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Disease burden of and expectations from surgery in patients prior to total knee arthroplasty: Results of the prospective FInGK study



Hannes Jacobs^{a,*}, Gesine H. Seeber^{b,d}, Djordje Lazovic^b, Uwe Maus^c, Falk Hoffmann^a

^a Department of Health Services Research, Carl von Ossietzky University Oldenburg, Oldenburg, Germany

^b University Hospital for Orthopaedics and Trauma Surgery Pius-Hospital, Medical Campus University of Oldenburg, Oldenburg, Germany

^c Department of Orthopaedics & Trauma Surgery, University Hospital Düsseldorf, Germany

^d Department of Orthopedics, University of Groningen, University Medical Center Groningen, Groningen, The Netherlands

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ABSTRACT

Background: Disease burden in patients prior to total knee arthroplasty (TKA) varies widely between studies and countries. We aimed to characterize individuals undergoing TKA and examine their expectations from the surgery, focusing on variations in disease burden.

Methods: Consecutive patients undergoing primary TKA in a German university hospital were recruited. A questionnaire including information on disease burden, preoperative expectations from surgery, health care utilization, demography, and socioeconomic status was collected one day prior to surgery and linked to data from medical records. Patients were categorized into disease burden quartiles using the Western Ontario and McMaster Universities Osteoarthritis Index' (WOMAC) total score. Subsequently, study population's characteristics and expectations from surgery were analyzed stratified by disease burden. **Results:** A total of 196 patients were included (41 % male; mean age: 68.2 years). The median WOMAC was 52.0 (IQR: 41.0–58.0). Patients in Q1 were more often males (Q1: 63 % vs Q4: 29 %) and had a shorter duration of complaints with the impaired knee. They were also less restricted in social participation, reported less often signs of depression, and were less often treated with physiotherapy (Q1: 27 % vs Q4: 54 %). Furthermore, expectations from surgery were highest in patients with a low disease burden.

Conclusion: We found large variations in disease burden with a considerable number of patients undergoing TKA whose functional capacity is still maintained and for which guideline-recommended conservative treatment options are not fully exhausted. Further research on this subgroup as well as establishing an international consensus on specific thresholds for TKA indication are needed.

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1. Introduction

Osteoarthritis (OA) is one of developed countries' ten most disabling diseases [1]. It is characterized by the degeneration of cartilage and surrounding joint structures and often leads to pain, reduced function, and, consequently, diminished quality

* Corresponding author at: Department of Health Services Research, Carl von Ossietzky University Oldenburg, Ammerländer Heerstr. 114–118, 26129 Oldenburg, Germany.

E-mail address: Hannes.Jacobs@uol.de (H. Jacobs).

of life (QoL) [2]. As a large weight-bearing joint, the knee is most commonly affected [3]. Management of knee OA traditionally involves a combination of non-pharmacological and pharmacological interventions [4,5]. However, for individuals with end-stage knee OA no longer responding to non-surgical interventions, total knee arthroplasty (TKA) is recommended [6].

TKA is one of the most frequently performed procedures worldwide, and its number has increased rapidly over the past decades. In OECD countries, the age-adjusted average TKA rate has more than doubled between 2009 and 2019 [7]. Simultaneously, these rates also display high levels of variations. Generally, they are highest – with more than 200 surgeries per 100,000 inhabitants – in Switzerland, Finland, Austria, the USA, Australia, Belgium, and Germany. On the contrary, countries like Norway, Poland, Israel, and Ireland have TKA rates $\leq 100/100,000$, which is below the OECD average (137/100,000) of 2019 [7].

Variations in TKA rates may occur for many reasons, including differences in OA prevalence, differences in surgeons' expectations and treatment preferences, and restricted access to the procedure [8]. Although there are some national approaches on the criteria for conducting TKA like the New Zealand Priority Criteria Project [9], there is no internationally accepted consensus on the exact indication or optimal timing for TKA [10]. Besides, it has been shown that patients from diverse countries have different expectations from TKA [11]. These are influenced by multiple factors such as demographic characteristics [12], patient information/education [13], as well as clinical features [11] and, therefore, may – in combination with the preoperative disease burden [12,14] – also play a role in country-specific TKA variation.

Studies on disease burden before TKA show a wide range of pain-, stiffness-, and functional levels of the affected knee between countries [15–18]. Generally, studies report a more significant preoperative disease burden in women [16,19,20]. Papaskostidou et al. further observed an association between obese individuals and higher disease burden, whereas age and socioeconomic status (SES) were not associated [20]. In contrast, other authors reported age differences [16] and significantly worse preoperative pain and function in lower-income versus higher-income patients [21]. Simultaneously, TKA growth rates show trends of varying degrees. While most OECD countries show a remarkable increase, others show above average or unchanged growth rates [7]. Time trends in the characteristics of patients undergoing TKA also show that comorbidities like obesity and depression increased in the last three decades. In contrast, data on sex remained unchanged and on age are inconsistent [22–25]. In Germany, data on the characterization of patients undergoing TKA are scarce. It is known from official statistics registries that the proportion of males increased from 2005 to 2019 from 31 % to 39 % [26]. Additionally, Stürmer et al. provided information on disease burden [27]. However, the underlying data are 25 years old, and TKA rates have greatly increased in the meantime [7]. Moreover, data on the factors associated with disease burden is lacking for Germany, and international data are inconsistent.

Therefore, this study aims to characterize patients undergoing TKA in Germany regarding disease burden and expectations from surgery. In addition, we particularly aim to characterize those individuals with a lower disease burden and identify associated factors.

2. Material and Methods

2.1. Study design and study population

The present study was part of the FlNGK project, a prospective cohort of patients undergoing unilateral primary or revision TKA. Participants were consecutively recruited in a German university hospital between December 2019 and May 2021. The following inclusion criteria had to be fulfilled: age ≥ 18 years, projected life expectancy > 12 months, and sufficient cognitive ability and German language skills to give informed consent and to complete the questionnaires. Ultimately, 241 of 283 eligible patients consented to participate in the study (response 85 %). We excluded patients with revision TKA ($n = 37$) (Supplementary material 1). Details on recruitment, differences between responders and non-responders, and the sample size calculation are described elsewhere [28].

2.2. Data collection

Data were collected pre-operatively (usually at admission one day before surgery) and 2 and 12 months after surgery (via a postal survey). For this cross-sectional study, analyses combined data from patient self-reported baseline questionnaires and clinical data obtained from hospital records.

2.2.1. Survey data

The baseline questionnaire included information on (1) disease burden of the impaired knee, (2) expectations from surgery, (3) utilization of health services, (4) sociodemographic characteristics, and information on (5) QoL, depressive symptoms, and restrictions on social participation.

The German version of the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) was used to evaluate the disease burden of the impaired knee [29]. The WOMAC consists of 24 self-administrated questions in three subscales and considers the components pain (5 items), stiffness (2 items), and function (17 items). Each question is scored on a 5-point Likert scale (none, mild, moderate, severe, and extreme). The total (0–96) and the three subscales' scores were summed up with higher scores indicating more pain or disability. As recommended [30] and for cross-study comparisons,

the WOMAC total score was also reported normalized (range 0–100, 100 representing the worst outcome). In that context, duration of knee complaints, duration from the decision to operate to surgery, and fear of surgery were assessed. Furthermore, current use of analgesics and physiotherapy (PT) utilization for the impaired knee joint in the year before surgery was evaluated.

Health-related QoL was assessed by the EQ-5D visual analogue scale (EQ-5D-VAS) [31]. It is scored from 0 (“worst imaginable health state”) to 100 (“best imaginable health state”) and has good reliability and validity in knee OA patients [32]. The WHO Well-Being Index (WHO-5) measures psychological well-being and shows favorable properties for detecting major depression [33]. Scores were transformed (range 0–100) and categorized into “moderate-to-severe” (0–28), “mild” (29–50), and “no” (>50) depressive symptoms as validated and used in previous studies [34,35]. To measure restrictions on social participation, the IMET index was used [36]. Based on ICF criteria [37], it determines in 9 items the subjective impairment of chronically ill people in their everyday lives and can be evaluated as a total score (0–90; high values indicate high participation restrictions). The tool has proven to be valid and reliable for application in chronically ill patients [38]. Patients were also asked whether they were living alone in their household.

Patient expectations from surgery regarding pain relief, activities of daily living (ADL), and physical activities were assessed using the preoperative German New Knee Society Score (GNKSS) [39]. Each question was scored on a 5-point Likert scale. For analyses, categories 0 (“none”), 1 (“a little”), and 2 (“somewhat”) were eventually combined and presented as one single category named “none/low”. Category 3 (“moderate”) stayed unchanged. Category 4 “a lot” was renamed as “high”.

According to the International Standard Classification of Education (ISCED) [40,41], we divided the level of education as low, middle, or high. In the German school system, a low, medium, and high educational level corresponds to nine years of schooling or leaving school without having graduated (ISCED level 0–2B), ten years of schooling (level 2A), and 12 or 13 years of schooling (level 3A), respectively.

2.2.2. Data from medical records

Data from hospital medical records included subjects' age and sex. Body mass index (BMI) was obtained from height and weight as determined one day before surgery. Missing values ($n = 4$) were completed via patient self-report. Primary and secondary diagnoses were retrieved based on the International Classification of Diseases, 10th Revision, German Modification (ICD-10-GM), and comorbidities were categorized by the Elixhauser comorbidity index. This index was developed for studies using administrative hospitalization databases and includes 31 severe comorbidities [42].

2.3. Statistical analyses

As in previous studies [43], patients were categorized into quartiles using the WOMAC total score. Individuals with missing data for total WOMAC score were excluded. Study population characteristics and expectations from surgery for pain relief, ADL, and physical activities were analyzed descriptively (percentages, mean, standard deviation [SD]) and stratified by WOMAC total score quartiles (Q1–Q4).

Backwards multivariable logistic regression analysis was used to determine factors associated with having a lower disease burden (being categorized in Q1 of the WOMAC total score) prior to surgery. We adjusted for main demographic (sex, age, living status), disease-related (social participation restrictions, number of comorbidities, presence of depressive symptoms, current use of analgesics, PT utilization, duration of complaints), socioeconomic (level of education), and surgery-related (fear of surgery, expectations from surgery about pain relief, ADL, and physical activities) characteristics. A significance level of 0.05 was required for a variable to stay in the model. Age and level of education were always included in the model. Adjusted odds ratios (OR) were calculated with a 95 % confidence interval (CI). Non-overlapping 95 % CIs were considered statistically significant.

Data analyses were performed with SAS (Version 9.4, SAS Institute, Cary, NC, USA).

3. Results

3.1. Baseline characteristics of the study population

For a total of 196 of 204 patients undergoing primary TKA, the WOMAC was available, of whom 41 % were male, and the mean age was 68.2 years (Table 1). Mean EQ-5D-VAS and IMET scores were 54.7 and 38.6, respectively. According to the WHO-5, more than one-third had moderate to severe depressive symptoms. Nearly half of the participants had a low educational level, and approximately two-thirds were categorized in the BMI group ≥ 30 kg/m² (mean BMI: 32.7 kg/m²). In addition, 35 % had ≥ 3 comorbidities. Regarding treatment options, 72 % were currently using analgesics, and 40 % had used PT within the year before surgery. Vast fear of surgery was reported by 39 % of the study population. The mean duration of complaints with the impaired knee was 8.3 years.

Overall, the mean WOMAC total score was 50.4 (median: 52.0; IQR: 41.0–58.0) (Table 1). Compared to participants in Q2–Q4, those in Q1 were more often males (Q1: 63 % vs Q4: 29 %) and had a shorter period of complaints. They were also less restricted in social participation (15 % above the median score vs 38 %, 65 %, and 80 % in Q2–Q4, respectively), were less likely to be obese, and reported less often signs of depression. Furthermore, they had fewer comorbidities and were less often treated with analgesics or PT. Patients grouped in Q1 had similar education levels and similar proportions of fear of surgery as

Table 1
Characteristics of the study population in %; stratified by total WOMAC-score quartiles.

Characteristics	WOMAC total score				Total (n = 196; 100.0 %)
	Q1 (score < 41.0); (n = 48; 24.5 %)	Q2 (score ≥ 41.0 - <52.0); (n = 49; 25.0 %)	Q3 (score ≥ 52.0 - <58.0); (n = 47; 24.0 %)	Q4 (score ≥ 58.0); (n = 52; 26.5 %)	
WOMAC total, 0–96, mean (SD) (n = 196)	32.2 (7.0)	46.7 (3.2)	54.3 (1.7)	67.2 (7.8)	50.4 (14.0)
WOMAC total*, 0–100, mean (SD) (n = 196)	33.5 (7.3)	48.6 (3.3)	56.6 (1.8)	70.0 (8.1)	52.5 (14.5)
WOMAC pain, 0–20, mean (SD) (n = 196)	7.0 (2.0)	9.6 (1.8)	11.3 (1.5)	14.0 (2.3)	10.5 (3.2)
WOMAC stiffness, 0–8, mean (SD) (n = 196)	3.2 (1.5)	4.4 (1.2)	5.1 (1.0)	5.5 (1.5)	4.6 (1.6)
WOMAC function, 0–68, mean (SD) (n = 196)	22.0 (5.4)	32.7 (2.9)	37.9 (2.1)	47.7 (6.1)	35.3 (10.3)
EQ-5D scale, 0–100, mean (SD) (n = 192)	70.2 (16.3)	59.0 (15.4)	48.7 (21.9)	42.6 (20.4)	54.7 (21.4)
Sex, male (n = 196)	62.5	46.9	27.7	28.9	41.3
Age in years, mean (SD) (n = 196)	69.8 (8.4)	65.7 (9.6)	67.8 (10.4)	69.5 (10.2)	68.2 (9.8)
18–64 years	20.8	46.9	42.6	32.7	35.7
65–74 years	45.8	34.7	31.9	25.0	34.2
75+ years	33.3	18.4	25.5	42.3	30.1
Social participation restrictions (IMET total), 0–90, mean (SD) (n = 191)	26.3 (12.7)	32.8 (12.7)	41.7 (13.8)	53.0 (17.9)	38.6 (17.6)
Above median (score > 38.3)	14.6	38.3	65.2	80.0	49.7
Level of education (n = 193)					
low	47.8	47.9	42.6	48.1	46.6
middle	28.3	27.1	44.7	34.6	33.7
high	23.9	25.0	12.8	17.3	19.7
Living alone, yes (n = 191)	19.2	12.5	23.9	32.0	22.0
BMI, mean (SD) (n = 196)	30.4 (4.4)	33.1 (5.8)	33.2 (6.2)	34.1 (7.3)	32.7 (6.1)
<25	4.2	8.2	8.5	11.5	8.2
25–<30	50.0	22.5	23.4	13.5	27.0
≥30	45.8	63.4	68.1	75.0	64.8
Elixhauser comorbidity index score (n = 196)					
0	12.5	12.2	12.8	5.8	10.7
1–2	72.9	57.1	48.9	38.5	54.1
≥3	14.6	30.6	38.3	55.8	35.2
Depressive symptoms (WHO-5), 0–100, mean (SD) (n = 191)	60.7 (22.3)	46.8 (22.3)	35.8 (20.2)	29.1 (19.5)	42.8 (24.2)
no (>50)	70.8	42.2	23.9	19.2	38.7
mild (29–50)	18.8	31.1	28.3	21.2	24.6
moderate-to-severe (≤28)	10.4	26.7	47.8	59.6	36.7
Current use of analgesics, yes (n = 191)	46.8	74.5	76.6	88.0	71.7
Use of physiotherapy prior to surgery (n = 194)	27.1	40.4	38.3	53.9	40.2
Duration of complaints in years, mean (SD) (n = 186)	8.0 (8.5)	9.4 (7.8)	7.6 (8.2)	8.1 (9.8)	8.3 (8.6)
<3 years	25.0	20.8	31.8	26.0	25.8
3–<6 years	40.9	25.0	29.6	32.0	31.7
≥6 years	34.1	54.2	38.6	42.0	42.5
Duration from decision to operate to surgery in years, mean (SD) (n = 193)	2.6 (8.6)	1.7 (3.0)	1.9 (5.0)	1.4 (1.7)	1.9 (5.2)
<1 year	43.5	47.9	36.2	46.2	43.5
≥1–<2 years	39.1	31.3	46.8	25.0	35.2
≥2 years	17.4	20.8	17.0	28.9	21.2
Fear of surgery (n = 186)					
no or little	70.2	68.2	57.8	48.0	60.8
big	29.8	31.8	42.2	52.0	39.3

*=normalized (0–100 scale); SD = standard deviation; IMET = limitation of social participation; BMI = body mass index in kg/m²; WOMAC = Western Ontario and McMaster Universities Osteoarthritis Index; WHO5 = WHO-Five Well-being index.

patients in Q2 but more often had a high level of education and less fear of surgery compared to those individuals in Q3 or Q4. There were none or just small differences between the quartiles regarding age.

3.2. Expectations from surgery

Overall, 84 % of the study population had high expectations for pain relief. However, the proportion of patients with high expectations concerning ADLs and physical activities was smaller at 65 % and 51 %, respectively (Figure 1 and Supplementary material 2).

Stratified by WOMAC total score quartiles, expectations from surgery were highest in patients categorized in Q1 in all three expectations categories. In this group, for instance, 92 % reported high expectations regarding pain relief before surgery versus only 77 % and 81 % of the patients in Q3 and Q4, respectively.

3.3. Factors associated with having a lower disease burden prior to TKA

Univariable and multivariable (backwards) logistic regression on factors associated with being categorized into WOMAC total score Q1 is shown in Table 2. Univariable logistic regression models showed that sex, social participation restrictions, depressive symptoms, BMI, PT utilization, and duration of complaints with the impaired knee were associated with having a lower disease burden. In contrast, age and level of education were not. Backwards multivariable logistic regression revealed that male sex (OR: 4.38; 95 % CI: 1.44–13.36), fewer restrictions on social participation, absence of depressive symptoms, a lower BMI, having not used PT within the year before surgery (OR: 4.08; 95 % CI: 1.23–13.54) and a shorter duration of complaints with the impaired knee were factors associated with having a lower disease burden. Here, we additionally entered age and education level in the final model (although the significance levels were ≥ 0.05) since they are meaningful parameters. However, both factors were not associated with having a lower disease burden while controlling for the other variables.

4. Discussion

Overall, in patients undergoing TKA in Germany, we found a considerable variation in disease burden and that expectations from surgery were highest in those reporting a lower disease burden. Moreover, male sex, less social participation restrictions, absence of depressive symptoms, a lower BMI, having not used PT within the year before surgery, and a shorter duration of complaints with the impaired knee were associated with a lower disease burden.

4.1. Expectations from surgery and duration of complaints

Patients' expectations from surgery in this study were reasonably high, especially regarding pain. The vast majority (84 %) of patients expected considerable pain relief confirming different authors' findings [44,45], where 85 % and 75 % of patients

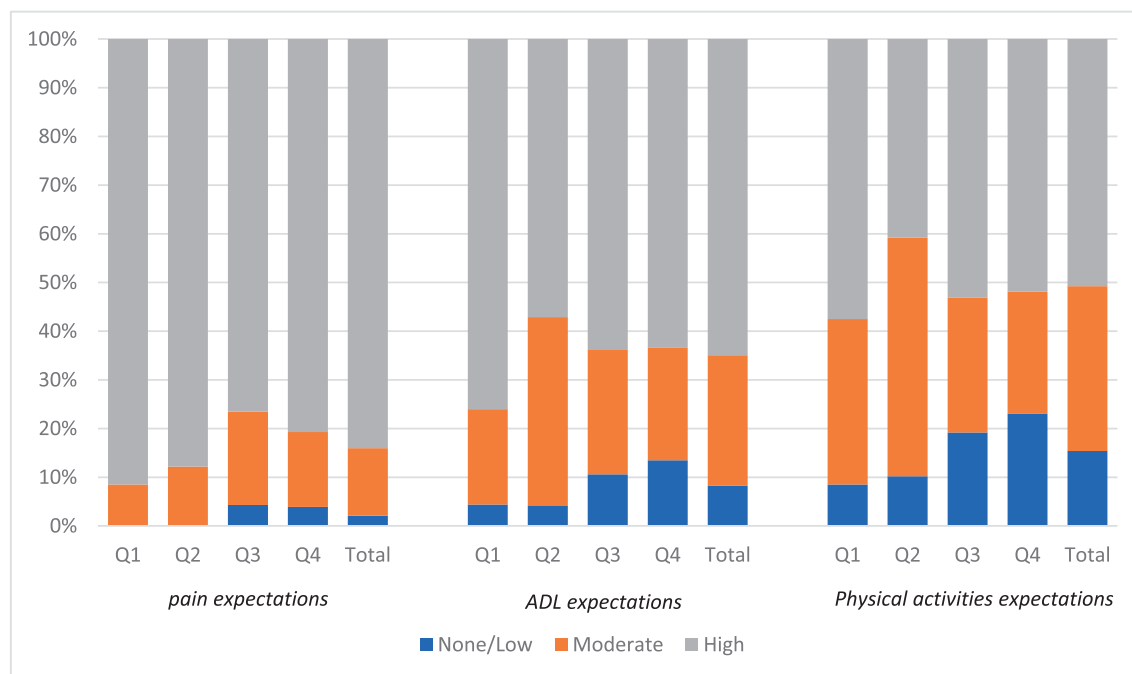


Figure 1. Expectations from surgery for pain relief, activities of daily life (ADL), and physical activities from total knee arthroplasty depending on WOMAC total score quartiles.

Table 2

Factors associated with being in Q1 of total WOMAC-score; results from univariable and backwards multivariable logistic regression analyses (with backwards selection).

Characteristics	reference	OR (95 % CI)	
		Univariable analysis	Multivariable analysis
Sex, male	female	3.43 (1.61–7.30)	4.38 (1.44–13.36)
Age	per 1 year	1.03 (0.99–1.07)	1.00 (0.94–1.06)
Level of education			
Middle	low	0.82 (0.35–1.92)	1.51 (0.42–5.39)
high	low	1.16 (0.46–2.93)	1.81 (0.46–7.18)
Social participation restrictions (IMET total score)	per 1 unit	0.92 (0.89–0.95)	0.93 (0.90–0.97)
BMI	per 1 unit	0.89 (0.83–0.96)	0.88 (0.78–0.99)
Depressive symptoms (WHO-5)			
No	moderate to severe	15.65 (4.42–55.38)	11.02 (2.32–52.31)
mild	moderate to severe	3.80 (0.92–15.66)	1.89 (0.35–10.05)
No use of physiotherapy prior to surgery	yes	2.24 (1.00–5.00)	4.08 (1.23–13.54)
Duration of complaints in years			
<3 years	≥6 years	1.90 (0.74–4.89)	11.17 (2.19–56.99)
3–<6 years	≥6 years	2.13 (0.89–5.07)	7.16 (1.79–28.61)

IMET = limitation of social participation; BMI = body mass index in kg/m²; WOMAC = Western Ontario and McMaster Universities Osteoarthritis Index; WHO5 = WHO-Five Well-being index; forced-in variables: age and level of education.

expected being pain-free following TKA, respectively. Previous research also reported that expectations do not appear to be influenced by preoperative knee pain or patient-reported function scores [12,14,45–47]. However, although our results were not statistically significant, we observed the highest expectations in patients with a comparable low disease burden measured by total WOMAC score. Furthermore, we found an association between being in total WOMAC score Q1 and having a shorter duration of complaints with the impaired knee. Generally, unrealistic pain or walking outcome expectations are powerful predictors of willingness to undergo TKA [48,49], and in addition, patients often overestimate the potential improvement after TKA [44,45]. It seems possible that this overestimation is especially true for those with comparable low disease burden and short duration of complaints because those patients have lower postoperative satisfaction scores [50,51]. As an explanation, Dunbar et al. suggest that patients with a comparatively short duration of complaints base their TKA expectations on their relatively high pre-disease function [50]. These findings highlight the importance of preoperative expectations management. On the one hand, patients with unrealistic high expectations might discuss their individual goals, the extent of improvement, and timelines that can realistically be achieved with their surgeon. Consequently, they might be more satisfied with the surgery. On the other hand, patients could rethink their willingness to undergo surgery but instead first max out recommended conservative OA treatment.

4.2. Variations of patients undergoing TKA

We observed sparse conservative OA management before surgery, especially in those with a low disease burden. For example, while 75 %–88 % of patients categorized in Q2–Q4 were currently using analgesics, only 47 % of those classified in Q1 did so. The same was seen for PT, which corresponds to findings that PT utilization is associated with a higher disease burden in patients with knee OA [28,52]. However, this also means that nearly-three fourth in the Q1 subgroup (and still 46 % for those in Q4) underwent TKA without receiving PT in the last year, which seems to clearly violate relevant guidelines recommending at least six months of conservative management, including PT, for patients with symptomatic knee OA before surgery [53].

There were also large sex differences regarding disease burden in patients prior to TKA. 71 % of patients categorized with the highest disease burden were women (compared to 37.5 % in Q1). That finding is in line with studies observing that women generally report more significant pain and worse function of the impaired knee prior to TKA than men [16,20]. It seems possible that women often delay opting for TKA because they are more fearful of the surgery and, thus, prefer to suffer OA pain rather than have surgery [54,55], leading to potential unmet needs among women [56]. On the contrary, evidence suggests that men are more likely to be referred to an orthopedic surgeon by their general practitioner and, if referred, are more likely than women to be offered surgery [57,58]. In addition, men seem more receptive to receiving invasive treatment and choose surgery earlier in the disease [5,55]. Furthermore, men also less often prefer holistic approaches [58] and/or conservative treatment such as PT or analgesics [52,59–62].

Depression is a common comorbidity in pain [34] and OA patients [63,64]. We found an association between a higher total WOMAC score and depressive symptoms confirming previous studies [65]. These findings indicate that depression may be associated with increased knee pain intensity and is further associated with functional limitation in patients with knee OA, emphasizing the need for recognition and appropriate treatment [63].

4.3. Variation of disease burden

Our findings show a considerable variation of disease burden in patients prior to TKA. When compared to earlier data from Germany [27], our results are similar regarding the median total WOMAC score and its IQR, suggesting that national

variations remained unchanged in the last 25 years. However, compared to international research, the results are inconsistent. Alongside similar disease burden levels in Belgium [66], Greece [20], and France [67], the current study's findings suggest a lower burden of disease in German patients versus patients in the United Kingdom [17,68–70], Finland [71], Sweden [17], Spain [8] and Canada [72]. Nevertheless, we observed higher total pain, stiffness, or dysfunction scores compared to findings from the United States [73], the Netherlands [74], Australia [15], and the United Kingdom [16]. Several reasons for these differences have been postulated, including variations in waiting times for surgery [75], rationing of surgery due to limited resources, cultural differences, and disparities in access to surgery according to SES, sex, or ethnicity [56,76,77].

4.4. Strengths and limitations

A major strength of the present study was the great variation of disease burden in patients prior to TKA and, consequently, the possibility to characterize individuals with low and high disease burden, respectively. Furthermore, our high response of 85 % and only eight individuals excluded from analyses due to insufficient WOMAC data reduced the risk of selection bias.

Some limitations must be considered. First, due to the COVID-19 pandemic, recruitment had to be paused between 17 March and 13 May 2020 (recruitment stop 1) and between 18 December 2020 and 31 January 2021 (recruitment stop 2) because all elective surgeries were postponed. Therefore, we had to extend our scheduled recruitment period, which was initially planned for 12 months. Second and even more importantly, the COVID-19 pandemic and its related measures might have influenced the disease burden prior to TKA. Therefore, we performed sensitivity analyses by stratifying by time periods and observed that the disease burden was slightly lower before recruitment stop 1 (mean total WOMAC score 47.6) compared to patients following lockdown 1 (mean total WOMAC score 51.8) and lockdown 2 (mean total WOMAC score 50.7), which might be due to postponed surgeries resulting in expanded waiting times. However, differences were marginal and remained at the same level when stratifying by WOMAC quartiles, suggesting that the differences were not clinically meaningful. Third, our study was limited to only one university hospital, thus limiting the generalizability. Nevertheless, the hospital's catchment area is large (only 31 % of study participants resided in the city of the hospital) and covers urban as well as rural regions.

5. Conclusions

To conclude, there is considerable heterogeneity - in Germany and internationally - regarding disease burden amongst patients undergoing TKA. In addition to patients with high levels of disease burden, a considerable number of patients whose functional capacity is still maintained received a TKA. In the current study, those are primarily normal-weight males without depressive symptoms and fewer restrictions in social participation, who did not use PT within the year before TKA, and have a high expectation for surgery. Future research is clearly needed and should provide more information on this subgroup especially on their expectation management and why guideline-recommended conservative OA management options are not fully exhausted before TKA. Furthermore, an international consensus regarding specific thresholds for TKA indication should be established.

Ethics approval

The medical ethics committee of the University of Oldenburg approved this study (#2019–064). All participants gave written informed consent prior to enrolment.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.knee.2023.01.020>.

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