

Rehabilitation after fast-track knee arthroplasty: A scoping review on evidence-based challenges

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Abstract

Purpose: The purpose of this scoping review is to identify post-operative prognostic factors associated to the outcomes of rehabilitation, in terms of functional recovery and patient satisfaction, after fast-track Total Knee Arthroplasty.

Method: Surgeons, physiatrists and physiotherapists from our hospital (IRCCS Orthopaedic Institute Galeazzi, Milan, Italy) with experience on fast-track pathways selected five postoperative issues including relevant prognostic factors associated to rehabilitation. An electronic research was performed in PubMed using the following keywords: “fast(-)track” AND “arthroplasty” AND issue (i.e. “pain and analgesia”). After screening for eligibility, 43 papers were included in the synthesis.

Results: A multimodal analgesic regimen based on LIA; opioid consumption; intensive and early physiotherapy when possible; standard exercise programs based on patient cluster of characteristics; discharge planning according to functional, psychological and social criteria; patient motivation; use of psychopharmacological treatment; substantial connection between institutions; are postoperative prognostic factors which play a major impact on the effectiveness of rehabilitation after fast-track TKA.

Conclusions: Social, psychological and logistical aspects, together with clinical and functional outcomes, are fundamental to improve patient education, compliance and ability to cope with rehabilitation. Future research should therefore identify recovery curves to predict, track and understand specific outcomes to specific cohorts (or clusters) of patients, in order to refer them to the most suitable rehabilitative modality and setting.

Introduction

The individual and social burden caused by knee osteoarthritis calls for clinical and logistical innovations to improve the effectiveness and efficiency of Total Knee Arthroplasty (TKA). Fast-track surgery is a multidisciplinary perioperative approach aimed at reducing surgical stress and facilitating postoperative recovery, resulting in decreased convalescence, better patient satisfaction, and reduced hospital costs [1-2]. Indeed, accelerated recovery was attributed to better coordination and collaboration between orthopaedic surgeons, physiatrists, physical therapists and patients [3].

Accelerated recovery is not alternative to safe recovery, and fast-track pathways are increasingly considered effective, spread and inclusive [4-8]. However, the postoperative portion of care is perhaps the aspect that received least attention, and room for improvement had been recently identified in many issues [2]. Which prognostic factors, among them, can improve the outcomes of rehabilitation, in terms of functional recovery and patient satisfaction after TKA, how, and for whom?

The aim of this paper is to provide an answer retrieving evidence from the latest publications in literature. Consistently with recommended guidelines on scoping reviews [9], the research includes a high range of study designs in order to inform clinical practice, healthcare policy, and research priorities.

Methods

Relevant studies were identified as follows.

- i) Surgeons, physiatrists and physiotherapists from our hospital (IRCCS Orthopaedic Institute Galeazzi, Milan, Italy) identified five postoperative issues as significantly prognostic to rehabilitation: pain and analgesia, assessment of activity and physical function (as compared to patient-related outcomes), physiotherapy, delirium and cognitive dysfunction, psychology and expectations. Their expertise is given by daily experience with fast-track pathways.
- ii) An electronic research was performed in PubMed looking for the following keywords: “fast(-)track” AND “arthroplasty” AND the object of the topic, either in singular or combined words (i.e. “delirium and cognitive dysfunction”, “delirium”, “cognitive dysfunction”). 164 articles were found.
- iii) Inclusion criteria were English language, fast-track and year of publication from 2015 onwards (namely after the publication of the narrative review which identified room for improvement in post-acute care as introduced previously) [2]. Exclusion criteria were outpatient procedures, non-primary procedures, errata. 62 articles resulted eligible, of which 59 remained after removing doubles.

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iv) Eligible articles were screened to identify the site of arthroplasty, resulting in 27 papers related only to knee procedures, 16 only to hip procedures, and 16 to both hip and knee procedures. The 16 papers related only to hip procedures were excluded. 43 papers were included in the synthesis (Figure 1).

Inclusion and exclusion criteria were such as not to require double review to solve disagreement. The research was completed on March, 8th 2019.

Results and discussion

Information is organized in tables. Data retrieved from reviews are reported outside, in order to introduce, confirm or discuss the findings retrieved from original studies

Pain and analgesia

One of the major challenges to total knee arthroplasty (TKA) is optimal pain control. Effective analgesia is capital in fast-track surgery programs to allow patient's early functional outcomes [10] (Table 1).

Assessment of activity and physical function vs patient-reported outcomes

The ability to generate benefits that matter to people is what creates real value in healthcare delivery. Since objective and subjective-reported outcomes can present significant discrepancies, major joint replacement included [21], when evaluating the effectiveness of a health technology

it is fundamental to consider the wider possible range of outcomes, both in terms of perspective (subjective or objective assessment) and range of time. (Table 2).

Physiotherapy

Fast-track TKA has shortened the time available for physiotherapists to reach functional criteria before discharge, raising safety concerns related to knee stiffness, pain, and the need for manipulation under anaesthesia (MUA). Proper physical exercise is fundamental not only to return to physical function as soon as possible, but also to avoid readmissions and long-term complications.

Once physical exercise is prescribed, little is known about how patients cope with pain, rehabilitation program or daily activities at home. Due to the high number of papers which investigated patient issues, motivation and experience in relation of physical therapy, a dedicated section is distinguished within the same table (Table 3).

Delirium and cognitive dysfunction

Major surgery in elderly patients may be followed by delirium and cognitive dysfunction, which often complicates recovery both during hospitalization and later (Table 4).

Psychology and expectations

Accelerated pathways presuppose a high degree of patient engagement, which requires in turn a high educational, physical

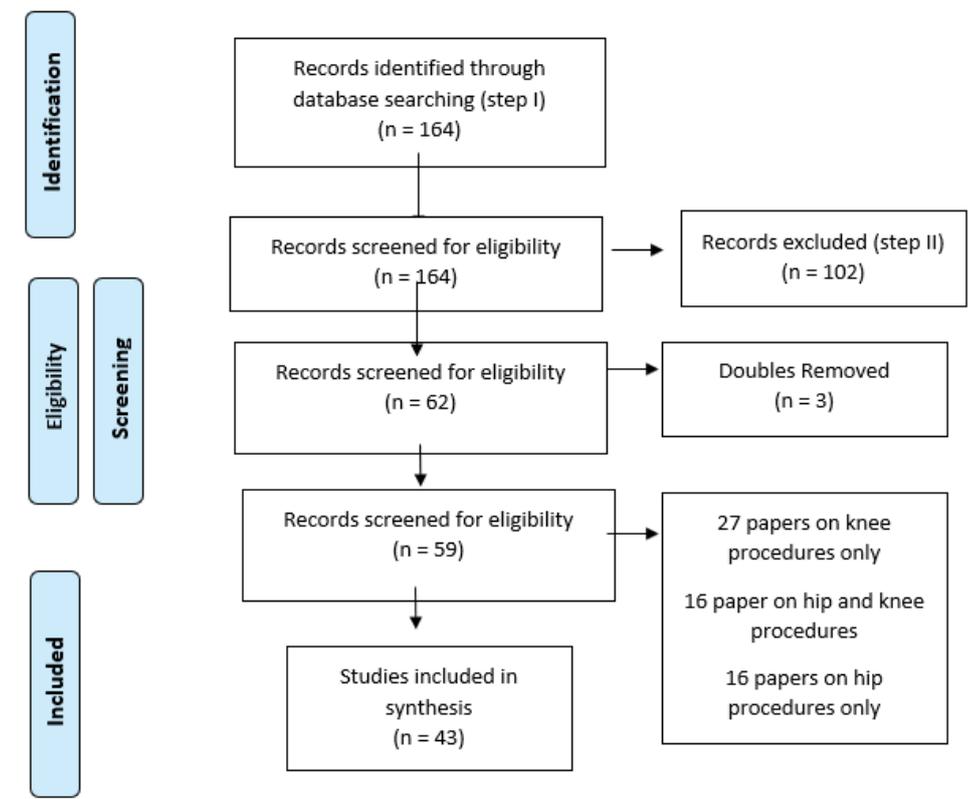


Figure 1. Flowchart

Table 1. Pain and analgesia

Findings	Study design	Population	Duration	Reference
Local Administered Analgesia (LIA) is a safe adjuvant to Femoral Nerve Block (FNB) to reduce perioperative pain 36h after surgery, which is crucial to enable early rehabilitation LOS, patient's satisfaction, complications and pain at 15-day follow up were not significantly affected.	Randomized Controlled Trial (RCT)	121 selected patients undergoing TKA.	1 month (m) after Surgery (AS)	[11]
The addition of perineurally or subcutaneously buprenorphine 0.3 mg to a single-shot FNB (i) reduced opioid consumption and improved sleep quality at the first post-operative night, but (ii) did not to cause any significant change in pain and early mobilization, along with (iii) an increase in the overall incidence of nausea and vomiting.	RCT	63 selected patients aged 50-80 undergoing TKA.	48 hours (h) AS	[12]
<i>Patients receiving sublingual sufentanil tablet system Zalviso® (SSTS) had better pain control (NRS), lower incidence of adverse events and better recovery in comparison with those who had continuous FNB, within a multimodal analgesic treatment.</i> All the patients were discharged home three days after surgery.	Retrospective study	95 selected patients aged > 18 undergoing TKA.	3 days (d) AS	[13]
A single Adductor Canal Block (ACB) injection combined with intravenous dexamethasone is not inferior to ACB catheters in 24-hours opioid consumption.	Randomized Non-Inferiority Trial	177 selected patients aged > 18 undergoing TKA.	48 h AS	[14]
Both LIA and ABC (administered with catheter plus single-shot sciatic nerve block) allow early patient mobilization and high satisfaction. Morphine oral consumption and resting pain levels were also comparable between the treatments. LIA alone reduced peri-operative time of an average 25 minutes, thanks to its faster induction.	RCT	20 selected patients age > 18 undergoing TKA under GA.	N/A [ability to walk on the ward]	[15]
Adrenaline is often included in multimodal analgesic pathways to release early post-operative pain, despite its potential side-effects on tissue necrosis. Ropivacaine alone is a safer and effective alternative to release post-operative pain 48h after LIA. Readmission rates and Patient-Related Outcome Measurements (PROMs) were comparable at 3 months within both treatments.	RCT	50 selected patients undergoing TKA.	3 m AS	[16]
Reduced Pressure Pain Threshold (PPT) on the arm and increased Pain Catastrophizing Scale (PCS) are predictive variables for moderate/severe pain 24h after surgery.	Prospective observational study (POS)	60 patients aged 50-80 undergoing unilateral TKA.	24 h AS	[17]
The relation between self-rated pre-operative pain and post-operative pain was examined in a qualitative study (Pain Catastrophizing Scale, Brief Pain Inventory). No associations were found between preoperative pain catastrophizing and pain 8w or 1y after surgery.	Prospective cohort study	71 random patients aged ≥ 18 undergoing TKA.	1-year (y) AS	[18]
The relation between self-rated pre-operative pain and post-operative pain was examined in a qualitative study (Pain Sensitivity Questionnaire, Brief Pain Inventory). Patients younger than 70 years exhibited more pain 8w after surgery, regardless to the degree of pain that was expressed before. The authors could not explain this correlation.	Prospective cohort study	71 random patients aged ≥ 18 undergoing TKA.	8 weeks (w) AS	[19]
Perioperative administration of escitalopram 10mg daily from pre-anaesthesia to post-operative day 6 did not reduce significantly the level of pain assessed by the patients 48h after surgery, in comparison with placebo.	RCT	120 high pain catastrophizing patients (PCS) undergoing TKA.	6 d AS	[20]
<ul style="list-style-type: none"> • These findings support reviews according to which i) regional anaesthesia and multimodal analgesia are key innovations to reduce pain, minimize narcotic consumption and achieve a faster rehabilitation [21]; ii) FNB could be counterproductive in an accelerated pathway, since it generates a significant decrease in femoral quadriceps strength (FQS) which can prevent early exercise after surgery [10]. • The question is which combination is optimal, whether in addition (LIA, better with bupivacaine) or in alternative (LIA, ultrasound ACB, sufentanil tablet system) to FNB. • To avoid catheterization, a single ACB injection combined with intravenous dexamethasone is a safe alternative. • LIA and ACB can allow early mobilization and high patient-satisfaction also after GA, when this treatment is necessary. The former contributes to an overall 25 min average reduction of the perioperative process • The psychological capacity to cope with pain is also important, since identifying high-patient responders pre-operatively can help planning individual strategies to improve recovery early after surgery. However, these findings need validation on more patients, as well as further studies on which drugs and doses can support that recovery. 				

Table 2. Activity, physical function, patient-related outcomes

Findings	Study design	Population	Duration	Reference
Patient reported improved physical function (mean 7, Knee Injury and Osteoarthritis Outcome Score) when objective assessed change in physical performance (paced-walk, chair-stand, stair-climb tests) decreased.	Prospective cohort study	40 selected patients aged 55-80 undergoing TKA.	From preoperative to 3 w AS	[21]
Barthel test, MRC knee scale and VAS parameters were significantly greater, in fast-track patients, at 2 months after surgery.	Retrospective observational study (ROS)	95 selected patients aged 40-95 who underwent TKA under the same surgeon.	2 m AS	[22,23]
Patients who underwent fast-track rehabilitation had reduced LOS (3d in comparison to 4) and comparable results in knee function (American Knee Society knee - AKSK - and functional - AKSF - scores) 1 year after surgery.	POS	84 patients undergoing TKR with accelerated rehabilitation.	From 1 y before to 1 y AS	[24]
Mean LOS was 5 days. Age > 70 was the most important factor influencing LOS, followed by BMI ≥ 30 and the number of comorbidities. Gender and type of arthroplasty, on the contrary, were not significant. The same factors played a significant role in determining patient-reported outcomes 1 year after surgery.	Retrospective cohort study.	566 patients aged mean 69.3 who underwent TKR.	1 y AS	[25]
Mean patient satisfaction was 9.3 out of a maximum of 10. Mean length of stay was 3.1 days. Revision rates until 1-year follow-up were 3.3%. Function scores and patient-reported outcome scores were improved in all groups.	Retrospective register-based study	66 selected patients aged 36-89 undergoing TKA.	1 y AS	[26]
<ul style="list-style-type: none"> Fast-track protocol for primary TKA showed significantly lower knee pain scores and improved functional outcome in the first 7d after TKA compared to a regular protocol. Studies on a high number of unselected patients confirm that patient characteristics, more than LOS itself, determine patient-reported recovery in the longer run. Despite fast-track pathways are associated with reduced length of stay, high patient satisfaction, low revision rates and with improved health-related quality of life and functionality, early improvement in patient-reported outcomes does not correlated with objectively assessed function. Patient-reported outcomes measurements (PROMs) should not be considered alone when evaluating the impact of a technology on recovery. 				

Table 3a. Physiotherapy.

Findings	Study design	Population	Duration	Reference
A ROM of ≥70° flexion combined with an extension deficit of ≤10° is suggested as an "optimal-zone" for ROM at discharge. The reason is the low occurrence of MUA (4.3%) in relation to the large amount of TKAs it represents (71%).	ROS	359 patients undergoing TKA.	N/A [MUA rate after surgeries]	[27]
A 15-minute walk immediately after recovery from anaesthesia did not increase pain (VAS) in comparison to a traditional non-intensive protocol, but neither did it improve functional recovery (Knee Society Score) up to 2w after surgery.	RCT	31 patients aged mean 68 undergoing TKA.	2 w AS	[28]
In 15% patients, free acupuncture applications reduced post-operative pain from 1 day after surgery. Women and white patients had more odds of receiving acupuncture in comparison to men and non-white patients.	POS	1875 patients ≥ 18 undergoing TJR.	N/A [Self-reported pain assessment before and after acupuncture application]	[29]
In motivated patients, 10 repetitions of maximum-loaded knee extension performed in one set until contraction failure increases voluntary activation of the quadriceps, along with no acute pain immediately after repetition nor at rest.	Prospective cross-sectional study.	24 selected patients aged 18-80 undergoing unilateral TKA.	Early AS (no further specified)	[30]
20 TKA/THA booklets were found 40% of them were related to accelerated pathways 55% of the hospitals to which they were related stated their patients to be mobilized on the day of surgery 100% TKR guidelines suggested the use of bed exercise for rehabilitation 35% TKR guidelines suggested functional exercise as a method for rehabilitation 55% TKR guidelines proposed strength or resistance-based exercises. Many patient information booklets do not follow ERAS principles for fast-track rehabilitation.	UK Google search	N/A	N/A	[31]
In both sexes, knee and gait measures improved nonlinearly over time. It was possible to establish expected deviations from the pattern according to patient characteristics.	ROS	2987 selected patients aged ≥ 50 who underwent unilateral TKA followed by postoperative outpatient physiotherapy.	12 w AS	[32]
<ul style="list-style-type: none"> Significant reductions in MUA and LOS can be simultaneously achieved through a standard degree of flexion and extension at discharge. Earlier and more intensive physiotherapy can enhance recovery, but the best combination of intensity and duration has not been determined. Nearly half patient information booklets do not follow accelerated principles and are non-procedure specific. A high variance in modalities and frequency prevents physiotherapeutic rehabilitation and TKR in general to express their potential. Patient characteristics are the fundamental predictor of LOS and postoperative rehabilitation and determine preventable deviations from the standard pattern. These deviations are helpful to optimize standard treatments according to specific cohorts of patients. Acupuncture can support earlier physical therapy by reducing pain from the first day after surgery, despite its effectiveness varies according to sex and ethnicity. 				

Table 3b. Patient issues, motivation and experience in relation to physical therapy.

Findings	Study design	Population	Duration	Reference
Leg oedema was the major issue after discharge (90.7%), followed by pain (81.4%), sleeping disorders (47.7%), appetite disturbance (38.4%) and bowel disfunction (34.9%). In case rehabilitation was organized by municipal care services, patients were left alone with regard to issues related to pain. 69.8% patients did not entirely comply with recommended exercises.	Qualitative cross-sectional study	86 patients aged ≥ 18 undergoing TKA which were discharged home and referred to physiotherapy in the community.	3 w after discharge (AD)	[33]
The use of a sphygmomanometer device is cheap and feasible technique in postoperative independent knee extension training.	Qualitative study (QS)	24 selected patients undergoing TKA or UKA.	From Post-Operative Day (POD) 1 to discharge	[34]
An android-based knee training device could be an effective support to patient rehabilitation in addition to regular physiotherapy. The absence of technical issues and a high volunteer satisfaction suggest the high potential to reduce the lack of compliance.	Qualitative case report	50 healthy volunteers aged 18-40.	Single session	[35]
Understanding information, dealing with pain, feeling unconfident and being unready for discharge are the main worries in patients undergoing LOS >3 days.	QS	8 selected patients aged 42-82 undergoing unilateral THA/TKA.	From preoperative outpatient visit 1 to discharge.	[36]
The fast-track pathway seemed to enable patients to take an active role in own self-care. The patient's coping capacity was strengthened by education, knowledge and predictability. Four main areas related to coping emerged after discharge: The majority of patients expressed that it was good to come home and take responsibility for their own rehabilitation. The possibility to be assisted in case of pain, even just with a phone call, was considered an important prerequisite for feeling secure after returning home. The patients seemed empowered by sharing experiences with others. Postoperative pain was prevalent in many patients after discharge, but the patients seemed prepared by information provided.	Qualitative focus group study	13 patients aged 40-79 undergoing TKA which were discharged home.	2 w AS	[37]
28 patients were positive regarding short LOS. Pain gradually decreased and quality of life and function gradually improved during the 6w. Mean hours of weekly physiotherapy were 0.6 for w1 and 0.9 during the w6, with high variance of treatment modalities due to the lack of standardized treatment protocols. The intensity of physiotherapy was surprisingly low. The quality of life 6w after discharge was similar to that before the surgery.	QS	30 selected patients aged 52-85 undergoing TKA.	6 w AS	[38]
<ul style="list-style-type: none"> • Patients' lack of compliance to home physical therapy is often a problem, due to misunderstandings or inadequate pain management • In order to improve compliance, several devices are being tested. However, their effectiveness and accessibility must be test on more patients in number and characteristics. • The potential side effects of reduced or fragmented institutionalization, among which inaccurate pain management stands first, are the major worries expressed by patients when they are discharged. Preoperative patient education and/or postoperative pain support (even just a telephone consultation) are then supposed to be highly cost-effective innovations in rehabilitation. • When rehabilitations is not provided by the same institution in which they underwent surgery, patients fear being abandoned or inadequately assisted. At this purpose, more studies are needed to evaluate the pros and cons of continued or interrupted institutionalization, both clinically and economically, on a broader and longer-sighted point of view. 				

Table 4. Delirium and cognitive dysfunction.

Findings	Study design	Population	Duration	Reference
Among the 789 patients who had LOS >4 days, 0.7% were delayed because of Postoperative Delirium (PD). Mean age was 80.7 and median LOS 10 days, without differences in gender and site of arthroplasty. Early mobilization, lower opioid consumption and return to routine (both in physiological terms of restored circadian rhythms and in psycho-social terms of recovering in place) contributed to a significant reduction in its incidence.	Prospective risk-assessment study	6331 patients aged ≥ 70 years undergoing unilateral THA/TKA.	N/A [PD or not]	[39]
<ul style="list-style-type: none"> • Opioid consumption, together with sleep disturbances, pain and neuroinflammation, is indeed a prognostic factor to PD and rehabilitation²¹. • Lower opioid consumption is confirmed to be effective in reducing the incidence of POD, calling for more studies on the combination of optimized opioid-sparing analgesia, reduction of inflammatory-immunological responses, early mobilization and discharge. • Logistical and psycho-social factors such as recovering in place also contribute to a better recover after surgery, so that preoperative discharge-planning according to patient characteristics and living network is highly recommended. More information about this will follow in sections 8 and 9. 				

Table 5. Psychology and expectations

Findings	Study design	Population	Duration	Reference
Understanding information, dealing with pain, feeling unconfident and being unready for discharge are the main worries in patients undergoing LOS >3 days.	QS	8 selected patients aged 42-82 undergoing unilateral THA/TKA.	From preoperative outpatient visit 1 to discharge.	[40]
Patients appreciated only 1 or 2 days in hospital. However, they were not sufficiently involved in the discharge planning. There was a feeling of uncertainty and being left on their own after discharge. Dealing with transition between hospital and home, pain, self-medication and self-rehabilitation were the main worries.	QS	8 patients	12 w AD	[41]
For TKR, median satisfaction score was 8.5 out of 10. No association was found between overall satisfaction following THR or TKR and sex comorbidity, or LOS. THR patients had shorter mean LOS than TKR patients, even though the median LOS was 2 days for both groups. THR patients were more satisfied than TKR patients in the first weeks after discharge.	QS	445 patients undergoing THR/TKR.	2 w AD	[42]
Psychiatric conditions were evaluated preoperatively (SCL-90-R). Patients undergoing THA/TKA are not more burdened by psychiatric symptoms than a healthy control group with the exception of symptoms relating to somatization.	Prospective comparative study	2183 patients undergoing THA/TKA	N/A [Preoperative questionnaire administration]	[43]
Patients with a preoperative registered psychiatric diagnosis (PsD) had no increase in LOS > 4, 30- and 90d readmissions in comparison to those who received psychopharmacological treatment, without a psychiatric diagnosis. Both groups had increased risk of LOS > 4 in comparison with a healthy population.	Prospective comparative study	943 patients undergoing THA/TKA who received psychopharmacological treatment.	90 d AS	[4]
Pharmacologically treated psychiatric disorder is among the medical risky conditions which can be preventable before surgery.	POS	8373 unselected patients undergoing THA/TKA.	90 d AS	[44]
PsD was associated with increased risk of LOS more than 4 days regardless of treatment with SSRIS, other antidepressants or antipsychotics. PsD was associated with increased 30-and 90day surgery-related readmissions, significant for SSRIs, other antidepressants, and antipsychotics. In psychiatric patients, pain (1.4%), postoperative anemia (1.1%), and pulmonary complications (1.1%) were the most frequent causes of LOS > 4. Falls (1.9%) were the most frequent TKA readmissions, and 90d surgery-related mortality was 0.7% with and 0.2% without PsD. Psycho-pharmacologically treated psychiatric disorder is a risk factor for postoperative morbidity after fast-track arthroplasty.	POS	1001 patients affected by Psychiatric Disorders undergoing THA/TKA.	90 d AS	[45]
Patient anxiety was evaluated before surgery (Spielberger State-Trait Anxiety Inventory). Care-givers anxiety was evaluated during the same tool during a scheduled postoperative visit. In male patients, a relationship between caregiver's anxiety and patient's anxiety was positive, although not statistically significant, and in women was neither present nor significant. Anxious male caregivers appear to impart their anxiety to male patients but not to female patients.	POS	118 selected patients aged ≥ 18 undergoing TKA.	From 2w before hospitalization to postoperative clinic visit.	[46]
<ul style="list-style-type: none"> • Not all patients can bear the mental and physical demand of an accelerated pathway. Accurate pre-operative assessment is fundamental before admission. • Psychiatric disorders may not be, in themselves, a reason to exclude patients from accelerated pathways, while psycho-pharmacological treatment could be, due to drugs side-effects. • Along with hypersensitivity and catastrophizing (which we addressed in section 2), anxiety is a particularly widespread phenomenon affecting patients before arthroplasty, despite we believe it to be physiological and non-harmful until it does not affect the outcomes of surgery (which has to be demonstrated). • However, patients generally appreciate a shorter LOS, provided accurate support and education. • Dealing with transition between hospital and home, pain, self-medication and self-rehabilitation are fundamental concerns which emerge during recovery and remain up to 12m after surgery, regardless to sex, comorbidity or LOS. 				

and mental demand. Involving the patient is a fundamental key to compliance and better recovery. The more (and earlier) patients take responsibility for their recovery, the more they are likely to achieve positive outcomes (Table 5).

Conclusions

Which postoperative factors can improve the outcomes of rehabilitation after TKA, in terms of functional recovery and patient satisfaction, how, and for whom? A multimodal analgesic regimen based on LIA; opioid consumption; intensive and early physiotherapy when possible; standard exercise programs based on patient cluster of characteristics and relative recovery curves; post-acute care and discharge planning according to functional, psychological and social criteria; patient motivation; use of psychopharmacological treatment (regardless to a PsD); formal and substantial connection between the institution in which the patient is operated and the institution in which

he is rehabilitated; are postoperative prognostic factors which play a major impact on the effectiveness of rehabilitation after fast-track TKA.

Outcomes themselves, however, must be cautiously considered, for many subjective psychosocial variables may positively or negatively bias an objective evaluation. Since the purpose of JA is to improve function and quality of life when conservative treatment of osteoarticular pain is not effective [47], this is not a reason to neglect the former (i.e. patient-related outcomes), but rather to establish an equally rigorous set of indicators.

On these grounds, clinical and functional outcomes are not the only factors that have to be considered. Social, psychological, cognitive and logistical aspects are fundamental to turn theoretical benefits (efficacy) into real (effectiveness), in order to improve patient education, compliance and ability to cope with rehabilitation. These arrangements are better to be defined since before the surgery.

Future research should therefore identify recovery curves to predict, track and understand specific outcomes to specific cohorts (or clusters) of patients, in order to refer them to the most suitable rehabilitative modality (i.e. intensity and frequency) and setting (i.e. outpatient, domiciliary, day-hospital). Despite early and tailored exercise are known to benefit the recovery of patients, we need more specific evidence about how long and how intensive should be the intervention after surgery and discharge.

Out of the 43 papers included in the synthesis, 22 were Observational Studies (either POS or ROS), 9 were Qualitative Studies, 7 were RCTs, 4 were Reviews and 1 was a Google Search. The degree of evidence can therefore be affected by the high variability in the methodological approaches adopted between the studies, which can be a limitation of the present study. However, this is consistent with the goal of a scoping review, which is to summarize and update evidence in support of more detailed research and clinical trial.

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