Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

How do patients, physiotherapists and orthopedic surgeons perceive delayed recovery during total knee arthroplasty rehabilitation? A qualitative study

Anke van den Broek
HAN University of Applied Sciences
J. Bart Staal
HAN University of Applied Sciences
Maaike G.J. Gademan
Leiden University Medical Center
Thea Vliet Vlieland
Leiden University Medical Center
Jesper Knoop
jesper.knoop@han.nl
HAN University of Applied Sciences

Research Article

Keywords: Total knee arthroplasty, Rehabilitation, Physiotherapy, Orthopedics, Recovery, Outcome domains, Prognostic factors.

Posted Date: April 17th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-9291961/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Version of Record: A version of this preprint was published at BMC Musculoskeletal Disorders on September 1st, 2026. See the published version at https://doi.org/10.1186/s12891-026-10255-8.

Abstract

Background. Although total knee arthroplasty (TKA) and its physiotherapeutic rehabilitation process are among the most frequently performed medical interventions, a substantial proportion (10-30%) of patients is not satisfied with their recovery. Early identification of delayed recovery would enable timely adjustments of the rehabilitation process. This study aimed to explore and compare the perceptions of patients, physiotherapists, and orthopedic surgeons regarding delayed recovery during TKA rehabilitation.

Methods. Three focus group meetings were organized: patients (n=6), physiotherapists (n=6), and orthopedic surgeons (n=5). Focus group meetings were structured around three predefined topics regarding delayed recovery during TKA rehabilitation: (i) most important outcome domains, (ii) how and when delayed recovery can be identified, and (iii) most important prognostic factors of (delayed) recovery. To facilitate the discussion of the third topic, a rapid review of reviews was performed prior to the focus group meetings, to compile a list of prognostic factors consistently associated with TKA rehabilitation recovery, as reported in recent systematic reviews.

Results. The focus group meetings showed that patients prioritized pain relief as most important outcome domain of TKA rehabilitation recovery, whereas physiotherapists prioritized physical function, and orthopedic surgeons patient satisfaction. According to the physiotherapists, delayed recovery can already be identified within the first six weeks after TKA, while orthopedic surgeons mentioned much longer periods before delayed recovery can be determined. All three stakeholder groups perceived patient expectations as an important prognostic factor of TKA rehabilitation recovery. Besides this factor, physiotherapists and orthopedic surgeons mostly prioritized other patient-related factors, whereas patients considered predominantly external factors as important prognostic factors of recovery during TKA rehabilitation.

Conclusion. This study found similarities but mostly differences in how patients, physiotherapists and orthopedic surgeons perceive delayed recovery during TKA rehabilitation, and which prognostic factors they consider to be most important in this recovery. Our findings suggest that consensus is needed among clinicians on how and when TKA recovery should be considered as delayed. Future research should confirm that patient expectations are an important prognostic factor as well as a potential treatment target in TKA rehabilitation that could result in optimization of TKA rehabilitation outcomes.

Introduction

Total knee arthroplasty (TKA) is one of the most frequently performed surgical procedures worldwide, and its incidence is still increasing (Kurtz et al., 2011; van Veghel et al., 2025). This procedure is widely regarded as a successful and cost-effective intervention for managing advanced symptomatic knee osteoarthritis (OA) (Kamaruzaman et al., 2017). After TKA, postoperative physiotherapy in primary care for a period of 3 to 6 months is standard practice (Groot et al., 2022; Jette et al, 2020). While many patients recover well during TKA rehabilitation, a substantial proportion (10–30%) is not satisfied with

their recovery (Beswick et al., 2012; Bourne et al., 2010; DeFrance et al., 2023; Gunaratne et al., 2017; Halawi et al., 2019). Apart from the impact on the individual patients, unsuccessful TKAs lead to a significant societal and economic burden, including increased costs due to prolonged work absenteeism and at-work productivity loss (Hylkema et al., 2019; Marsh et al., 2022; Tilbury et al., 2015).

Currently, it is challenging to predict recovery during TKA rehabilitation (Halvorson et al., 2024). This may be due to previous prognostic research (Dowsey et al., 2016; Duan et al., 2023; Gokhale et al., 2023; Halvorson et al., 2024; Harmelink et al., 2017; Pua et al., 2019; Sanchez-Santos et al., 2018; Santaguida et al., 2008; Waheeb et al., 2015) predominantly focusing on acute (e.g., first week after surgery) rather than long-term outcomes, and on preoperative rather than postoperative) predictors, as well as a lack of consensus regarding the definition of delayed or unsuccessful recovery. As a result, international guidelines (e.g., Jette et al., 2022) provide limited guidance on how to predict and optimize this recovery, leading to suboptimal TKA rehabilitation. Potentially, early prediction of recovery could enable timely treatment adjustments and improve outcomes (George et al., 2020; Sinnige et al., 2022; Van der Groen et al., 2024). Considering the enormous and even further increasing number of TKA procedures performed annually and the substantial proportion of TKAs failing to achieve the desired outcome, it is important to gain new insights into the prediction of delayed recovery during TKA rehabilitation. Recent qualitative studies explored patients' (Singh et al, 2021; Te Molder et al., 2024a; Te Molder et al., 2024b) and professionals' perceptions of TKA outcomes (Te Molder et al., 2024a; Te Molder et al., 2024b), with a primary focus on negative outcomes such as adverse consequences. Thus, there remains limited understanding of how (differently) patients, physiotherapists, and orthopedic surgeons perceive delayed recovery during the TKA rehabilitation process, and which prognostic factors play a role in this (delayed) recovery. Addressing these gaps would be a next step towards early prediction and optimization of TKA rehabilitation outcomes.

The overall objective of this study is to explore and compare the perceptions of patients, physiotherapists, and orthopedic surgeons regarding delayed recovery during TKA rehabilitation. Specifically, the study focused on three predefined topics: (i) most important (positive and negative) outcome domains for TKA rehabilitation, (ii) how and when delayed recovery can be identified during the TKA rehabilitation process, and (iii) most important prognostic factors of (delayed) recovery during TKA rehabilitation. To facilitate the discussion of the third topic, a rapid review of reviews was performed prior to the focus group meetings, to compile a list of prognostic factors consistently associated with TKA rehabilitation recovery, as reported in recent systematic reviews.

Methods

Study Design

A qualitative study design, to gain insight into the perceptions of patients, physiotherapists, and orthopedic surgeons regarding aspects of delayed recovery during TKA rehabilitation. Reporting of the

qualitative study was done according to the Consolidated Criteria for REporting Qualitative Research (COREQ) (Tong et al., 2007).

Focus groups

Three online focus groups were conducted, each with a distinct stakeholder group: patients, physiotherapists, and orthopedic surgeons. Each focus group was intentionally designed to be homogenous in terms of participant type (i.e., patients, physiotherapists, or orthopedic surgeons), to create a comfortable environment where participants can speak more freely and to ensure focused discussions (Krueger, 2014). A maximum of six participants per focus group was chosen to ensure in-depth discussions, individual input and richer exchanges of perspectives (Smith et al., 2009). We chose online meetings to enable participation from different locations without the need for travel (Jones et al., 2022; Lee et al., 2024). We applied a deductive approach (i.e., use of semi-structured interview guide with predefined topics) in combination with elements of nominal group technique to facilitate structured discussion, enhance participant engagement and achieve consensus within each stakeholder group (McMillan et al., 2016; Rankin et al., 2016; Harvey et al., 2012).

Recruitment and selection

Purposive sampling was used to recruit participants who met the predefined inclusion criteria (Appendix 1). Patients were recruited from an ongoing multi-center, prospective cohort study (Longitudinal Leiden Orthopedics Outcomes of Osteoarthritis Study (LOAS) (Tilbury et al., 2020; Groot et al., 2022)). Since 2012, that study includes patients scheduled for primary TKA or total hip arthroplasty as a result of osteoarthritis. A research assistant from the LOAS study contacted potentially eligible participants for the current qualitative study via phone, but only if they had previously given consent for being contacted for future research. If this would not be sufficient, patients were additionally recruited from the network of the project group or via the participating physiotherapists or surgeons. Physiotherapists and orthopedic were recruited from six primary care physiotherapy practices and five hospitals, respectively, with one person per site allowed. If this would not be sufficient, additional candidates were recruited from the network of the project group.

For the focus group with patients, we aimed for diversity in terms of age, gender, educational level, and whether they were satisfied or dissatisfied with their perceived recovery after TKA. For the focus group with physiotherapists and with orthopedic surgeons, diversity was sought in age, gender, and working experience in TKA rehabilitation/procedures.

Study procedure

All potentially eligible participants received an information letter, outlining the study background, aims, and design, and a consent form to sign. After having provided informed consent, three focus groups

were scheduled between June and September 2024.

One week before the focus group meeting, participants were asked to complete a brief online questionnaire via Microsoft Forms (Microsoft Corporation, Redmond, WA). Next to collecting general characteristics (for patients; age, gender, time since TKA, duration (in months and number of sessions) of physiotherapy rehabilitation, and whether they were satisfied (yes/no) with their recovery); for physiotherapists and surgeons: age, gender, profession, education, work experience, TKA rehabilitation/surgery experience), the questionnaire allowed participants to independently reflect on the three main topics by filling in four open-ended questions. This would ensure that each participant had time to carefully consider the topics before engaging in the focus group discussion.

A semi-structured interview guide with open-ended questions was constructed, as shown in Appendix 2. The focus groups were structured into three parts, each dedicated to one of the three main topics:

1. most important (positive and negative) outcome domains of recovery during TKA rehabilitation;
2. how and when delayed recovery during the TKA rehabilitation process can be identified;
3. most important prognostic factors of (delayed) recovery during TKA rehabilitation.

To facilitate the discussion of the third topic, a rapid review of reviews was performed prior to the focus group meetings. Aim of this review was to pragmatically compile a list of prognostic factors consistently associated with TKA rehabilitation recovery, as reported in the most recent systematic reviews (i.e., published since the review of Harmelink et al 2017). We included systematic (umbrella) reviews reporting associations between prognostic factors and outcome domains pain and/or physical functioning, with follow-up points exceeding 6 months post-TKA. Reviews were identified through a PubMed search strategy (see Appendix 3). From the selected reviews, prognostic factors were derived if reported in at least two individual studies with consistent evidence which we defined as ≥ 75% of these studies reporting a statistically significant association in the same direction). This definition is in line with the Cochrane Collaboration Back Review Group (Van Tulder et al., 2013) and used by for example Van der Worp et al., 2015.

The focus group meetings followed the subsequent stages of the nominal group technique: round robin, clarification, and voting (McMillan et al., 2016). The ‘round robin stage’ involved participants sharing their ideas one at a time, with each response being recorded for further discussion. The summarized responses from the questionnaire served as the foundation for the group discussion (‘silent generation of ideas’). The ‘clarification stage’ allowed participants to expand on their responses, ask for clarification, and evaluate the importance of the ideas in the context of the study. In the ‘voting stage’, participants collaboratively discussed the ideas generated and came to a consensus on which answers, ideas, or themes were the most important for each main topic. When applicable, insights from previous focus group(s) were incorporated into subsequent ones. All three online focus group meetings were conducted using Microsoft Teams (Microsoft Corporation, Redmond, WA). Each focus group was led by a moderator (AvdB) and supported by an observer (JK). The moderator followed the semi-structured interview guide, encouraged active participation from all patients, and facilitated interaction among

participants. Meanwhile, the observer took notes, ensured the continuity of the recordings, and assisted the moderator when needed. With permission from participants, focus group meetings were audio recorded.

Data analysis

The questionnaire was analyzed descriptively, using numbers and percentages (for categorical variables) and median, minimum and maximum (for continuous variables). The focus group meetings were transcribed, coded and interpreted qualitatively, using elements of thematic analysis (Braun and Clarke, 2006; Braun and Clarke, 2021). After each group meeting, one researcher (AvdB) analyzed the audio recordings, cross-referenced them with the notes and verified the completeness of the data analysis. The detailed minutes of the focus group were sent to participants via email to check whether this reflected the views of participants (Morse et al., 2002).

Results

Literature review

For the rapid review of reviews facilitating the discussion of the third topic, from a total of 18 eligible reviews published since 2017, the three most recent reviews focusing on the outcomes pain and physical function were selected. These were an umbrella review of reviews by Fernandez-de-las-Penas et al. (2023) (outcome: pain), and two systematic reviews by Olsen et al.: Olsen et al. (2022) (outcome: physical function) and Olsen et al. (2023) (outcome: pain). From these three reviews, 11 prognostic factors with consistent evidence were derived (see Table 1). Factors consistently associated with more pain during/after TKA-rehabilitation were more preoperative pain (Fernandez-de-las-Penas et al. (2023); Olsen et al. (2023)), presence of chronic pain (Fernandez-de-las-Penas et al. (2023); Olsen et al. (2023)), central sensitization (Fernandez-de-las-Penas et al. (2023)), anxiety (Fernandez-de-las-Penas et al. (2023); Olsen et al. (2023)), and pain catastrophizing (Fernandez-de-las-Penas et al. (2023); Olsen et al. (2023)); factors consistently associated with less pain were higher radiological severity of knee OA (Kellgren-Lawrence (KL) grade) (Olsen et al. (2023)) and more social support (Fernandez-de-las-Penas et al. (2023); Olsen et al. (2023)). Factors consistently associated with worse physical functioning during/after TKA-rehabilitation were BMI and walking aid use; factors consistently associated with better physical functioning were better preoperative physical functioning, higher radiological severity of knee OA (KL grade), and more knee joint mobility (all reported in Olsen et al. (2022)).

Table 1
Prognostic factors identified in rapid review of reviews

Pain	Physical function
• Preoperative pain	• Preoperative physical function
• Severity of osteoarthritis (KL grade)	• Preoperative knee joint mobility
• Chronic (knee) pain	• BMI
• Central sensitization	• Walking aid use
• Anxiety	
• Pain catastrophizing	
• Social support	

BMI: Body Mass Index; KL: Kellgren Lawrence.

Focus group meetings

Participant characteristics

Twelve patients were approached, of whom six participated: three from the LOAS cohort study and three via one of the researchers' (AvdB) own network. From nine invited physiotherapists, six participated. One physiotherapist did not fully meet the requirement of two years of experience, but was deemed eligible due to his/her amount of supervised TKA-rehabilitation trajectories. From ten invited orthopedic surgeons, five participated. One orthopedic surgeon did not fully meet the requirement of performing 30 TKA procedures a year, but was included for his/her extensive prior experience. Characteristics of focus group participants are presented in Table 2. The focus group meetings were conducted in the following order: physiotherapists (duration 86 minutes), orthopedic surgeons (68 minutes), and patients (85 minutes).

Thematic analysis

The consensus-based results for each of the three topics are presented separately for each stakeholder group below, and summarized in Table 3.

Table 2
Characteristics of focus group participants*.

Female	**Patients**	**Physiotherapists**	**Orthopedic surgeons (n = 5)**
	(n = 6)	**(n = 6)**	
	4 (66.7)	**3 (50)**	**1 (20)**
Age (years)	66 (50–76)	43 (23–60)	47 (41–66)
Highest level of education	3 (50.0)	---	---
High school	2 (33.3)	---	---
Vocational or technical school	1 (16.7)	---	---
University or college			
Time elapsed since TKA (years)	2.25 (1–5)	---	---
TKA rehabilitation	6 (3–10)	---	---
Duration (months)	2 (33.3)	---	---
Number of PT-sessions	4 (66.7)	---	---
3–12 sessions			
25–36 sessions			
Satisfied with recovery after TKA rehabilitation (yes)	4 (66.7)	---	---
Working experience with TKA patients (years)	---	18 (2–30)	14 (10–35)
Number of TKA patients per year	---	13 (10–25)	150 (15–160)

*Values are numbers (percentage) or median (range; i.e., min-max); PT = physiotherapy; TKA = total knee arthroplasty.

Table 3
Consensus-based results on the three topics by stakeholder group.

Topic	Patients	Physiotherapists	Orthopedic surgeons
Most relevant outcome domains during TKA rehabilitation	• Being pain-free, allowing the return to activities important for the patient, such as ADL, work, hobbies, and sports	• Physical functioning in ADL, work, and sports, for which outcomes at the impairment level (e.g., pain, ROM, stability) are prerequisite	• Meeting patient expectations and patient satisfaction • Pain and its related physical functioning in ADL, work, and sports • Technically well-performed surgery, with no infection occurring
How and when to identify delayed recovery during TKA rehabilitation	• If there is no improvement in recovery after 6–8 months and it is still not possible to perform certain activities that are important to the patient and should be possible according to the physiotherapist	• A lack of progress in comparison to expected outcomes based on preoperative status and exercise frequency, with no improvement despite modifications to the treatment plan • Delayed recovery could generally be identified within 6 weeks post-TKA: reduced ROM, in particular knee flexion (4–6 weeks), persistent pain that does not decrease (6 weeks), wound healing (1 week), stiff gait pattern with a non-relaxed swing phase (6 weeks)	• 6 weeks to 3 months post-TKA: functional impairment in the knee, with extension deficits being considered more significant than flexion deficits • 9 to 12 months post-TKA: pain and ADL outcomes do not reach the expected level for the patient
Most important prognostic factors for (delayed) recovery during TKA-rehabilitation*	• Positive, realistic patient expectations, managed by preoperative patient education • Physiotherapist's guidance during rehabilitation • Social support and well-prepared home environment • Post-TKA pain medication • Obesity	• Positive, realistic patient expectations • Psychological factors (e.g., fear of movement, pain perception, coping strategies, confidence in movement, illness/pain perceptions) • Preoperative status (particularly limited knee extension and history of chronic (knee) pain/central pain mechanisms) • Active rehabilitation approach	• Positive, realistic patient expectations • Psychological factors (e.g., pain catastrophizing, fear of movement, coping strategies, motivation, anxiety, depression) • Preoperative status (particularly better physical functioning) • Work conflict

ADL: activities of daily living; ROM: range of motion; TKA: total knee arthroplasty.

*consensus for a top 3–5 was attempted to reach within each focus group

Topic 1: Most relevant (positive and negative) outcome domains

Patients

All six patients mentioned pain as the most relevant outcome domain during TKA rehabilitation. Pain relief was considered to enable better sleep, regain activities of daily living (ADL), and return to hobbies, sport, or work, and longer walking and cycling distances. Both two patients who were not satisfied with their recovery after TKA mentioned persistent pain hindering their activities as most important outcome domain.

Physiotherapists

The majority of the participating physiotherapists identified physical functioning as a key outcome domain during TKA rehabilitation. They emphasized the importance of patients regaining independence in ADL and achieving functional use of the knee, including activities such as walking and cycling. Additionally, the ability to participate in sports and return to occupational activities, when applicable, was regarded as important. Outcomes such as pain reduction, knee range of motion (ROM), knee stability, and gait pattern were viewed as prerequisites for achieving the patient-specific goals.

Orthopedic surgeons

Orthopedic surgeons emphasized that patient satisfaction (by meeting the patient's expectations) is the most relevant outcome domains during TKA rehabilitation. Orthopedic surgeons described patient satisfaction as multifaceted and sometimes unpredictable, referring to it as a black box. While a technically well-executed surgery without complications was considered a prerequisite for success, it was mentioned that a well-executed TKA was not always decisive for patient satisfaction. Pain and physical functioning, particularly in ADL, work, or sports, were also identified as important outcome domains, despite difficulties regarding their subjective nature.

Topic 2: How and when to identify delayed recovery

Patients

Most patients indicated that they would be concerned if there was no improvement and they were unable to perform important activities after on average 6–8 months post-TKA. Two patients emphasized that understanding what to expect, especially during the first months after TKA, helped them manage their recovery process more effectively. Patients considered physical complaints during this first period (3 months) challenging but normal.

Physiotherapists

Most physiotherapists stated that delayed recovery could generally be identified already within 6 weeks post-TKA. They mentioned reduced knee mobility (in particular knee flexion) at 4–6 weeks as a first sign of delayed recovery, and that in such cases an orthopedic surgeon or hospital-based physiotherapist may need to be consulted. While pain alone was not considered a definitive indicator of delayed recovery, physiotherapists considered pain accompanied with other issues like reduced mobility to be concerning, within the first 6 weeks. Also wound complications, such as poor closure or leakage, were flagged as signs of delayed recovery. Physiotherapists stressed the importance of prompt referral to the orthopedic surgeon within one week to prevent infection. Additionally, abnormal gait patterns, such as a stiff walk without a relaxed swing phase, were noted as contributing to delayed recovery, as they could exacerbate pain and hinder progress.

Orthopedic surgeons

Orthopedic surgeons generally believed that the 6-week period that was mentioned by the physiotherapists is too early to determine delayed recovery. They recognized that patients are often referred to them by worried physiotherapists within this early stage. Such cases usually do not require intervention rather than reassurance, as symptoms often improve over time, according to the orthopedic surgeons. Orthopedic surgeons did acknowledge limited knee mobility in the period from 6 weeks to 3 months to be concerning. For example, if a patient still does not achieve 90 degrees of knee flexion and has a knee extension deficit of 15–20 degrees at 3 months, referral to the surgeon may be warranted to assess whether an intervention is necessary. One surgeon emphasized the greater importance of extension deficits over flexion limitations, as activities such as walking can still be performed with 60 degrees of flexion. In the period between 9 to 12 months post-TKA, orthopedic surgeons defined delayed recovery as suboptimal progress in physical functioning and/or persistent pain. By this stage, most patients should have achieved their goals, provided that these were formulated realistically. All surgeons stressed the importance of informing patients that recovery from a TKA is a lengthy process. While many patients experience most of their improvements within a year, further progress in pain relief and function can continue between 2 and 5 years postoperatively.

Topic 3: Prognostic factors for TKA rehabilitation recovery

Patients

Patients mentioned several prognostic factors that could positively influence recovery during TKA rehabilitation, such as adequate guidance from the physiotherapist, a supportive home environment (including social support and a well-prepared home situation), adequate (pre-operative) patient education resulting in realistic expectations for recovery, and effective (post-surgery) pain medication management. Patients also identified several prognostic factors that could impede recovery, with obesity considered to be most important, while other factors mentioned being overloading the knee too early after TKA, complications during or after surgery (such as infection), insufficient pain relief in the early postoperative phase (particularly during the first few days), mental health (i.e., anxiety and depression), and severely limited preoperative knee joint mobility. After being informed on the prognostic factors

consistently associated with TKA outcomes as reported in the literature, the group discussion resulted in a consensus-based top-5 of most important prognostic factors: patient expectations (being positive but realistic, managed by preoperative patient education), physiotherapist's guidance during rehabilitation, social support and well-prepared home environment, post-TKA pain medication and obesity.

Physiotherapists

According to the physiotherapists, the most important prognostic factors for recovery after TKA were (positive but realistic) patient expectations, psychological factors (such as illness or pain perception, fear of movement, anxiety), coping style, motivation and preoperative status (particularly limited knee extension and history with chronic pain or central pain mechanisms). Building trust and an active treatment strategy were also identified as important to recovery, particularly for patients with negative coping styles or low self-efficacy. Regarding patient expectations, they emphasized the need for preoperative education in which realistic expectations about the recovery process and realistic goals should be discussed to avoid disappointment and to ensure commitment to rehabilitation. Other prognostic factors that were noted included inadequate pain management, inadequate social support and insufficient physical capacity. After being informed on the prognostic factors consistently associated with TKA outcomes as reported in the literature, the group discussion resulted in a consensus-based top-4 of most important (categories of) prognostic factors: patient expectations (being positive but realistic), psychological factors (e.g., fear of movement, pain perception, coping strategies, confidence in movement, illness/pain perceptions), preoperative status (particularly limited knee extension and history of chronic (knee) pain/central pain mechanisms) and active rehabilitation approach.

Orthopedic surgeons

Orthopedic surgeons identified several prognostic factors that positively influence recovery during TKA rehabilitation, with positive but realistic patient expectations (and goals) as the most important one. First, they emphasized the importance of patients understanding the gradual nature of recovery, in which initial post-operative pain is normal. In addition, similar to the physiotherapists, they stressed the importance of establishing realistic goals through preoperative discussions, ensuring that patients have a clear understanding of what to expect from the procedure. Other prognostic factors that, according to orthopedic surgeons, could positively influence recovery were worse preoperative functional status, having social support (particularly the presence of a partner at home), financial stability, positive mindset, and pro-active role of the patient during rehabilitation. The following prognostic factors were identified that could impede recovery, namely unrealistic expectations, passive coping style, psychological factors (such as anxiety, depression, pain catastrophizing), low physical activity and work-related issues (such as physical labor and work conflicts). Also strength training with too much intensity too soon in the TKA-rehabilitation was mentioned as factor that could hinder recovery.After being informed on the prognostic factors consistently associated with TKA outcomes as reported in the literature, the group discussion resulted in a consensus-based top-4 of most important (categories of) prognostic factors: patient expectations (being positive but realistic), psychological factors (e.g., pain

catastrophizing, fear of movement, coping strategies, motivation, anxiety, depression), preoperative status (particularly better physical functioning) and work conflict.

Discussion

This qualitative study on delayed recovery during the rehabilitation phase following TKA showed that patients, physiotherapists and orthopedic surgeons had different perspectives. According to physiotherapists, delayed recovery can already be identified in the first phase of rehabilitation, while patients and especially orthopedic surgeons mentioned longer periods to determine delayed recovery. Patients considered being pain free as most important outcome for recovery, physiotherapists prioritized physical functioning, whereas orthopedic surgeons patient satisfaction. Finally, despite some overlap, the stakeholder groups clearly differed in which prognostic factors for delayed recovery they perceived to be most important.

The prioritization of most important outcome domains of TKA rehabilitation differed across the three stakeholder groups, with pain being prioritized by patients, physical functioning by physiotherapists and patient satisfaction by orthopedic surgeons. On the other hand, the three stakeholder groups agreed in recognizing the interconnected nature of these three outcome domains. Patients highlighted that pain relief enables them to resume daily activities, a view supported by physiotherapists, who regarded pain reduction as prerequisite for functional recovery. Similarly, while prioritizing patient satisfaction as most important, orthopedic surgeons also acknowledged the importance of pain and physical functioning. These three outcome domains – pain, physical functioning, and patient satisfaction – align with findings from other qualitative studies (Singh et al., 2021; Te Molder et al., 2024a; Te Molder et al.; 2024b) and are part of the OMERACT core domain set (Singh et al., 2017). Te Molder et al. (2024b) suggested that patients may accept some pain if it allows them to perform valued activities, while our study found patients less willing to accept pain, prioritizing it over activities. Besides the three outcome domains, orthopedic surgeons in our study also emphasized the importance of a technically well-performed surgery, consistent with the knee specialists' views in a previous qualitative study (Te Molder et al., 2024a).

The differences between physiotherapists on the one hand and patients and especially orthopedic surgeons on the other hand in when and how they identify delayed recovery after TKA were remarkable. Physiotherapists argued that limited knee mobility in the first 6 weeks is a sign of delayed recovery that needs direct judgement and possible intervention from the orthopedic surgeon. Orthopedic surgeons mentioned much longer periods to determine delayed recovery in general, but acknowledged that in individual cases with severe knee mobility limitations, direct intervention between 6 weeks to 3 months can be required. This statement from the orthopedic surgeons seems to be in line with Te Molder et al (2024a) in which knee specialists (i.e., combination of mostly orthopedic surgeons and physiotherapists) stated that patients with limited knee mobility within 3 months post-TKA should be referred to the orthopedic surgeon as the knee could need manipulation under anesthesia to regain full range of motion. In general, the orthopedic surgeons in our focus groups stressed that recovery from a

TKA is a lengthy process, in which the natural course of recovery should be allowed to proceed without intervention, and in which improvements in pain and physical function can still occur even after a year. This aligns with previous study findings that “getting used to the prosthetic knee” is part of a long process (Te Molder et al,. 2024a). Overall, there appears to be a lack of consensus in clinical practice regarding the definition and time-point of delayed recovery during TKA rehabilitation and thereby also in the indication for orthopedic surgeons to intervene in the first phase of TKA rehabilitation.

Although there is considerable overlap in the prognostic factors the three stakeholder groups consider important, some interesting differences were found as well. While both physiotherapists and orthopedic surgeons primarily focused on patient-related factors (such as psychological factors and preoperative status), patients placed greater emphasis on external factors (such as social support and physiotherapist’s guidance during rehabilitation). This patient perspective is particularly interesting, as such factors have barely been included so far in prognostic studies. Most important similarity across the stakeholder groups is that patient expectations were considered to be an important prognostic factor in each group. They all mentioned that prior to surgery, the patient’s expectations of the outcome (and its course) should be positive but also realistic, with especially patients emphasizing the importance of adequate preoperative patient education to set realistic expectations. Such education is important, because patients tend to have overly high expectations going into TKA surgery (Mannion et al., 2009; Nilsdotter et al., 2009; Neuprez et al., 2016). Despite this consensus within clinical practice, the literature does not yet provide strong evidence for an association between patient expectations and treatment outcomes for TKA (Haanstra et al., 2012; Culliton et al., 2012). This could be attributed to various reasons, such as a lack of a clear definition of the underlying construct of patient expectations, its multifaceted and complex nature, and the varying methods used to measure it (Haanstra et al., 2012). Recent studies (Laferton et al., 2022; Blum et al., 2021) however suggested that patient expectations might be a prognostic factor of TKA-rehabilitation outcome. Another difference between practice-based and literature-based prognostic factors is the emphasis on postoperative factors (e.g. post-operative trajectory of pain and knee mobility, and the physiotherapist’s guidance) in the focus groups, whereas the literature mostly focused on preoperative factors (e.g., preoperative pain and function, radiographic severity).

Implications for clinical practice and future research

The findings of this study have several implications for clinical practice. Based on the perceived importance of patient expectations as a prognostic factor, these expectations could also be a main treatment target. Enhancing preoperative patient education may lead to more positive, yet still realistic recovery expectations and rehabilitation goals. Furthermore, the findings highlight that consensus between physiotherapists and orthopedic surgeons is needed on how and especially when they identify delayed recovery. This may prevent uncertainty in patients regarding their recovery process.

Future research should focus on determining whether practice-based prognostic factors, such as patient expectations and the physiotherapist’s guidance indeed have prognostic value in the (delayed) recovery

during TKA rehabilitation. More knowledge on prognostic factors could ultimately lead to an accurate clinical decision support tool in which TKA rehabilitation outcomes can be predicted early in (or even before) the rehabilitation process and could inform treatment decisions if needed.

Strengths and limitations

The strength of this study is its multi-stakeholder approach, which captures diverse perspectives on recovery following TKA. The use of small focus groups enabled in-depth exploration of experiences, and the modified nominal group technique facilitated consensus within stakeholder groups (Harvey et al., 2012). The study has some limitations. First, despite having used purposeful sampling, the small sample size may not fully reflect the diversity of experiences in the particular profession. Second, the orthopedic surgeon group, consisted of predominantly middle-aged men, lacked diversity, although seems to be an adequate representation of the Dutch population. Third, only one instead of multiple focus groups per stakeholder group was conducted, which may have not been sufficient to achieve saturation (Hennink et al., 2019). Fourth, for patients with a successful recovery, it was challenging to discuss delayed recovery, as they could not base this on their own experiences.

Conclusion

In conclusion, this study found similarities but mostly differences in how patients, physiotherapists, and orthopedic surgeons perceive recovery during TKA rehabilitation. Patients prioritized pain relief as most important outcome domain of TKA rehabilitation recovery, whereas physiotherapists prioritized physical function, and orthopedic surgeons patient satisfaction. Physiotherapists and orthopedic surgeons also differed on how and especially when they identify delayed recovery. All three stakeholder groups considered positive but realistic patient expectations as important prognostic factor for TKA rehabilitation recovery. In addition, physiotherapists and orthopedic surgeons considered patient-related factors as more important, whereas patients consider external factors as more important. Our findings imply that consensus is strongly needed across clinicians on how and especially when delayed recovery can be identified. Future research should confirm that patient expectations are an important prognostic factor as well as a potential treatment target in TKA rehabilitation that could result in optimization of TKA rehabilitation outcomes.

Declarations

Ethics approval and consent to participate

The study was approved by the ethics committee of HAN University of Applied Sciences Nijmegen, Netherlands (approval number ECO 552.05/24). They considered the study not being subject to the Medical Research Involving Human Subjects Act (in Dutch: WMO). Prior to the focus group meetings, written informed consent was obtained from all participants.

Consent for publication

Not applicable.

Competing interests

The authors declare they have no competing interests.

Funding

The study was funded by SIA (project number KIEM.K23.01.063). The funder had no role in the design, organization and execution of the study.

Author Contribution

AvdB was the executive researcher of this study, and drafted the first version of the manuscript. AvdB and JK conducted the focus group meetings. JBS, MGJG, TVV and JK conceptualized the study, acquired funding, supervised AvdB and provided feedback on the manuscript. All authors contributed to this study and approved the final version of the manuscript.

Acknowledgement

We would like to thank all patients, physiotherapists and orthopedic surgeons who participated in the focus groups.

Data Availability

The data generated during these studies will not be publicly available, but will be available upon reasonable request to the corresponding author.

References

1. Beswick AD, Wylde V, Gooberman-Hill R, Blom A, Dieppe P. (2012). What proportion of patients report long-term pain after total hip or knee replacement for osteoarthritis? A systematic review of prospective studies in unselected patients. BMJ open, 2(1), e000435.
2. Blum CL, Lepkowsky E, Hussein A, Wakelin EA, Plaskos C, Koenig JA. Patient expectations and satisfaction in robotic-assisted total knee arthroplasty: a prospective two-year outcome study. Arch Orthop Trauma Surg. 2021;141(12):2155–64.
3. Braun V, Clarke V. Using thematic analysis in psychology. Qualitative Res Psychol. 2006;3(2):77–101.

4. Braun V, Clarke V. Can I use TA? Should I use TA? Should I not use TA? Comparing reflexive thematic analysis and other pattern-based qualitative analytic approaches. Counselling Psychother Res. 2021;21(1):37–47.
5. Bourne RB, Chesworth BM, Davis AM, Mahomed NN, Charron KD. Patient satisfaction after total knee arthroplasty: who is satisfied and who is not? Clin Orthop Relat Research®. 2010;468(1):57–63.
6. Culliton SE, Bryant DM, Overend TJ, MacDonald SJ, Chesworth BM. The relationship between expectations and satisfaction in patients undergoing primary total knee arthroplasty. J Arthroplast. 2012;27(3):490–2.
7. DeFrance MJ, Scuderi GR. Are 20% of patients actually dissatisfied following total knee arthroplasty? A systematic review of the literature. J Arthroplast. 2023;38(3):594–9.
8. Dowsey MM, Spelman T, Choong PF. Development of a prognostic nomogram for predicting the probability of nonresponse to total knee arthroplasty 1 year after surgery. J Arthroplast. 2016;31(8):1654–60.
9. Duan X, Zhao Y, Zhang J, Kong N, Cao R, Guan H, Tian R. Prediction of early functional outcomes in patients after robotic-assisted total knee arthroplasty: a nomogram prediction model. Int J Surg. 2023;109(10):3107–16.
10. Fernández-de-Las-Peñas C, Florencio LL, De-La-Llave-Rincón AI, Ortega-Santiago R, Cigarán-Méndez M, Fuensalida-Novo S, Navarro-Santana MJ. Prognostic factors for postoperative chronic pain after knee or hip replacement in patients with knee or hip osteoarthritis: an umbrella review. J Clin Med. 2023;12(20):6624.
11. George SZ, Lentz TA, Beneciuk JM, Bhavsar NA, Mundt JM, Boissoneault J. Framework for improving outcome prediction for acute to chronic low back pain transitions. Pain Rep. 2020;5(2):e809.
12. Gokhale S, Taylor D, Gill J, Hu Y, Zeps N, Lequertier V, Enticott J. Hospital length of stay prediction for general surgery and total knee arthroplasty admissions: Systematic review and meta-analysis of published prediction models. Digit Health. 2023;9:20552076231177497.
13. Groot L, Latijnhouwers DAJM, Reijman M, Verdegaal SHM, Vlieland V, Gademan TPM, M. G. J.,Longitudinal Leiden Orthopedics Outcomes of Osteoarthritis Study (LOAS) Group Nelissen RGHH van der Linden HMJ Kaptein BL Damen PJ Kaptijn HH Vehmeijer SBW Marijnissen WJCM, Onstenk R. (2022). Recovery and the use of postoperative physical therapy after total hip or knee replacement. *BMC Musculoskeletal Disorders*, *23*(1), 666.
14. Gunaratne R, Pratt DN, Banda J, Fick DP, Khan RJ, Robertson BW. Patient dissatisfaction following total knee arthroplasty: a systematic review of the literature. J Arthroplast. 2017;32(12):3854–60.
15. Haanstra TM, van den Berg T, Ostelo RW, Poolman RW, Jansma IP, 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;10:1–14.

16. Halawi MJ, Jongbloed W, Baron S, Savoy L, Williams VJ, Cote MP. Patient dissatisfaction after primary total joint arthroplasty: the patient perspective. J Arthroplast. 2019;34(6):1093–6.
17. Halvorson RT, Torres-Espin A, Cherches M, Callahan M, Vail TP, Bailey JF. (2024). Predicting Recovery Following Total Hip and Knee Arthroplasty Using a Clustering Algorithm. Arthroplasty Today, 101395.
18. Harmelink KE, Zeegers AV, Hullegie W, Hoogeboom TJ, Nijhuis-van der Sanden MW, Staal JB. Are there prognostic factors for one-year outcome after total knee arthroplasty? A systematic review. J Arthroplast. 2017;32(12):3840–53.
19. Harvey N, Holmes CA. Nominal group technique: an effective method for obtaining group consensus. Int J Nurs Pract. 2012;18(2):188–94.
20. Hennink MM, Kaiser BN, Weber MB. What influences saturation? Estimating sample sizes in focus group research. Qual Health Res. 2019;29(10):1483–96.
21. Hylkema TH, Stevens M, Selzer F, Amick BA, Katz JN, Brouwer S. Activity impairment and work productivity loss after total knee arthroplasty: a prospective study. J Arthroplast. 2019;34(11):2637–45.
22. Jette DU, Hunter SJ, Burkett L, Langham B, Logerstedt DS, Piuzzi NS, Poirier NM, Radach LJL, Ritter JE, Scalzitti DA, Stevens-Lapsley JE, Tompkins J, Zeni J Jr. American Physical Therapy Association. Physical Therapist Management of Total Knee Arthroplasty. Phys Ther. 2020;100(9):1603–31.
23. Jones JE, Jones LL, Calvert MJ, Damery SL, Mathers JM. A literature review of studies that have compared the use of face-to-face and online focus groups. Int J Qualitative Methods. 2022;21:16094069221142406.
24. Kamaruzaman H, Kinghorn P, Oppong R. Cost-effectiveness of surgical interventions for the management of osteoarthritis: a systematic review of the literature. BMC Musculoskelet Disord. 2017;18:1–17.
25. Krueger RA. Focus groups: A practical guide for applied research. Sage; 2014.
26. Kurtz SM, Ong KL, Lau E, Widmer M, Maravic M, Gómez-Barrena E, de Pina Mde F, Manno V, Torre M, Walter WL, de Steiger R, Geesink RG, Peltola M, Röder C. International survey of primary and revision total knee replacement. Int Orthop. 2011;35(12):1783–9.
27. Laferton JAC, Oeltjen L, Neubauer K, Ebert DD, Munder T. The effects of patients' expectations on surgery outcome in total hip and knee arthroplasty: a prognostic factor meta-analysis. Health Psychol Rev. 2022;16(1):50–66.
28. Lee, S. H., Ten Cate, O., Gottlieb, M., Horsley, T., Shea, B., Fournier, K.,… Humphrey-Murto,S. (2024). The use of virtual nominal groups in healthcare research: An extended scoping review. Plos one, 19(6), e0302437..
29. Mannion AF, Kämpfen S, Munzinger U, Kramers-de Quervain I. The role of patient expectations in predicting outcome after total knee arthroplasty. Arthritis Res therapy. 2009;11:1–13.
30. Marsh J, Joshi I, Somerville L, Vasarhelyi E, Lanting B. Health care costs after total knee arthroplasty for satisfied and dissatisfied patients. Can J Surg. 2022;65(5):E562.

31. McMillan SS, King M, Tully MP. How to use the nominal group and Delphi techniques. Int J Clin Pharm. 2016;38:655–62.
32. Morse JM, Barrett M, Mayan M, Olson K, Spiers J. Verification strategies for establishing reliability and validity in qualitative research. Int J qualitative methods. 2002;1(2):13–22.
33. Neuprez A, Delcour JP, Fatemi F, Gillet P, Crielaard JM, Bruyère O, Reginster JY. (2016). Patients' expectations impact their satisfaction following total hip or knee arthroplasty. PLoS ONE, 11(12), e0167911.
34. Nilsdotter AK, Toksvig-Larsen S, Roos EM. Knee arthroplasty: are patients' expectations fulfilled? A prospective study of pain and function in 102 patients with 5-year follow-up. Acta orthopedica. 2009;80(1):55–61.
35. Olsen, U., Lindberg, M. F., Rose, C., Denison, E., Gay, C., Aamodt, A.,… Lerdal, A.(2023). Factors correlated with pain after total knee arthroplasty: A systematic review and meta-analysis. PloS one, 18(3), e0283446..
36. Olsen, U., Lindberg, M. F., Rose, C., Denison, E., Gay, C., Aamodt, A.,… Lerdal, A.(2022). Factors correlated with physical function 1 year after total knee arthroplasty in patients with knee osteoarthritis: a systematic review and meta-analysis. JAMA network open, 5(7), e2219636-e2219636..
37. Pua, Y. H., Poon, C. L. L., Seah, F. J. T., Thumboo, J., Clark, R. A., Tan, M. H.,…Yeo, S. J. (2019). Predicting individual knee range of motion, knee pain, and walking limitation outcomes following total knee arthroplasty. Acta Orthopedica, 90(2), 179–186..
38. Rankin, N. M., McGregor, D., Butow, P. N., White, K., Phillips, J. L., Young, J. M.,…Shaw, T. (2016). Adapting the nominal group technique for priority setting of evidence-practice gaps in implementation science. BMC medical research methodology, 16, 1–9..
39. Sanchez-Santos, M. T., Garriga, C., Judge, A., Batra, R. N., Price, A. J., Liddle,A. D.,… Arden, N. K. (2018). Development and validation of a clinical prediction model for patient-reported pain and function after primary total knee replacement surgery.Scientific reports, 8(1), 3381..
40. Santaguida, P. L., Hawker, G. A., Hudak, P. L., Glazier, R., Mahomed, N. N., Kreder,H. J.,… Wright, J. G. (2008). Patient characteristics affecting the prognosis of total hip and knee joint arthroplasty: a systematic review. Canadian Journal of Surgery, 51(6), 428..
41. Singh JA, Dowsey MM, Dohm M, Goodman SM, Leong AL, Voshaar MMS, Choong PF. Achieving consensus on total joint replacement trial outcome reporting using the OMERACT filter: endorsement of the final core domain set for total hip and total knee replacement trials for endstage arthritis. J Rhuematol. 2017;44(11):1723–6.
42. Singh JA, Mehta B, Mirza SZ, Figgie MP, Sculco P, Parks M, Goodman SM. When has a knee or hip replacement failed? A patient perspective. J Rhuematol. 2021;48(3):447–53.
43. Sinnige A, Kittelson A, Van der Wees PJ, Teijink JA, Hoogeboom TJ. Personalised outcomes forecasts of supervised exercise therapy in intermittent claudication: an application of neighbours

based prediction methods with routinely collected clinical data. Eur J Vasc Endovasc Surg. 2022;63(4):594–601.

44. Te Molder ME, Smolders JM, Heesterbeek PJ, van den Ende CH. Definitions of poor outcome after total knee arthroplasty: an inventory review. BMC Musculoskelet Disord. 2020;21:1–6.
45. Te Molder ME, Vriezekolk JE, van Onsem S, Smolders JM, Heesterbeek PJ, van den Ende CH. Exploration of adverse consequences of total knee arthroplasty by patients and knee specialists: a qualitative study. Rheumatol Adv Pract. 2024a;8(1):rkad111.
46. Te Molder ME, Verhoef LM, Smolders JM, Heesterbeek PJ, van den Ende CH. Prioritization of Adverse Consequences After Total Knee Arthroplasty Contributing to a Poor Response: A Best-Worst Scaling Exercise Among Total Knee Arthroplasty Patients and Knee Specialists. J Arthroplast. 2024b;39(3):651–7.
47. Tilbury, C., Leichtenberg, C. S., Tordoir, R. L., Holtslag, M. J., Verdegaal, S. H.M., Kroon, H. M.,… Vliet Vlieland, T. P. M. (2015). Return to work after total hip and knee arthroplasty: results from a clinical study. Rheumatology international,35, 2059–2067.
48. Tilbury, C., Leichtenberg, C. S., Kaptein, B. L., Koster, L. A., Verdegaal, S. H.,Onstenk, R.,… Vlieland, T. P. V. (2020). Feasibility of collecting multiple patient-reported outcome measures alongside the Dutch Arthroplasty Register. Journal of Patient Experience, 7(4), 484–492..
49. Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. Int J Qual Health Care. 2007;19(6):349–57.
50. Van der Groen, O., Ghosh, M., Norman, R., Kuceyeski, A., Tozlu, C., Kimberley, T.J.,… Edwards, D. J. (2024). Point of view on outcome prediction models in post-stroke motor recovery. Neurorehabilitation and neural repair, 38(5), 386–398..
51. Van der Worp MP, ten Haaf DS, van Cingel R, de Wijer A, Nijhuis-van der Sanden MW, Staal JB. Injuries in runners; a systematic review on risk factors and sex differences. PLoS ONE. 2015;10(2):e0114937. 10.1371/journal.pone.0114937.
52. Van Tulder M, Furlan A, Bombardier C, Bouter L, Editorial Board of the Cochrane Collaboration Back Review Group. Updated method guidelines for systematic reviews in the cochrane collaboration back review group. Spine (Phila Pa 1976). 2003;28:1290–9.
53. Van Veghel MHW, van Steenbergen LN, Gademan MGJ, van den Hout WB, Schreurs BW, Hannink G. How many people in the Netherlands live with a hip, knee, or shoulder replacement? Bone Jt Open. 2025;6(1):74–81. 10.1302/2633-1462.61.BJO-2024-0162.R1.
54. Waheeb A, Zywiel MG, Palaganas M, Venkataramanan V, Davis AM. (2015, February). The influence of patient factors on patient-reported outcomes of orthopedic surgery involving implantable devices: a systematic review. In *Seminars in Arthritis and Rheumatism* (Vol. 44, No. 4, pp. 461–471).

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Appendix123Qualitativestudyperceptionsdelayedrecoveryduring TKArehabilitation.docx