joint arthroplasty in patients with preoperative anxiety and depression. *The Journal of Arthroplasty*, 31, 533–536. Available from: https://doi.org/10.1016/j.arth.2015.09.015
24. Riddle, D.L., Wade, J.B., Jiranek, W.A. & Kong, X. (2010) Preoperative pain catastrophizing predicts pain outcome after knee arthroplasty. *Clinical Orthopaedics & Related Research*, 468, 798–806. Available from: https://doi.org/10.1007/s11999-009-0963-y
25. Sullivan, M., Tanzer, M., Reardon, G., Amirault, D., Dunbar, M. & Stanish, W. (2011) The role of presurgical expectancies in predicting pain and function one year following total knee arthroplasty. *Pain*, 152, 2287–2293. Available from: https://doi.org/10.1016/j.pain.2011.06.014
26. Sullivan, M.J.L., Bishop, S.R. & Pivik, J. (1995) The pain catastrophizing scale: development and validation. *Psychological Assessment*, 7, 524–532. Available from: https://doi.org/10.1037/1040-3590.7.4.524
27. Sullivan, M.J. & D'Eon, J.L. (1990) Relation between catastrophizing and depression in chronic pain patients. *Journal of Abnormal Psychology*, 99, 260–263. Available from: https://doi.org/10.1037/0021-843X.99.3.260
28. Sun, J.N., Chen, W., Zhang, Y., Zhang, Y., Feng, S. & Chen, X.Y. (2020) Does cognitive behavioral education reduce pain and improve joint function in patients after total knee arthroplasty? A randomized controlled trial. *International Orthopaedics*, 44, 2027–2035. Available from: https://doi.org/10.1007/s00264-020-04767-8
29. Vajapey, S.P., McKeon, J.F., Krueger, C.A. & Spitzer, A.I. (2021) Outcomes of total joint arthroplasty in patients with depression: a systematic review. *Journal of Clinical Orthopaedics and Trauma*, 18, 187–198. Available from: https://doi.org/10.1016/j.jcot.2021.04.028
30. Vakharia, R.M., Ehiorobo, J.O., Sodhi, N., Swiggett, S.J., Mont, M.A. & Roche, M.W. (2020) Effects of depressive

disorders on patients undergoing primary total knee arthroplasty: a matched-control analysis. *The Journal of Arthroplasty*, 35, 1247–1251. Available from: https://doi.org/10.1016/j.arth.2019.12.011
31. van der List, J.P., Benner, J.L., Temmerman, O.P.P. & Keijser, L.C.M. (2023) Preoperative pain catastrophizing prior to total knee arthroplasty is associated with worse preoperative symptoms and more clinical improvement: a prospective comparative study. *The Journal of Arthroplasty*, 38, 470–475. Available from: https://doi.org/10.1016/j.arth.2022.09.016
32. van der List, J.P., Zuiderbaan, H.A. & Pearle, A.D. (2016) Why do medial unicompartmental knee arthroplasties fail today? *The Journal of Arthroplasty*, 31, 1016–1021. Available from: https://doi.org/10.1016/j.arth.2015.11.030
33. Wallis, J.A. & Taylor, N.F. (2011) Pre-operative interventions (non-surgical and non-pharmacological) for patients with hip or knee osteoarthritis awaiting joint replacement surgery—a systematic review and meta-analysis. *Osteoarthritis and Cartilage*, 19, 1381–1395. Available from: https://doi.org/10.1016/j.joca.2011.09.001
34. Williamson, A. & Hoggart, B. (2005) Pain: a review of three commonly used pain rating scales. *Journal of Clinical Nursing*, 14, 798–804. Available from: https://doi.org/10.1111/j.1365-2702.2005.01121.x
35. Wood, T.J., Gazendam, A.M., Kabali, C.B., Wood, T.J., Petruccelli, D.T., Tushinski, D.M. et al. (2021) Postoperative outcomes following total hip and knee arthroplasty in patients with pain catastrophizing, anxiety, or depression. *The Journal of Arthroplasty*, 36, 1908–1914. Available from: https://doi.org/10.1016/j.arth.2021.02.018
36. Yapp, L.Z., Scott, C.E.H., Howie, C.R., MacDonald, D.J., Simpson, A.H.R.W. & Clement, N.D. (2022) Meaningful values of the EQ-5D-3L in patients undergoing primary knee arthroplasty. *Bone & Joint Research*, 11, 619–628. Available from: https://doi.org/10.1302/2046-3758.119.BJR-2022-0054.R1
37. Zigmond, A.S. & Snaith, R.P. (1983) The hospital anxiety and depression scale. *Acta Psychiatrica Scandinavica*, 67, 361–370. Available from: https://doi.org/10.1111/j.1600-0447.1983.tb09716.x

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