Rehabilitative Care Alliance

Rehabilitative Care Best Practices for Patients with Hip & Knee Replacement

Updated April 2026
(2025, 2022, 2019, 2017)

Table of Contents

Background and Introduction 3
Purpose and Intent of Framework 3
Purpose 3
Intent 4
Development and Update of the Framework 4
The Framework 4
Best Practice Recommendations 5
Considerations 5
Equitable & Culturally Appropriate Care 5
Conservative Management 6
Location of TJR Rehabilitative Care 7
Figure 1: Referral Decision Tree for Rehabilitative Care 8
Model of TJR Rehabilitative Care 8
Group-Based Rehabilitation 9
Same-Day Discharge (SDD) 9
Virtual Care 10
Total Joint Replacement Process Indicators 11
Conceptual Framework 13
Preoperative Care 14
Rehabilitation in Acute Care / ICHSC 25
Bedded Rehabilitative Care 33
Rehabilitation in Outpatient/Community Clinics 43
In-Home Rehabilitative Care 57
Best Practice References 69

Rehabilitative Care Best Practice Framework for Patients with Hip and Knee Replacement

Background and Introduction

Purpose and Intent of Framework

Purpose

Development of the *Rehabilitative Care Best Practice Framework for Patients with Hip and Knee Replacements* was first undertaken in 2017 by the Rehabilitative Care Alliance (RCA) to support implementation of the Total Joint Replacement (TJR) Quality Based Procedure (QBP), and the TJR QBP Clinical Handbook, developed by Ontario Health Quality (OHQ – previously Health Quality Ontario).

OHQ has developed Clinical Handbooks for a number of conditions, including total joint replacements, "to serve as a compendium of the evidence-based rationale and clinical consensus driving the development of the policy framework and implementation approach for patients with specific conditions seen in hospitals."[1] The Total Hip and Knee Replacement handbook includes high level recommendations for postoperative rehabilitative care; however, the extent to which these recommendations can be operationalized across locations of care is limited. The *Rehabilitative Care Best Practice Framework for Patients with Hip and Knee Replacements* meets this need by identifying standardized rehabilitative care best practices, where not already defined in the TJR QBP Clinical Handbook.

In 2018/19, the Ministry of Health implemented "bundled care" for select patient populations with the intent of improving acute/post-acute care coordination and efficiency. To guide provincial implementation of bundled care for patients following simultaneous bilateral hip and knee replacement, the Rehab Care Alliance and Ontario Health Quality worked in collaboration with a provincial subject matter expert group to develop recommendations and update the *Rehabilitative Care Best Practice Framework for Patients with Hip and Knee Replacements* to also include specific consideration of patients with simultaneous bilateral hip and knee replacements.

In 2021/22, as Ontario implemented strategies in keeping with pandemic recovery planning, the RCA recognized that best practice support was needed for new and emerging models of care, given the stricter infection prevention and control measures. In 2025, the framework was updated to include the Same-Day Discharge model of care as well as the latest research on best practices related to rehabilitative care for hip and knee replacement.

Intent

The Rehabilitative Care Best Practice Framework for Patients with elective Hip and Knee Replacements (the Framework) is intended to:

- Influence best practice across the province;
- Provide a basis for informing and improving quality care for this population; and
- Provide a framework to support an approach to capacity planning that not only considers surgical allocations but also rehabilitative care allocations, and the optimal models/locations of rehabilitative care.

To make this framework as practical as possible, readers may review the sections that align with their area of practice. While the full document provides comprehensive guidance, each section is written to stand on its own for ease of use.

Development and Update of the Framework

The Framework was originally developed by the TJR QBP Task and Advisory Groups of the RCA for primary unilateral total joint replacement. These provincial groups consisted of partners with clinical and system level expertise, including representatives from surgical and acute care services, bedded rehabilitative care programs, community physiotherapy clinics, private rehab clinics, regional home and community care services, and the Ontario Association of Community Care Access Centres.

With the Ministry of Health launching the bundled care funding model in 2018/19 for simultaneous bilateral hip and knee replacements, hospitals participating in the new model began to take a close look at their post-acute pathways, pointing to the need for best practice guidance. A group of subject matter experts was therefore convened by the Rehabilitative Care Alliance and Health Quality Ontario, representing organizations across Ontario who perform high numbers of simultaneous bilateral total joint replacements. The RCA-HQO Bilateral TJR Task Group, including orthopaedic surgeons and rehabilitative care professionals, updated the framework to include best practice recommendations for both unilateral and simultaneous bilateral hip and knee replacement.

In 2021/22, the RCA TJR Best Practices Task Group further revised the framework based on an updated literature review, input from subject matter experts, patients & care partners, current data and new models of care. The framework was updated again in 2025 to include the latest research on new surgical models of care (e.g., Same-Day Discharge) and in 2026, the framework was updated based on an extensive literature review of recent rehab models of care.

The Framework

The Framework was originally developed based on existing TJR care pathways and more recently based on moderate to strong evidence (systematic reviews, meta-analyses and randomized controlled trials), which identify best practice recommendations specific to different levels/locations of rehabilitative care. The

Framework includes best practice recommendations for rehab in pre-operative care, acute care, bedded, outpatient/community clinics and in-home rehabilitation.

For simultaneous bilateral hip and knee replacement, it was noted in 2019 that there was wide variation in where and how rehabilitative care was provided, i.e., inpatient rehabilitation versus outpatient rehabilitation or in-home services. Given that the available clinical evidence was relatively sparse for bilateral joint replacement, rehabilitative care recommendations were developed based on consensus and informed by available administrative data on current practices in Ontario. The Framework was updated based on these recommendations.

Best Practice Recommendations

The TJR QBP Task and Advisory Groups established guiding principles to inform the identification and development of practice recommendations for inclusion in the framework. The groups agreed that the best practice recommendations would:

- Be patient centered
- Address the rehabilitative care needs for the majority of TJR patients and, where possible, identify considerations for TJR patients with more complex needs
- Be evidenced based whenever possible; in the absence of high-quality evidence, make recommendations based on expert consensus.

In addition to extensive iterative review and endorsement by the TJR QBP Task and Advisory groups, RCA-HQO Bilateral TJR Task Group, TJR Best Practices Task Group and the RCA Patient & Caregiver Advisory Group, the original and updated best practice recommendations included in the framework were validated through consultation by additional external provincial stakeholders. Stakeholders included orthopedic surgeons, clinicians working in rehabilitative programs, and cross-sectoral representatives from regional rehab care committees from across the province.

Considerations

Equitable & Culturally Appropriate Care

All people with hip and knee arthritis requiring conservative and/or surgical management should receive equitable and culturally appropriate care. Equity does not require that everyone receive the same rehabilitative care interventions; it requires fairness and justice in the processes of care and patient outcomes. Differential treatment and resource distribution must be provided to achieve comparable outcomes among all people undergoing TJR.

Redistribution recognizes and addresses barriers to opportunities that could prevent rehab participation and achievement of their rehabilitative care goals.[2] Preoperative screening can be used to identify barriers.[3] Customized care plans should ensure optimal time and amount of rehabilitation are provided, as well as advocacy for patients who need additional care to achieve outcomes. Providers must take care to assess need through measuring patient reported and performance-based function and ensure their provision of rehabilitation matches each patient's needs.[4] This individualized approach to care enables consideration of the social determinants of health unique to a person.[4]

An anti-racism approach is a systematic method of analysis and a proactive course of action that recognizes the existence of racism, including systemic racism, and actively seeks to identify, reduce and remove the racially inequitable outcomes and power imbalance between groups and the structures that sustain these inequities.[4] Action is needed to respond to embedded historical and current injustices through an anti-oppressive approach, by proactively understanding the role that health and other systems may play in marginalization (in the past and today). Example actions include training to learn about specifics of engaging with a particular marginalized population and commitment to internalizing lessons learned.[4]

Rehabilitative care should use an inclusive and affirming approach, advocate for equitable access, and be conducted in a culturally appropriate, inclusive environment.[4–6] Inclusion recognizes and embraces diversity. Diversity refers to the visible and invisible qualities, experiences and identities that shape a person's individuality, uniqueness and how they are perceived. Dimensions of diversity include race, ethnicity, gender, gender identity, sexual orientation, socioeconomic status, age, physical or mental abilities, religious or spiritual beliefs, and political ideology.[4]

Rehabilitative care should consider the intersecting experiences of marginalization and the needs of the whole person. For example, a Black gay man may face racism inside the LGBTQ2S (Lesbian, Gay, Bisexual, Transgender, Queer and Two-Spirit) community and homophobia in the Black community.[5]

Conservative Management

Although this framework does not provide detailed guidance on conservative management of hip and knee arthritis, it should be noted that an initial clinical assessment for diagnosis to inform the care plan should be initiated in primary care. This care plan should include first-line treatments such as patient education, self-management, therapeutic exercise, physical activity and weight management.[7] Referrals to health care professionals with expertise in arthritis management should also be considered for a comprehensive assessment and management plan, including pharmacological symptom management.[7] Aligned with the international guidelines for the management of hip and knee osteoarthritis, GLA:D™ is one example of an evidence-based conservative management program.[8] For conservative management rehab resources, please visit: https://rehabcarealliance.ca/conservative-management-tjr.

Location of TJR Rehabilitative Care

To support alignment with provincial directions for rehabilitative care, the RCA's Referral Decision Tree was adapted to serve as a decision-making tool regarding the optimal location of rehabilitative care for patients following primary unilateral or simultaneous bilateral hip and knee replacement.

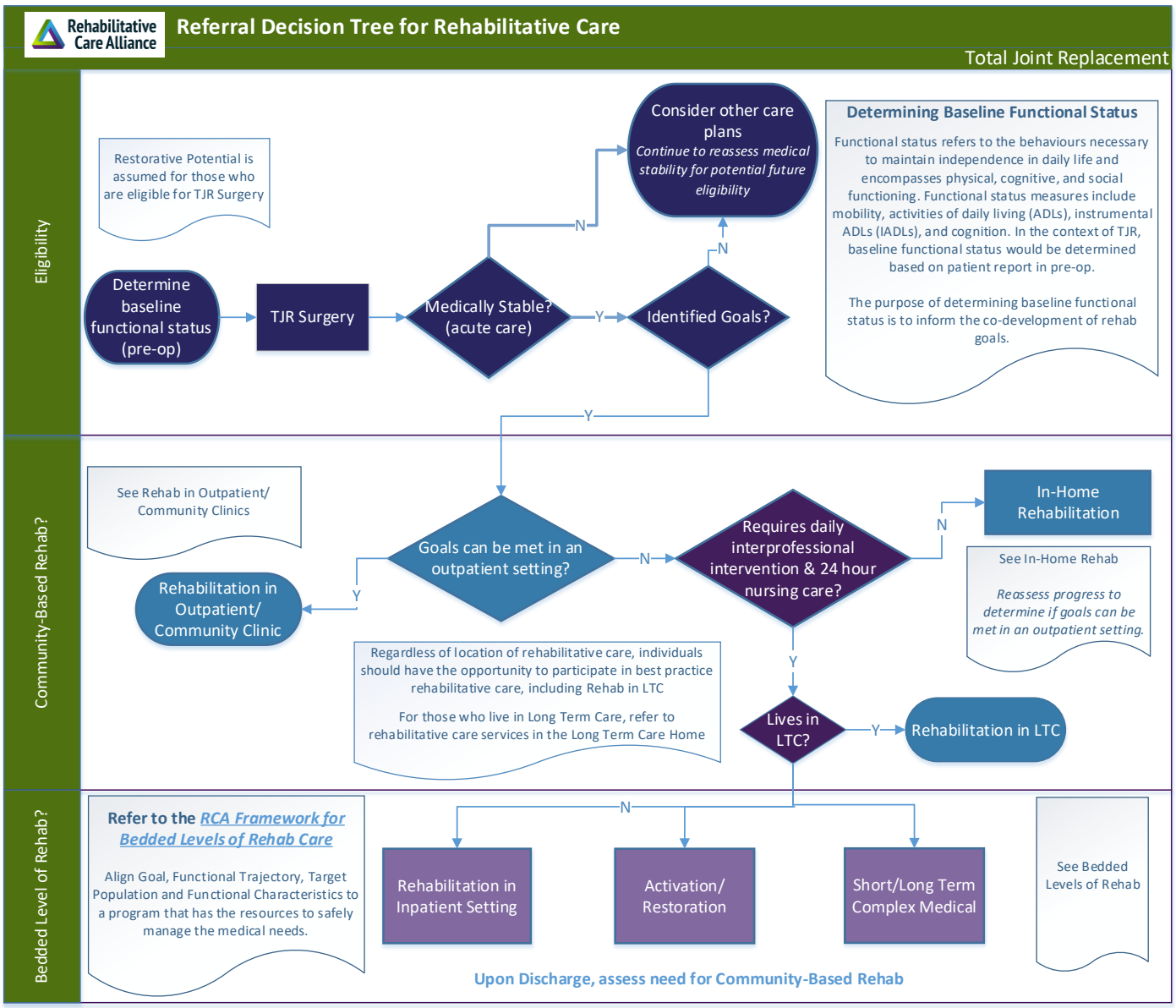
Recommendations related to the optimal location of TJR rehab for both primary unilateral and simultaneous bilateral TJR should be implemented in consideration of the following recommendations from the TJR QBP Clinical Handbook[1]:

- *The health system should support a move towards community-based rehabilitation following primary total knee or hip replacement and discharge from acute care*.[9]
- *Inpatient rehabilitation should be restricted to patients who meet specific eligibility criteria, and eligibility criteria for inpatient rehabilitation should be standardized*[10], and
- *The location of rehabilitation within the community should allow for flexibility, depending on the local care context and patients' needs*.[10]

The provision of community-based TJR rehabilitation should also be considered within the context of current Ministry of Health (MOH) policy. Please refer to current MOH policy documents for guidance related to reimbursement and contracting.

For clients/patients receiving in-home rehabilitative care, progress should be monitored, and patients regularly reassessed to determine whether their functional goals can be met in an outpatient/community setting outside of the home.

Figure 1: Referral Decision Tree for Rehabilitative Care



Model of TJR Rehabilitative Care

Wherever rehabilitative care is provided, the best practices identified in the framework should be provided by regulated health professionals, who work with patients to progress them towards self-management of their own health and ongoing rehabilitation.

Recommendations for both 1:1 and individualized group-based rehabilitation are included in the framework. Evidence indicates that both 1:1 and individualized group-based therapy can be beneficial, and that the model of rehabilitative care should be based on best practice, as well as availability, access, and patient need.

As Health Service Providers (HSPs) continue to implement best practices and re-engineer clinical processes to improve patient outcomes, innovative TJR models of care will continue to evolve, as is the intention of evidence-informed bundled care for these populations.[1]

As indicated in the Clinical Handbook, practice changes and innovative models of care should be implemented, *"together with the adoption of evidence-informed practices*", in an effort to "*improve the overall patient experience and clinical outcomes"*, in addition to reducing costs in order to "*create a sustainable model for health care delivery*".[1]

Group-Based Rehabilitation

Research indicates that outpatient group-based therapy can produce statistically and clinically significant improvements in function following TJR; and for most patients, group-based therapy yields similar outcomes as 1:1 therapy.[11,12] For patients with simultaneous bilateral TJR, smaller group sizes or 1:1 rehabilitative care may need to be considered. Patients in group-based therapy programs report high levels of satisfaction with their treatment, as group-based/congregate therapy allows patients recovering from similar procedures to participate in rehabilitation within a social and supportive environment.[13,14]

Where clinically appropriate and feasible, group-based rehabilitation (in-person and/or virtual) following TJR is recommended (following any infection control and prevention protocols that may apply). Expert consensus and patient satisfaction reports suggested that small groups were best (with 1 provider per 3-4 patient ratio).[15,16] However, one on one therapy is also effective where group-based therapy is less feasible due to lower patient volumes.

Same-Day Discharge (SDD)

In recent years, advances in surgical and anaesthetic techniques such as minimally invasive surgical approaches have resulted in a significant increase in the annual rates of same-day discharge following total hip and knee replacement.[17] Important prognostic factors of success include: younger age (i.e., typically less than 75 years old although not a hard and fast rule), cardiovascular status with fewer co-morbid conditions and support at home.[18] The preoperative assessment and education with the patient by the physiotherapist/occupational therapist in conjunction with other team members (along with other considerations such as the anaesthesia assessment) serve to inform the decision-making as to who would be appropriate for the SDD model. Protocols, developed to ensure patient safety, include screening of candidates pre-operatively for mobility, social support and cognitive appropriateness. Protocols for same-day discharge focus on the common theme of safety for discharge, early mobilization and physiotherapy assessment[19,20], safe mobility and prophylactic therapies for pain and nausea. The physiotherapist role is key. One of the most common reasons for delayed discharge for Total Knee Arthroplasty is a delay in review by a physiotherapist or access to rehabilitation service.[21] Early mobilization decreases hospital length of stay (LOS) and postoperative complications.[20]

Immediate post-discharge supports may include postoperative home visits and/or virtual supports such as telephone call follow up or remote monitoring via web-based platforms (e.g., apps).[22] A 2024 study of 171 patients undergoing SDD Total Knee Arthroplasty randomly assigned 76 patients to electronic remote patient monitoring (ERPM) and remote postoperative physiotherapy (RPT). At the same time, 95 patients were randomized to ERPM and formal, supervised outpatient therapy (OPT). The study found equivalent outcomes in both groups. Patients in the ERPM + RPT group also had considerable cost and time savings.[23] Other benefits of this approach include providing a consistent rehabilitation schedule based on predetermined functional recovery milestones; using automated tracking and alerts tied to defined recovery milestones; ensuring a more standardized and closely monitored approach to rehabilitation; and time and cost savings.[23]

Regardless of length of hospital stay, all patients who undergo TJR benefit from the same community-based rehabilitation models of care. Patient satisfaction with SDD is generally rated as high and the procedures are cost-effective.[24,25] A prospective, cohort study of 79 patients found that most patients believed SDD sped up their postoperative rehabilitation (65.8% of patients), had a better or much better experience than they expected (70.8% of patients), and nearly 90% reported that they would prefer to have SDD surgery in the future.[26]

Virtual Care

Virtual care is defined as "any interaction between patients and/or members of their circle of care, occurring remotely, using any forms of communication or information technology with the aim of facilitating or maximizing the quality and effectiveness of patient care."[27] Virtual care may be considered as a potential strategy to provide TJR rehabilitative care and evidence shows that it is as effective as face-to-face intervention for patients who have been assessed as able to benefit.[28–48] However, virtual care is not appropriate for all rehabilitative care needs and should therefore be utilized at the recommendation of the regulated rehabilitative care professional in consultation with the patient and care partner, and based on the needs, preferences and abilities of the patient. Patient engagement in virtual care is associated with their education level, cohabitation status, age, type of surgery, presence of comorbidities and sense of self-efficacy.[49]

Virtual care can be utilized for various aspects of patient care, including the patient interview, physical assessment and diagnosis, treatment, maintenance activities, consultation, education and training. Virtual care is more than video or phone visits. It includes digital supports for self-care, online education and self-management tools, provider-to-provider and provider-to patient supports via messaging, email, text, apps, etc. and remote sensor monitoring before and after surgery. Hybrid rehabilitative care models which include both in-person and virtual care may also be considered (e.g., virtual assessment with in-person follow up, if required).[27,39,50–55] Virtual care may also foster positive psychological experiences for patients, improve adherence to rehabilitation care plans and can reduce the influence of social and economic factors.[56] Commercially available activity monitoring wearables and smartphone apps have the potential to engage patients as advocates in their personalized care, offer health care providers objective assessments of their patients' daily activity patterns and provide real-time feedback to patients, which can be a motivator.[57–60]

The following factors should be considered when considering virtual care delivery of rehabilitation interventions[61–64]:

- Care partner involvement and availability
- Access to technology and internet and other practical limitations (e.g., communication abilities)
- Potential safety issues. Engage and train care partners to provide assistance regarding the safety of tasks during intervention and/or technical support
- Impact of language barriers, hearing and/or visual impairment on their patient's ability to participate
- Cognitive ability and how it may impact their patient's safety, the ability to complete a self-directed program and to follow the carry-over advice that is provided
- Privacy and confidentiality issues. Patients may be at home with many other people or in a virtual group therapy session, which can impact confidentiality. Additional sessions may be required for sensitive issues, e.g., phone call or private in-person visits. Patients may need to sign consent forms and/or paperwork. Additional time for mailing may be needed.
- Need for flexible hours to accommodate the needs of patients and their care partners
- Allow for extra time to build rapport and trust and for potential technical issues

The onset of the COVID-19 pandemic resulted in a rise in the use of virtual rehabilitation. Given the implementation of virtual rehabilitation, the RCA developed Evaluation Considerations for Virtual Rehab. This document provides guidance around outcome indicators that can be considered to evaluate the efficacy and quality of virtual rehabilitation for service delivery.

Total Joint Replacement Process Indicators

To inform identification of indicators to support performance monitoring, the Total Joint Replacement Best Practices Task Group conducted a review of possible indicators. The following four process indicators were identified as key components of care, throughout the pathway, that will optimize rehabilitative care outcomes following TJR:

1) Processes are in place for pre-operative education, treatment (as applicable) and plan for postoperative rehabilitative care
    a. % of hospitals that perform TJR surgery that have standardized processes in place to provide pre-operative:
        i. Education
        ii. Treatment, as applicable
        iii. Plan for postoperative rehabilitative care
2) Outcome measures are utilized
    a. % of hospitals that perform TJR surgery that utilize clinical outcome measures
    b. % of hospitals that perform TJR surgery that have a centralized method for reporting and analysis of clinical outcome measures

3) In partnership with clients, a postoperative rehabilitative care plan is prepared and in place prior to discharge
    a. % of hospitals that perform TJR surgery that have standardized processes in place to:
        i. plan for postoperative rehabilitative care
        ii. engage clients and care partners as part of this discharge planning process

4) Patients receive timely access to rehabilitative care post-acute care discharge
    a. % of patients who receive rehabilitative care in outpatient/community clinic following TKR within 7 days of discharge from Acute Care
    b. % of patients who receive rehabilitative care in outpatient/community clinic following THR within 4 weeks post discharge from Acute Care
    c. % of patients who receive In-Home rehabilitative care following TKR within 7 days of discharge from Acute Care
    d. % of patients who receive In-Home rehabilitative care following THR within 7 days of discharge from Acute Care

	Rehabilitative Care Best Practices for Patients with Hip and Knee Replacements Conceptual Framework				
Processes of Care	***Pre-Operative Care***	***Rehabilitation in Acute Care / ICHSCs****	***Bedded Rehabilitative Care***	***Rehabilitation in Outpatient/ Community Clinics***	***In-home Rehabilitative Care***
Patient & Care Partner Engagement					
Screening					
Assessment					
Treatment/Interventions • **Individual (1:1) and Individualized Group-based Interventions** • ***Functional Training** (e.g. ADLs & Mobility)*					
Pain					
Transition Care Planning					
Clinical Outcome Measures					

**Integrated Community Health Services Centres – In addition to total joint replacement surgery, ICHSCs are responsible for providing pre- and post-operative elements of orthopedic services to their patients at no additional cost to the patient, including ensuring appropriate post-operative rehabilitation care for all patients. (Call for ICHSC Applications, 2025)*

These best practice recommendations are applicable to both primary unilateral and simultaneous bilateral Total Joint Replacement (TJR) populations regardless of whether patients underwent Same-Day Discharge (SDD) except where specified. Additional special considerations for SDD are specifically identified as such.

Preoperative Care

For Preoperative Care TJR Rehab Resources, please visit: https://rehabcarealliance.ca/preoperative-care-tjr

An approach of trust, respect and accommodation should be recognized as essential to the provision of equitable and culturally appropriate rehabilitative care.

- Rehabilitative care providers must ensure a safe, inclusive space to provide rehabilitative care with consideration for the patient's intersecting identities, health beliefs, practices and values.[5,65]
- Rehabilitative care providers must use culturally appropriate language and a person-centred, history-taking approach, such as asking open-ended questions and ensuring privacy and confidentiality during interactions with all patients and care partners.[5,65]
- Rehabilitative care providers must learn about the health beliefs, practices and values of the cultural groups they serve and develop culturally responsive knowledge, skills and attitudes.[65]

Patient & Care Partner Engagement/Education

Education must be provided through a number of media (e.g., videos, information booklets, structured education sessions, written, audiovisual, and digital) and include the opportunity for patients and care partners to ask questions and to access materials according to their needs.[66] [67] Patient education materials should be developed using plain language as a key strategy for improving health literacy and be compliant with the Accessibility for Ontarians with Disabilities Act (AODA)[68] requirements for accessibility.

- Patients and families benefit from education on how to participate in a successful recovery and patients themselves have indicated that they wish to receive preoperative information [69]**.** It is therefore important to include patients and care partners in the circle of care communication and care planning.
- Designated care partners who provide care to maintain the patient's mental and physical health and who advocate on the person's behalf must be considered essential to rehabilitation and transition care planning and should be allowed to remain with the patient and participate as part of the circle of care.
- Providing quality health information (accurate, accessible, and actionable) enables patients to better manage their health and wellbeing, make fully informed decisions about their treatment and care,[66] and have clear rehabilitation goals and expectations for the recovery process.[70]
    - Structured preoperative (and postoperative) education can address the knowledge gaps that patients have about the procedure, complications, postoperative precautions and self-care activities,[71] and lower perioperative anxiety, reduce postoperative pain and enhance functional recovery.[72]
    - Well-designed written (printed or digital) patient education materials can significantly reduce preoperative anxiety and improve patient preparedness.[73]
    - Preoperative education and training may help patients by reducing the fear of pain and improving the awareness of rehabilitation's importance and finding appropriate strategies to maintain effective exercise intensity after TKR.[74]
    - Educational content should integrate pain management and mobility/exercise support, ideally delivered through multimodal formats.[67]

- Participation in preoperative education (as well as baseline health and patient-specific factors) can significantly influence long-term functional and quality-of-life outcomes after hip and knee arthroplasty. [75]
    - Significant predictors of better 1-year Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) and EQ-5D-5L scores include participation in a preoperative patient education session. Other predictive factors include younger age; higher preoperative EQ-5D-5L index; lower clinical complexity level; lower preoperative WOMAC score; and undergoing total hip arthroplasty (THR) vs. total knee arthroplasty (TKR).[75]
    - Attending a preoperative educational class can result in statistically significant differences in the LOS and postoperative physiotherapy (PT) outcomes in patients compared with those who did not attend as measured by ambulation distance, degrees of knee flexion, and degrees of hip flexion. [76]
- Preoperative uncertainty can lead to preoperative anxiety, which can negatively affect postoperative recovery.[77]
    - Receiving education about the surgery and pre- and post-surgical care, home preparation and other factors has been shown to reduce anxiety.[78]
    - Anxiety and depression can negatively affect mental and physical recovery after joint arthroplasty, positively correlate with acute pain measures, and be associated with the patient's subjective unreadiness to be discharged and a higher LOS. A structured PT education session can have a significant effect on postoperative anxiety, function, walking, pain, patient satisfaction, and home discharge destination.[77]
- SDD Consideration:
    - Given the shortened length of stay for patients receiving outpatient (SDD) arthroplasty, once a patient is deemed medically appropriate for SDD, the most important step is patient education.[79,80] A preoperative education class establishes patient expectations for the day of surgery and postoperatively; provides the opportunity for questions to be addressed; and decreases anxiety.[79,8020] These in-person education programs have been shown to decrease length of stay by a full day, and have also decreased patient anxiety and pain.[79]
- The use of IT devices (e.g., apps, smartwatches, automated text messaging) can significantly enhance the effectiveness of educational interventions.[67]
- Education that does not rely on reading materials for self-orientation but relies on a multidisciplinary approach using standardized lectures can also have a positive impact on functional outcomes, improving range of motion and walk ability in patients undergoing TKR.[81]
    - An example of one such approach, used 2 weeks before surgery during office consultation, included scheduled sessions of lectures delivered by an orthopaedic surgeon, a nurse and a physiotherapist concerning pre- and postoperative care, pain management, rehabilitation exercises to gain range of motion, the basic steps of the surgical procedure and the importance of walking with a walker. Patients were invited to attend a collective oral session, which included a standardized sequence of slides and images regarding the preoperative preparation, the procedure itself and the rehabilitation with a 15-min lecture delivered by a nurse, a 15-minute lecture delivered by a physiotherapist and a 15 minute lecture delivered by an orthopaedic surgeon, followed by additional time for patients to ask questions. Patients were also provided a phone contact number in case they had further questions.[81]
- Information should be paced to avoid overload during the preoperative and in-patient stages. Use of technology such as an app on their mobile phone, tablet etc. could support patients to revisit information at their own convenience and time of need.[82]
- Encourage patient's family/support persons to attend information sessions and become familiar with educational materials and role in recovery (driving, transportation plan including rides, public transit and potential for disabled parking permits, ADLs and accessing additional resources).

Discuss with patients all aspects of their rehabilitative care, including: responsibility to participate in their recovery, expected length of stay, joint protection, pain management, assistive devices and equipment, preparing for post-surgical recovery and health promotion.

- All patients need to be made aware of their responsibility to participate in their recovery. This includes participation in rehabilitation and exercise in the hospital and after discharge.[66]
- Discuss with patients all aspects of their rehabilitative care. The content of these discussion may include:[83]
  - Expected length of stay
    - SDD Consideration: Patients are informed of the expectation of same-day discharge.[80,84]
  - Precautions and joint protection postoperatively, energy conservation and pain management techniques.[85]
    - Pain has been shown to be the highest ranked area of concern for patients undergoing a TKR[86]
  - Information on assistive devices to support independence with ADLs, and home set-up.[85]
    - These may include: Raised toilet seat, bath seat/chair/bench, grab bars, non-slip surfaces, raised cushion, reachers, elastic shoe-laces, long handled scrub brush, long handled shoe horn, installation of handrails[66]
  - Discussing the importance of procuring the equipment recommended, preparing the home, and arranging for help with meal planning/preparation
  - Exercise, functional activities, ADLs (toileting, dressing, bathing, car transfers, homemaking, bed transfers, stairs)[66] [86]
  - Increased functional endurance and return to work/sports[66], specific movements (e.g., kneeling), use of walking aids, range of motion, sexual activity, psychological well-being, and medical complications.[85] [86]
  - Medical complications and when to seek medical attention[86]
  - Contact information for patients in the event that they have any follow-up questions.[66]
- Many patients who present as candidates for hip or knee replacement surgery present with lifestyle factors that influence outcomes such as obesity, lack of exercise and smoking. Many patients do not increase physical activity post-surgery, highlighting the need for behavioral interventions and educating patients about the benefits of physical activity and the risks of sedentary behavior.[87] These may be addressed through education focused on health promotion, disease prevention and lifestyle changes[66]; consider making referral to appropriate, available community resources.

Screening

Screen preoperatively to predict patients' postoperative discharge needs and inform proactive discharge planning.

- List of common elements[88,89]:
  1. Age
  2. Gender
  3. Mobility/Functional Status including strength and stability
  4. Community Supports
  5. Assistance at Home/Home Environment
  6. Type & Number of Active Medical Issues/Comorbidities
  7. Patient Safety

8. Baseline Cognition & Insight
9. Body Mass Index (BMI)
10. Tobacco Use
11. Planned weight-bearing status
12. Post-operative precautions

- Screen to identify:
  1. Potential post-op and/or discharge issues.
  2. If the patient would benefit from a preoperative in-home provider visit by a Physiotherapist (PT) or Occupational Therapist (PT) to assess the home environment.
- Screening for pain catastrophizing and providing targeted interventions can mitigate risks of poor postoperative recovery.[90]

Assessment

Assessment by a regulated rehabilitative care professional with knowledge and clinical experience in arthritis and TJR surgery should include: baseline functional status, functional tolerance, discharge transition needs, equipment needs post-surgery, cognitive status, coping skills and social supports. The assessment informs the co-development of rehab goals with the patient and care partner(s). (Please see note on page 68.)

- Baseline functional status should be determined based on patient and care partner report. Functional status refers to the behaviours necessary to maintain independence in daily life and encompasses physical, cognitive, and social functioning. Functional status measures include mobility, activities of daily living (ADLs), instrumental ADLs (IADLs), and cognition.[91] The purpose of determining baseline functional status is to inform the co-development of rehab goals.
- A patient's functional tolerance at the time of initial consult will assist in defining their level of disability and urgency rating.[66]
- Functional ability may be measured through self-administered questionnaires and/or through functional testing using valid outcome measures. Examples of these measures are provided in the "Clinical Outcomes" section.[66]
- Complete assessment to confirm the discharge destination of the patient post-surgery (i.e., home care, outpatient rehab, bedded rehab).[83]
  - (e.g., Discharge Triage Considerations for Patients Following Elective Hip/Knee Replacement)
  - Alignment with eligibility criteria for in-home care.
  - Consider the use of a discharge planning and risk assessment tool. For example: The Risk Assessment and Prediction Tool (RAPT)[92]
- Complete Physiotherapy or Occupational Therapy Assessment for equipment needs post-surgery. [83]
- Conducting an in-home, procedure-specific, peri-operative PT assessment approximately one month prior to surgery with patients undergoing TJR and their caregivers can help support earlier discharge to home.[75] The evaluation can include a standard PT assessment as well as an assessment of the home environment, including removal of fall hazards, evaluation for appropriate assistive devices for the patient and the home, instruction on the correct use of these devices, and stair and transfer training. All patients can be instructed on a preoperative home exercise program and, if needed, referred to preoperative outpatient PT.[93]

- SDD Considerations:
  - A preoperative physiotherapy session can help the transition back to home by giving instruction and demonstration for performing basic mobility tasks.[79]
  - A phone call/notification on the day before surgery to review arrival time to the hospital and what the patient can anticipate on the day of surgery. This helps to ensure patients arrive on time and provides another opportunity for the patient to ask questions. Patients have reported that they found this call to be reassuring and helpful in preparing them for surgery.[80]
  - While virtual means for notification are helpful, they may not be appropriate for all patients given the needs, preferences and abilities of the patient.
- Review and document goal setting and expectations.
- Evaluate cognitive status as indicated.
- Complete a home environment questionnaire.
- Complete the hospital specific preoperative outcome measure to establish the benchmark for patient progress and achievement of functional outcomes.
- A variety of contextual factors including a patient's coping skills, self-efficacy, anxiety, and social support are associated with perceived well-being and satisfaction after TJR surgery and therefore should be identified and addressed in the preoperative period.[94]

Treatment/Interventions

Tailored, patient-specific multi-modal prehabilitation, including range of motion, resistance, balance and endurance training, stretching, cognitive-behavioural interventions and functional training (e.g., ADLs and mobility), is recommended for both total knee (TKR) and total hip replacement (THR), particularly for older adults. Interventions may be individual (1:1) and individualized group-based.

- Previous evidence did not support preoperative physiotherapy as essential and patients who are physically active preoperatively may not benefit from prehabilitation programs.[95] However, more recent evidence as noted in the sections that follow for TKR and THR suggests otherwise.
- Structured prehabilitation, particularly with resistance training, has been shown to improve short-term postoperative outcomes for THR and TKR. Short-term outcomes (i.e., ≤ 6 months) for both procedures include improved strength, objective function, quality of life (QOL), and self-reported function. It may also lower the rate of complications for both.[96]
- Demonstration of standardized exercises specific to THR and TKR with a home program of exercises to be continued either at a gym facility or home.[89]
- Patients should stay as active as possible within limits of their pain. When preoperative physiotherapy is utilized, it must be tailored to individual patients until specific functional performance measures and muscle strength are achieved; therefore, consider referral to a preoperative strengthening/range of motion (ROM) exercise program appropriate for joint replacement (E.g., NEMEX-TJR, GLA:D™, community exercise programs)[97–99]
  - NEMEX-TJR stands for NEuroMuscular EXercise for Total Joint Replacement. It is based on principle of neuromuscular training with the "aim of improving sensorimotor control and achieving compensatory functional stability"[98]

- GLA:D™ consists of two patient education sessions and 12 neuromuscular exercise therapy sessions. All sessions are group-based and supervised by a GLA:D™ certified clinician with expertise in osteoarthritis and exercise therapy.[99]

- Following surgery, patients will require one or more walking aids to assist with ambulation. These may include a walker, crutches or a cane. Acquisition of these items should be arranged prior to surgery.[83]
- Fitting of the walking aid(s) by a health professional helps to ensure the correct dimensions for the patient, and to ensure the patient demonstrates safe use as appropriate.[66] Document the details of information provided to the client regarding assistive devices, needed equipment, and home modifications.

Total Knee Replacement

- Tailoring patient-specific interventions and employing more than one delivery format (home program, outpatient therapy, aquatherapy, etc.) appear to be valuable design elements for most preoperative TKR intervention types.[100] It has been found to be associated with improved outcomes for education interventions, exercise interventions, a combined diet and exercise intervention, and a Neuromuscular Electrical Stimulation (NMES) intervention.[101]
- Prehabilitation for TKR patients improves outcomes:
  - It significantly improves function (e.g., knee flexion, faster Timed Up and Go (TUG) test times, higher Knee Injury and Osteoarthritis Outcome Score (KOOS) score for Quality of Life & Sports/Recreation), and can shorten length of stay.[102] **103 104,105 106**
  - It effectively alleviates postoperative pain and partially enhances knee function (i.e., knee extension at 1 month and knee flexion at 3 months postoperatively) in the early postoperative period.[107]
  - High intensity prehabilitation provided by a PT to patients undergoing TKR demonstrates improved various functional and patient-reported outcomes, including walking capacity, quadriceps strength, range of motion, and quality of life measures. It also was found to reduce pain levels, significantly increase lower limb muscle strength, and enhance performance in functional tasks.[108,109 110] Short-term, high-intensity preoperative resistance training has been shown to have a long-lasting impact on muscle strength, even 12 months post-surgery.[110]
  - Structured prehabilitation with resistance training improves ROM and can reduce length of stay.[96]
- Prehabilitation provided by a PT can play a critical role in improving outcomes for patients with high pain catastrophizing undergoing TKR. Patients who receive physiotherapy can benefit in several ways: improved physical function, mood, and pain understanding; develop adaptive coping strategies; foster a sense of self-efficacy and empowerment; actively engage in rehabilitation and continue to use learned techniques post-surgery.[90,111] (Please see note on page 68.)
- A short-duration (3-week) prehabilitation program for patients undergoing TKR that consists of thrice-weekly, 90-minute rehabilitation and includes body weight exercises, resistance training, cycle ergometer workouts, and stretching can reduce postoperative pain and preserve physical activity levels, which are critical for recovery and long-term outcomes.[112]
- Preoperative physical conditioning, especially for patients with poor mobility, is important. For patients undergoing TKR who are unable to tolerate land-based exercise due to pain or stiffness, aquatic exercise offers a low-impact, accessible alternative. An aquatic exercise program (e.g., 60-minute water-based exercise sessions, 3 times per week for 4-8 weeks) can improve not only physical function but also mental health and cognition pre-surgery, which are critical for recovery and quality of life post-TKR. [113]
- SDD Consideration:

- OT-led cognitive-behavioral interventions significantly improve patient outcomes in TKR by reducing pain, anxiety, opioid use, and improving functional recovery and facilitates same-day discharge.[114]

- For older adults with frailty awaiting joint replacement, a multimodal prehabilitation program (e.g., tailored physical exercise, protein and vitamin D supplementation, and a medication review) is feasible, fosters strong retention and adherence to program components. It has the potential for improved postoperative outcomes, particularly for patients with knee replacements, with indications of enhanced pain management, reduced frailty, and better quality of life.[115]
- For older patients (i.e., 65 and older) undergoing TKR, 6 weeks of preoperative balance training, either as an adjunct to conventional rehabilitation or different from conventional rehabilitation, appears to be a potentially effective intervention for enhancing the patients' knee joint function, isometric knee flexion, knee extension, knee society score (KSS), stair test, and timed up and go. Rehabilitation programs highly emphasizing balance training significantly enhance the walking ability, balance specificity, and functional indicators of elderly patients post-TKR. [116]
- A 2022 study demonstrated that a six-week high intensity preoperative physiotherapy training program supervised by a physiotherapist before TKR is efficacious for quadricep muscle strength, decreasing knee pain, improving knee function, and enhancing daily living activities in patients with severe knee osteoarthritis**.** The 6-week program consisted of a 60-minute session as follows: [117]
  - A 10-minute aerobic warm-up using a treadmill or a stationary bike, followed by a circuit of bilateral lower body exercises (standing calf raise, seated leg press, leg curl, knee extension, knee flexion, and hip abduction) on standard strength training machines.
  - Three sets of eight repetitions of each exercise performed with a rest length of two minutes between sets and exercises.
  - All exercises started at 60% of their one-repetition maximum and increased gradually by increments of 1-2 kg per week, as tolerated, over the course of the six-week intervention. The load was to be increased only in case more repetitions than prescribed could be made.
  - All sessions concluded with two minutes of stretching exercises for knee extensors, knee flexors, and ankle plantar flexors.
- Patients who underwent a 5-day preoperative training session before TKR led by a PT resulted in improved recovery (higher Knee Score, lower postoperative pain, better range of motion and increased knee stability). The training sessions consisted of a 10-minute warmup, inner range quadriceps, heel slides, isometric quadriceps, ankle pumps and straight leg raises. [74]
- For patients undergoing TKR, early initiation of cryotherapy treatment – with application times beginning before surgery and applied up to 12 weeks post-surgery – contributes to functional recovery, avoids complications caused by prolonged immobility, and increases joint range of motion and muscle strength.[74]

Total Hip Replacement:

- Prehabilitation improves patient outcomes and decreases length of stay.[118]
- The focus of prehabilitation, according to expert consensus using the Delphi technique, is to maintain bronchial hygiene, range of motion and strength of uninvolved limbs; identify risk factors early and address the same risk factors postoperatively; provide patient education on postoperative rehabilitation; and provide pain coping skills.[119]
- Prehabilitation can improve functionality, strength and pain symptoms up to the time of the operation. In addition, patients undergoing THR who completed exercise-based prehabilitation before their operation have shown significant postoperative improvements compared with no intervention in the following tests: six-minute walk test, Timed Up and Go test, chair-rise test, and stair climbing.[120]

- A combined approach of preoperative and postoperative progressive resistance training yields better and faster improvements in gait, balance, muscle strength, and hip joint function compared to preoperative or postoperative progressive resistance training alone. Targeted muscle training can effectively reverse muscle atrophy on the operated hip with hip muscle strength surpassing baseline levels by approximately three months postoperatively.[121]
- Structured prehabilitation with resistance training can reduce postoperative pain[96] and may enable earlier onset of postoperative functional recovery following THR.[122]
- Prehabilitation (tailored exercise and education) may offer short-term benefits for older patients in gait speed and quality of life before THR surgery, which could be valuable for those facing long wait times.[123]
- For patients undergoing THR, maximal strength training interventions can improve muscle strength more than conventional PT after THR and strength gains persist for up to 6 months.[121,124]

Virtual Care Considerations: There is strong evidence that virtual prehabilitation is effective, feasible and acceptable to patients.[118]

- A home-based training program for patients undergoing TKR guided by online videos and supervision that includes progressive resistance exercises, balance activities, and proprioceptive training can result in significant gains in knee flexor-extensor strength, stair and TUG test performance, and KSS functional scores.[125]
- A digital preoperative physiotherapy program delivered via digital application can be a useful option for remote patients undergoing TKR.[126] An example of a digital prehabilitation PT program that resulted in comparable outcomes as in-person PT (along with postoperative rehab via digital application) is as follows[126]:
    - An initial one-to-one in person pre-op consult with an experienced physiotherapist where patients are given a tablet incorporating a prehabilitation program with an individualized daily exercise regime to be completed via a digital application (e.g., smartphone app).
    - Patients record their compliance and daily pain via the application and all patients have access to the physiotherapist via a direct messaging service 7-days a week.
    - Patients also receive four education packs sent directly to the tablet that addresses the hospital stay, postoperative pain and swelling management, use of walking aids, and how to negotiate an array of difficult daily activities postoperatively.
    - One-week prior to the patient's surgery, the patient participates in a 30-minute video telehealth consultation where the physiotherapist discusses important points about the upcoming surgery, reviews their preoperative exercise technique, and answers any questions that the patient has about their surgery.

  Note: Once discharged home, patients complete a daily, individualized, and progressive rehabilitation exercise program via the digital application on their tablet. Daily pain scores and compliance are recorded. Additionally, twice a week, patients participate in a 30-minute telehealth video consultation where the physiotherapist reviews their pain, swelling, function, daily well-being, as well as monitoring physical outcome measures, such as gait, knee range of motion and functional activities.
- For patients undergoing bilateral TKR, a preoperative telerehabilitation program provided to elderly female patients with end-stage osteoarthritis improved muscle strength, range of motion, and functional outcomes before TKR, which contributed to better functional recovery and better pain scores at 6 weeks after TKR. The telerehabilitation program consisted of 30 min/sessions, 2 times/day, 5 days/week for 3 weeks for a total of 30 sessions before TKR. Each session included warm-up, mobility, flexibility, strength, balance, and cool-down exercises.[127]

Pain

Each person's pain experience will be unique. Patient, physician and team should work together to ensure that pain is manageable. Multimodal pain management education and prehabilitation is recommended, including: sharing expected levels of pain; and pain management techniques, such as medications, cryotherapy and mindfulness meditation.

- Use multimodal pain management education to maximize effect and outcomes.[128] Review Pain management techniques, (i.e., medications, ice) and importance of joint protection.[92,94]
- Prehabilitation provided by a PT can play a critical role in improving outcomes for patients with high pain catastrophizing undergoing TKR. Patients who receive physiotherapy can benefit in several ways: improved physical function, mood, and pain understanding; develop adaptive coping strategies; foster a sense of self-efficacy and empowerment; actively engage in rehabilitation and continue to use learned techniques post-surgery. [90,111] Pain catastrophizing is currently defined as an exaggerated negative mindset during an actual or anticipated painful experience. Pain catastrophizing is related to central sensitization, which is defined as pain enhancement triggered by modulation of the central nervous system.[129]
- Provide resources to patients, including patient and/or family on pain management and what to expect. Patients have expressed the need for more information on expected levels of pain, pain medication usage, management of side effects and guidelines for weaning off the medication.[87]
- For patients undergoing TKR:
    - cryotherapy – with application times beginning from 14 days before surgery to 2 weeks postoperatively may be more suitable for pain relief compared with other alternative treatments to drug therapy.[130]
    - integrating Cognitive Behavioural Therapy (CBT)-based pain education into pre- and postoperative care for TKR patients, particularly in the early recovery phase, has been shown to be effective in reducing pain during activity and pain catastrophizing in the first three months post-op, both of which are critical for rehabilitation success.[131] Preop sessions occurred at: 2 weeks, 1 week and 2-3 days pre-op in the outpatient clinic provided by a PT. (Post-op sessions occur at post-op Day 2, 5-7 days post-op; and 2 weeks post-op). The content of the course included the following[131]:
        - Introduce theoretical knowledge related to pain and that the generation of pain is a complicated process, which is affected by thoughts, feelings, and behaviours
        - Provide training skills for coping with pain, including relaxing behaviour, pleasant imagery, attention shifting, etc.
        - Teach how to apply the learned skills to daily life or challenging activities.
- For patients undergoing TKR or THR, a single, 20-minute Mindfulness of Breath session during a 2-hour, preoperative education program was found to decrease preoperative pain scores.[132] Mindfulness meditation also decreased preoperative pain medication desire relative to cognitive-behavioral pain psychoeducation and increased postoperative physical functioning at 6-week follow-up relative to hypnotic suggestion and cognitive-behavioral pain psychoeducation.[133]
- Mindfulness meditation and hypnotic suggestion can lead to significantly less preoperative pain intensity, pain unpleasantness, and anxiety.[133]

Transition Care Planning

Transition plans must be developed and agreed upon in partnership with the patient, their care partner/s and the health care team involved at each point of transition. A communication liaison (such as a discharge planner or navigator) must be designated as part of the circle of care.

- Patients can be linked to other health optimization programs within the community through formal groups and informal networks (e.g., the Canadian Orthopaedic Foundation's Your Bone and Joint Health, The Arthritis Society, Weight Watchers®, smoking cessation programs, etc.).[66]

- Postoperative rehabilitation needs have been identified and a referral to rehabilitation has been initiated.[83]
- Mechanisms should be in place to communicate the date of the outpatient rehab appointment to the patient and inpatient acute care team; appointment to be confirmed by the inpatient team prior to the patient's discharge from acute care.[83]
- Transportation options for out-patient rehab are discussed and provided to the patient including locally subsidized programs, if available.[83]
- For patients who are expected to receive their rehabilitation services in home due to risk or complexity issues, the interdisciplinary assessment results and care plan (as below) should be shared with the in-home provider, according to patient need/urgency.
- Equipment, home management, home environment plans are discussed and patient's individual plan for care is initiated and discussed as needed.[83]
- Send a referral to an in-home provider for preoperative home assessment for patients identified as being at risk by the screening process.

Clinical Outcome Measures

Based on the needs of the patient in the preoperative care setting, range of motion (ROM), strength, gait speed, pain, Patient Reported Outcome Measures (PROMs) and Clinician Reported Outcome Measures (CROMs - aka Performance Outcome Measures) should be measured.

- PROMs and CROMs serve as valuable and complimentary clinical tools after TKR and THR and should not be used interchangeably. They provide a valid basis for interpreting patients' health outcomes across rehab settings and relying on either alone may lead to incomplete or misleading assessments. The integration of both types of measures facilitates more precise monitoring of progress, timely adjustment of rehabilitation strategies, and improved alignment between patient needs and clinical decision-making.[134]
- Performance Outcome Measure Examples:[66,135]
    - 30 Second Chair Stand Test (30CST)
    - Gait Speed (e.g., 4 Metre Walk Test, 10 Metre Walk Test, 6 Minute Walk Test, 40 Metre Fast-paced Walk Test)
    - Berg Balance Scale
    - Timed Up and Go (TUG)
    - Stair Climb Test
    - Functional Reach Test

It is also recommended that both a generic PROM tool and condition-specific PROM tool be utilized. In alignment with the directions of Ontario Health, the EQ-5D-5L and the Oxford Hip & Knee Score should be implemented as part of a provincial community-rehab data collection and reporting system. (For simultaneous bilateral TJR, complete separate Oxford Hip & Knee Score for each joint.)[136]

- Depending on the patient's needs, additional tools may be required to ensure shared decision making and collaborative goal setting.[137]

- Other Patient Reported Outcome Measures Examples[66,135]
    - Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)
    - Lower Extremity Functional Scale (LEFS)
    - Pain Visual Analogue Scale (VAS)/Numeric Pain Rating Scale (NPRS)
    - Hip Disability and Osteoarthritis Outcome Score (HOOS)/ Knee Injury and Osteoarthritis Outcome Score (KOOS)
    - Patient Specific Functional Scale (PSFS)

Rehabilitation in Acute Care / ICHSC For Rehabilitation in Acute Care TJR Rehab Resources, please visit: https://rehabcarealliance.ca/rehab-in-acute-care-tjr
An approach of trust, respect and accommodation should be recognized as essential to the provision of equitable and culturally appropriate rehabilitative care.
• Rehabilitative care providers must ensure a safe, inclusive space to provide rehabilitative care with consideration for the patient's intersecting identities, health beliefs, practices and values.[5,65] • Rehabilitative care providers must use culturally appropriate language and a person-centred, history-taking approach, such as asking open-ended questions and ensuring privacy and confidentiality during interactions with all patients and care partners.[5,65] • Rehabilitative care providers must learn about the health beliefs, practices and values of the cultural groups they serve and develop culturally responsive knowledge, skills and attitudes.[65]
Patient & Care Partner Engagement/Education
Structured multimodal postoperative education should address the knowledge gaps that patients have about the procedure, complications, postoperative precautions and self-care activities[71] and lower perioperative anxiety, reduce postoperative pain and enhance functional recovery and includes the opportunity for patients and care partner(s) to ask questions and to access materials according to their needs.[72]
• Patients and care partners must be included in the circle of care communication and care planning. • Following TJR, patients have stated that they wished that there was more coherence of care between hospital and home care teams.[138] • Designated care partners who provide care to maintain the patient's mental and physical health and who advocate on the person's behalf must be considered essential to rehabilitation and transition care planning and should be allowed to remain with the patient and participate as part of the circle of care. • As patients have different learning styles, it is recommended that this education be provided through a number of media and that it includes the opportunity for patients and families to ask questions and to access materials according to their needs. [66] • A patient information package is provided to standardize and consolidate information, to facilitate communication for the patient and health care providers, and to foster a sense of patient participation in outcomes achieved. • Providing quality health information (accurate, accessible, and actionable) enables patients to better manage their health and wellbeing, and make fully informed decisions about their treatment and care[66] and have clear rehabilitation goals and expectations for the recovery process.[70] • Providing a Transtheoretical model of health education, beginning on post-op Day 1 for 6 months, improves outcomes in elderly patients post-TKR. The model uses personalized intervention strategies aimed at addressing patients' maladaptive behavior. It seeks to gradually aid patients in altering detrimental behavior and psychological states, establishing appropriate behavior patterns, enhancing

their self-management capabilities, and achieving a positive prognosis. The theory has five distinct stages: the pre-intention stage, the intention stage, the preparation stage, the action stage, and the maintenance stage. It addresses kinesiophobia, a known barrier to rehabilitation, by tailoring education to psychological readiness and behavioral stages.[139]

- All patients need to be made aware of their responsibility to participate in their recovery. This includes participation in rehabilitation and exercise in the hospital and after discharge.[66] Many patients do not increase physical activity post-surgery, highlighting the need for behavioral interventions and educating patients about the benefits of physical activity and the risks of sedentary behavior.[87]
- Patient education materials should be developed using plain language as a key strategy for improving health literacy and be compliant with the Accessibility for Ontarians with Disabilities Act (AODA)[68] requirements for accessibility.
- Information given needs to be paced to avoid overload during the preoperative and in-patient stages. Use of technology such as an app on their mobile phone, tablet etc. could support patients to revisit information at their own convenience and time of need.[82]
- For patients undergoing TKR, providing education to patients and caregivers 1 day before surgery, 24 and 48 hours after the surgery, and at the discharge point that includes familiarization with knee joint replacement surgery, pre/postoperative care, mobility and exercise, and home preparation can be effective in reducing anxiety in patients undergoing TKR.[140]
- Integrating self-efficacy-enhancing interventions and early, structured, and sustained support into routine post-THR care improves rehabilitation outcomes. For example, providing one in-person education session before discharge; four health-coaching telephone follow up calls within 6 months post op (i.e., patients report the number of home exercises they have completed in the previous week, their level of pain, and their mental state; their efforts and successes are encouraged and reinforced) results in better exercise compliance and physical, psychological, and social functions after hip replacement compared with routine care.[141]

Assessment

A regulated rehabilitative care professional with knowledge and clinical experience in arthritis and TJR surgery should be responsible for the initial assessment prior to the first mobilization attempt. [97] (Please see note on page 68.)

- Shift schedules for physiotherapists may need to be adjusted to facilitate this initial assessment, in particular for those with same-day discharge.[20]
- PT initial evaluation and instructional session should be initiated on postoperative day 0 as early as 2 to 6 hours after surgery.[20] Mobilization will be based on lower limb motor function and the patient's ability to stand.
- There should be no range of motion restrictions unless specified by the operating surgeon.

Treatment/Interventions

Initial treatment starting Post-op Day (POD) 0 includes: early mobilization, range of motion exercises, foot and ankle pumping, deep breathing exercises, cryotherapy, rest and elevation.

- Patients should perform exercises to help with their circulatory and respiratory system, including:
    - Foot and ankle pumping (10x/hr)
    - Deep Breathing Exercises (10x/hr)[97]
- POD 0, patients encouraged to mobilize out of bed:[89,97]
    - Transfer bed to chair
    - Sit to stand
    - Bathroom transfers
    - Ambulation
    - For Same-Day Discharge, trial stairs
- Range of Motion (ROM) exercises, including passive, active assisted and active ROM should be taught[89]
- From POD 1, patient should be encouraged to mobilize as tolerated, including walking and stair climbing with a gait aid (walker, crutches or cane)[97]
- A policy that includes the identification and implementation of universal fall precautions that align with the clinical setting is required to ensure a safe environment that prevents falls and reduces the risk of injuries from falling.[142]
- SDD considerations:

    Note: While it is important that the following are met for SDD given the shortened length of stay, these considerations may also apply to patients who have an overnight stay.
    - A key and essential component of postoperative care in outpatient TJA is early ambulation.[79] Patients are to be seen by a physiotherapist[80] to receive a full physiotherapy evaluation with weight-bearing as tolerated[143] that includes range of motion, gait training with a walker or appropriate device, transfers in the bathroom, stair climbing, and exercise.[80]
    - The goal is to start physiotherapy and mobilization for all patients after two hours.[144] This is dependent on the patient's motor control recovery following spinal anesthesia and medical status after surgery, typically 2-6 hours following surgery.
    - At two hours postoperatively, knee ROM exercises (flexion-extension) as well as active and passive knee exercises in bed must be initiated by the physiotherapist.[144] Patients should bend the knee.[144] All members of the interprofessional team work together to assist with early mobilization.
    - It is important to have a physiotherapist available if the patient is returning to the unit after 5 p.m. (i.e., regular business hours).[19,21]
    - Physiotherapy clearance requires standing from the supine and sitting positions and functional ambulation with an assistive device.[143]

Total Knee Replacement:

- For TKR, swelling of the knee is common if activity is increased too abruptly. Patients should be allowed sufficient time to rest and elevate their leg 4-5 times a day[97]
- Early initiation of physical therapy exercises following TKR yields better functional outcomes.[145,146] Commencement of physical therapy within 24 hours of TKR is important in reducing the LOS.[146]
- OT-led cognitive-behavioral interventions significantly improve patient outcomes in TKR by reducing pain, anxiety, opioid use, improving functional recovery and facilitating same-day discharge. [114]

- Cryotherapy is a potentially beneficial adjunct in early postoperative rehabilitation following total knee arthroplasty (TKR), particularly for pain management.[147,148] It also results in improved range of motion[130] within and after 7 days postoperatively with no increased risk of adverse effects. Traditional cold packs are as effective as advanced devices, suggesting a more economical approach without compromising care quality.[148]
- A standard rehabilitative exercise protocol taught and supervised by peer volunteers in addition to standard physiotherapy started on post-op Day 0 is feasible and safe after TKR and is associated with improved knee flexion range of motion on discharge. The feedback, encouragement, and improved quality of rehabilitative exercise training because of the 1-to-1 presence of trained peer volunteers may be particularly beneficial for a geriatric population.[149]
- Enhancing conventional post-TKR rehabilitation by incorporating early hip muscle strengthening that especially targets muscles beyond the quadriceps results in greater improvements in pain and specific functional measures (i.e., knee extension range of motion; step test performance; strength of hip flexors, extensors, adductors and external hip rotation).[150]
- Continuous passive motion (CPM) when combined with physiotherapy does not appear to result in better functional outcomes than physiotherapy alone. [151–154]
- Cold therapy combined with Enhanced Recovery After Surgery [ERAS] protocols[155] significantly improves outcomes for TKR patients: shorter rehabilitation time and earlier out-of-bed activity; lower postoperative VAS scores; improved knee function scores; lower rate of complications; higher Barthel and SF-36 scores postoperatively; and higher nursing satisfaction scores.[156]
- Three sessions of intensive elastic resistance training in an acute phase of recovery after TKR leads to superior short-term clinical outcomes compared with conventional treatment. The training was provided at 24, 48, and 72 hrs after TKR, by means of one daily session of approximately 40-min duration. The sessions improve physical function, perceived pain, psychosocial variables, and inflammatory markers during the hospitalization period after TKR. The intervention was safe during the acute phase of TKR with no adverse effects reported. The intervention could also be administered at home with low-cost equipment. [157]
- Starting knee extension range of motion exercises within 4 hours post-TKR improves early range of motion, gait mechanics, and long-term functional outcomes. It significantly lowers pain scores. Enhanced gait patterns and range of motion suggest better integration into daily activities, which is critical for post-TJR rehabilitation planning. Early rehab did not increase complications or affect muscle strength negatively, supporting its safety and feasibility.[158]
- Integrating structured training in pain coping strategies into occupational therapy after TKR results in better Canadian Occupational Performance Measure (COPM) scores and understanding of pain management and coping techniques, which in turn, results in improved self-efficacy and goal achievement.[159]
- Motor imagery practice, where the patient imagines a maximal voluntary isometric contraction of the quadriceps in addition to physiotherapy can improve functional mobility (e.g., 15 min daily in hospital and 5x/week once home)**.** [160]

Total Hip Replacement:

- For patients following THR, range-of-motion and weight-bearing restrictions should be avoided to facilitate early mobilization.[161]
- An accelerated physiotherapy protocol starting on postoperative Day 1 after total hip arthroplasty (i.e., 3 sessions/day, gait training) leads to earlier mobilization, greater short-term muscle strength, and reduced hospital length of stay, without compromising safety.[162]

- One suggested protocol for rehabilitation in the early postoperative period following THR include the following:[85]

  Days 0–2. Goals: controlling pain, thromboembolic prophylaxis, ROM recovery, postural verticalization.
  - Bed exercise
    - dorsal and plantar foot flexion
    - quadriceps, gluteus medius and adductor isometric contractions
    - passive mobilization in the allowed range of motion
    - postural transition from sitting to standing
    - walking with crutches or walker, as early as possible.

  Days 3–7. Goals: maintain standing position, gain confidence in the use of crutches and in postural transitions (supine to sitting, sitting to standing).
  - continue with previous exercises
  - introduce concentric contractions (quadriceps, adductor and abductor)
  - walking with crutches, reciprocal pattern
- Enhanced Recovery After Surgery (ERAS) programs demonstrate excellent outcomes for patients following THR (e.g., better TUG and walking distance results; independent activity subitems) with comparable pain versus a conventional setup.
  - The ERAS program includes: preoperative multidisciplinary lecture and gait training with crutches; mobilization as soon as peripheral sensory and motor function are obtained, usually 1–2 hour after surgery; after stimulating cardiovascular and thrombosis prophylaxis exercises, walking exercises with crutches performed under PT supervision on day of surgery for a walking distance of at least 50 meters; standardized physiotherapy twice daily, including mobilization, gait training, muscle strengthening, instructions to improve coordination, thrombosis and pneumonia prevention.[163]
- The focus of early rehabilitation (postoperative Day 1 to discharge) following THR according to expert consensus using the Delphi technique, are to provide anti-DVT precautions, initiate and improve hip range of motion, initiate lower extremity muscle activation and balance reactions, restore functional mobility,

  and provide patient education regarding safe ambulation with assistive devices with emphasis on the dislocation precautions.[119] Precautions are sometimes prescribed by surgeons to mitigate the risk of early THR dislocation. Interprofessional communication of precautions can improve patient outcomes through coordinated effort and optimal patient counseling.[164]

Pain

Each person's pain experience will be unique. Patient, physician and team should work together to ensure that pain is manageable. Use multimodal pain management and multimodal pain management education to maximize effect and outcomes.[128] Assess pain using a standardized pain assessment instrument, e.g., The Numeric Pain Rating Scale (NPRS), VAS. Consider strategic use of PRN (as needed) pain medications (i.e., 30-45 minutes prior to assessment/treatment) to maximize participation and improve rehabilitative benefit[165]

- Educational content should integrate pain management and mobility/exercise support, ideally delivered through multimodal formats (oral, written, audiovisual, and digital). The use of IT devices (e.g., apps, smartwatches, automated text messaging) significantly enhances the effectiveness of educational interventions.[166]

- A biopsychosocial patient education model, including content related to sleep and nutrition, can significantly improve central sensitization syndrome, sleep disturbance, and pain catastrophizing, which are key pain-related risk factors.[167] Pain catastrophizing is currently defined as an exaggerated negative mindset during an actual or anticipated painful experience. Pain catastrophizing is related to central sensitization, which is defined as pain enhancement triggered by modulation of the central nervous system.[129]
- Kinesio taping with post op rehab for TKR showed positive effects on pain, joint swelling and function, but no benefit in pain relief for THR.[168]
- For patients undergoing TKR integrating CBT-based pain education into pre- and postoperative care for TKR patients, particularly in the early recovery phase, has been shown to be effective in reducing pain during activity and pain catastrophizing in the first three months post-op, both of which are critical for rehabilitation success.[131]. Post-op sessions provided by a physiotherapist occur at post-op Day 2, 5-7 days post-op; and 2 weeks post-op. {Note: Pre-op sessions occurred at: 2 weeks, 1 week and 2-3 days pre-op in the outpatient clinic.) The content of the course included the following:[131]
    - Introduce theoretical knowledge related to pain and that the generation of pain is a complicated process, which is affected by thoughts, feelings, and behaviours
    - Provide training skills for coping with pain, including relaxing behaviour, pleasant imagery, attention shifting, etc.
    - Teach how to apply the learned skills to daily life or challenging activities.
- Cryotherapy may be useful for pain relief and it can be used in combination with compression devices[97] For patients following TKR, cryotherapy results in lower pain scores on post-op days 1-3, lower consumption of opioids, reduced hemoglobin decrease and drainage, and no increased risk of adverse effects.[148] Traditional cold packs are as effective as advanced devices, suggesting a more economical approach without compromising care quality.[148]
- Review pain management techniques, (i.e., medications, ice) and importance of joint protection.[66]
- Cold therapy combined with Enhanced Recovery After Surgery protocols for patients following TKR results in lower postoperative VAS scores.[156]

Transition Care Planning

Transition plans must be developed and agreed upon in partnership with the patient, their care partner/s and the health care team involved at each point of transition. Plan is provided in writing to the patient & care partner, primary care team, specialists and rehab care providers and includes list of scheduled follow up rehab appointments. A communication liaison (such as a discharge planner or navigator) must be designated as part of the circle of care.

- Review therapy goals, treatment expectations and discharge criteria with patient.
- SDD Considerations:

    Note: While is important that the following are met for SDD given the shortened length of stay, these considerations may also apply to patients who have an overnight stay.
    - A plan is put into place with regard to home exercises to perform and outpatient physiotherapy should a patient need it.[80]
    - Safety suggestions for the patient at home are individualized and reviewed.[80]
    - Follow-up phone calls with the patient once home provides the patient with the opportunity to discuss issues directly with the care team following discharge.[79]

- If the patient is discharged to any provider other than the hospital where the surgery was performed, a Discharge Report must be completed, and provided to the receiving care provider. A discharge report should include information such as relevant post-op information (PT and/or MD note) and discharge date; treatment, activity and weight-bearing restrictions; a discharge medication list; and date of follow-up appointment.[169]
- Criteria for discharge home:
  - Ambulates and transfers safely with mobility devices
  - Able to do stairs if needed
  - Home exercise/education program has been provided to patient and/or caregiver
  - Rehabilitation plan is in place (Outpatient/Community Clinic/In-Home)
  - SDD Consideration: For a patient to be cleared for home, the patient must safely walk short distances with an appropriate device, transfer in the bathroom, climb stairs appropriately, and have overall safety awareness[80] to perform home exercises and address their own personal needs, have at least 90 degree of knee flexion, and a brace is not required.[144] Blood pressure should be stable during physiotherapy and the patient should be cognitively clear from anesthesia and sensation intact.[80]
- Refer to outpatient or community service as needed. Confirm appointments and referrals prior to discharge.
- Schedule face-to-face and real time discharge conversations ("warm handoffs") with the patient and care partner.
- Confirm patient and care partner's understanding of the information discussed, and document in the patient's chart.

Clinical Outcome Measures

Based on the needs of the patient, range of motion (ROM), strength, gait speed, pain, Patient Reported Outcome Measures (PROMs) and Clinician Reported Outcome Measures (CROMs - aka Performance Outcome Measures) should be measured.

- PROMs and CROMs serve as valuable and complimentary clinical tools after TKR and THR and should not be used interchangeably. They provide a valid basis for interpreting patients' health outcomes across rehab settings and relying on either alone may lead to incomplete or misleading assessments. The integration of both types of measures facilitates more precise monitoring of progress, timely adjustment of rehabilitation strategies, and improved alignment between patient needs and clinical decision-making.[134]
- Performance Outcome Measure Examples:[66,135]
  - Gait Speed (e.g., 4 Metre Walk Test, 10 Metre Walk Test)
  - Timed Up and Go (TUG)

It is also recommended that both a generic PROM tool and condition-specific PROM tool be utilized. In alignment with the directions of Ontario Health, the EQ-5D-5L and the Oxford Hip & Knee Score should be implemented. (For simultaneous bilateral TJR, complete separate Oxford Hip & Knee Score for each joint.)[136]

- Depending on the patient's needs, additional tools may be required to ensure shared decision making and collaborative goal setting.[137]
- Other Patient Reported Outcome Measures Examples[66,135]
  - Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)

- Pain Visual Analogue Scale (VAS)/Numeric Pain Rating Scale (NPRS)
- Patient Specific Functional Scale (PSFS)

Bedded Rehabilitative Care

For Rehabilitation in Bedded Levels of Rehab TJR Rehab Resources, please visit: https://rehabcarealliance.ca/bedded-levels-of-rehab-tjr

An approach of trust, respect and accommodation should be recognized as essential to the provision of equitable and culturally appropriate rehabilitative care.

- Rehabilitative care providers must ensure a safe, inclusive space to provide rehabilitative care with consideration for the patient's intersecting identities, health beliefs, practices and values.[5,65]
- Rehabilitative care providers must use culturally appropriate language and a person-centred, history-taking approach, such as asking open-ended questions and ensuring privacy and confidentiality during interactions with all patients and care partners.[5,65]
- Rehabilitative care providers must learn about the health beliefs, practices and values of the cultural groups they serve and develop culturally responsive knowledge, skills and attitudes.[65]

Considerations

Inpatient rehabilitation should not be the first choice for the typical patient with a primary unilateral or simultaneous bilateral elective total hip or knee replacement.[1] Referral to inpatient rehab is guided by the RCA Referral Decision Tree. (See Figure 1. Page 10)

- The target of the Orthopaedic Quality Scorecard indicates that no more than 10% of primary unilateral hip/knee replacement patients will require inpatient rehabilitation.[170]
- Post-acute rehabilitative care arrangements to be confirmed preoperatively.
- If admission to inpatient rehabilitation is necessary, community-based rehabilitative care service is to be agreed upon prior to discharge.
- Guided by the RCA Referral Decision Tree for Rehabilitative Care, the determining factors for discharge to inpatient rehabilitative care should be evaluated based on a patient's postoperative inpatient assessment and focus on physical and functional postoperative limitations. The following concerns may trigger consideration of discharge to inpatient rehabilitation:
    - Unable to transfer in/out of bed
    - Unable to ambulate with a gait aid sufficiently for household mobility
    - If applicable, unable to ascend/descend stairs with 1-assist (for entry/exit of home)
- A patient's inpatient rehabilitative care length of stay should be based on addressing the above specific functional limitations and meeting the patient's functional goals, with a transition plan to return home and continue rehabilitation in a community-based rehabilitative care setting, as soon as they are able.

Patient & Care Partner Engagement/Education

Patients and care partners must be included in the circle of care communication and care planning. Multi-modal education should be provided to patients that can be tailored to their individual preferences and experiences.[65] Education on all of the following topics should be available and reviewed with patient and care partner(s) as appropriate: pain and swelling management (including post-hospital care)[135], mobility, fall prevention, expected progress, caregiving/coaching training, safe activity resumption, including return to sports[171–173],

resume driving[94], principles of healthy lifestyles and active living, provision of resources or referrals to external programs and sources of help (e.g., Arthritis Society), TJR precautions, if applicable.
• Designated care partners who provide care to maintain the patient's mental and physical health and who advocate on the person's behalf must be considered essential to rehabilitation and transition care planning and should be allowed access to inpatient health care organizations. • Patient education is best accomplished using a combination of methods. When education materials are provided in addition to verbal communication, patient education is more effective.[174] • Use of health literacy best practices to confirm understanding, such as teach-back and asking open ended questions can support the patient-provider verbal communication.[175] • Providing quality health information (accurate, accessible, and actionable) enables patients to better manage their health and wellbeing, and make fully informed decisions about their treatment and care. • Patient education materials should be developed using plain language as a key strategy for improving health literacy and be compliant with the Accessibility for Ontarians with Disabilities Act (AODA) requirements for accessibility.[68] • Information given needs to be paced to avoid overload during the preoperative and in-patient stages. Use of technology such as an app on their mobile phone, tablet etc. could support patients to revisit information at their own convenience and time of need.[82] • Providing a Transtheoretical model of health education, beginning on post-op Day 1 for 6 months, improves outcomes in elderly patients post-TKR. The model uses personalized intervention strategies aimed at addressing patients' maladaptive behavior. It seeks to gradually aid patients in altering detrimental behavior and psychological states, establishing appropriate behavior patterns, enhancing their self-management capabilities, and achieving a positive prognosis. The theory has five distinct stages: the pre-intention stage, the intention stage, the preparation stage, the action stage, and the maintenance stage. It addresses kinesiophobia, a known barrier to rehabilitation, by tailoring education to psychological readiness and behavioral stages.[139] • Integrating self-efficacy-enhancing interventions and early, structured, and sustained support into routine post-THR care improves rehabilitation outcomes. For example, providing one face-to-face education session before discharge; four health-coaching telephone follow up calls within 6 months post op (i.e., patients report the number of home exercises they had completed in the previous week, their level of pain, and their mental state; their efforts and successes are encouraged and reinforced) results in better exercise compliance and physical, psychological, and social functions after hip replacement compared with routine care.[141] • All patients need to be made aware of their responsibility to participate in their recovery. This includes participation in rehabilitation and exercise in the hospital and after discharge.[66] Many patients do not increase physical activity post-surgery, highlighting the need for behavioral interventions and educating patients about the benefits of physical activity and the risks of sedentary behavior.[87] • Tools that are offered using technology such as Apps for smart phones might be helpful for some patients.
Assessment

Assessment should be provided by a dedicated interprofessional musculoskeletal (MSK)/orthopaedic team with general knowledge about the TJR rehab assessment and treatment process, and who has access to skills/training to develop and maintain the necessary skills and knowledge base. Assessment should include development of an individualized therapy plan (1:1 or group setting) and goal setting. Outcome Measures should include performance measures, self-report measures, and clinical measures.
Treatment/Intervention
Timing, frequency and intensity of rehabilitative care services provided in a bedded level of care to be defined in consideration of the following: functional tolerance and goals of the patient, RCA Rehab Care Standards for Bedded Levels of Care, and Quality Based Procedure Targets.

• As per the RCA Rehab Care Standards for Bedded Levels of Care, the functional characteristics of patients requiring inpatient rehabilitation are as follows[176]:
  ○ Achievement of goals require:
  ▪ Daily interventions
  ▪ Frequent/daily re-assessment by regulated health professionals
  ▪ A coordinated team approach by a dedicated/in-house interprofessional team of regulated health professionals
  ○ Although the patient's initial functional tolerance may fluctuate, the patient has the cognitive ability and the physical tolerance to participate in and progress through low or higher intensity rehabilitation
  ○ Patients are expected to return to their previous living environment or other appropriate community environment
  ○ Therapy Care includes[176]:
  ▪ Direct daily therapy (in alignment with treatment plan and patient tolerance)
  ▪ Establishment of achievable treatment goals
  ▪ Daily/frequent assessment & documentation of the functional status of patients
  ▪ Occurrence of regular case discussion amongst treating practitioners

Therapeutic interventions include[89]: exercises for active range of motion (AROM), strength and balance, functional training (e.g., gait, stairs, balance, transfers) including any applicable precautions, ADL/IADL assessment and training.
• Both 1:1 and individualized group-based exercise programs can be beneficial. • In regards to function, ROM and health-related Quality of Life, group-based physiotherapy provides similar outcomes as 1:1 physiotherapy following total joint replacement surgery.[11] • Progressive resistance training with sufficient intensity and dosage to enable a physiologic training effect should be a key component.[94] • Coordinate therapy with pain management
Total Knee Replacement:

- Core stability exercises can be more effective compared to routine physical therapy exercises after TKR in making patients active by achieving gain in functional movement and performance of activities.[177] The integration of core exercises improves mobility, balance, and quality of life. This is particularly relevant for older adults as core strengthening may reduce fall risk post-TKR.[178]
- Neuromuscular training, resistance training and balance training from the early postoperative period to 8 weeks post-op significantly improves range of motion, pain, and function.[130]
- Patients who receive lower extremity active resistance exercise have better clinical effects in terms of pain relief, strength recovery, and knee ROM.[179]
- A Stepped Care Model—tailoring rehabilitation intensity based on patient progress—can significantly improve early-stage outcomes post-TKR.[180]
- Early initiation of cryotherapy treatment – with application times beginning before surgery through to 12 weeks post-surgery – contributes to functional recovery, avoids complications caused by prolonged immobility, and increases joint range of motion and muscle strength.[130]
- Combined balance training with general physical therapy has a positive effect on range of motion, static and dynamic balance, gait, and functional outcomes in the acute phase post TKR.[181] An example of a combined balance exercise program includes: combined balance exercise with conventional physical therapy for 30 minutes per session, 5 times a week, for 4 weeks from the 3rd day after TKR.[181]
- Incorporating proprioception-based exercises in postoperative rehabilitation of TKR patients results in better outcomes (e.g., on 30-second chair-stand, stair climbing and 6-minute walk tests) than routine physiotherapy alone. Prioritizing neuromuscular control is essential for balance. Solely focusing on static and dynamic muscle strengthening does not adequately prepare the artificial joint for daily activities.[182]
- Combining manual therapy with exercise in postoperative TKR rehabilitation enhances pain relief, functional recovery, patient satisfaction and supports early gains in range of motion more effectively than exercise alone.[183]
- A combined approach of preoperative and postoperative progressive resistance training yields better and faster improvements in gait, balance, muscle strength, and hip joint function compared to preoperative or postoperative progressive resistance training alone. Targeted muscle training can effectively reverse muscle atrophy on the operated hip with hip muscle strength surpassing baseline levels by approximately three months postoperatively.[121]
- Integrating structured training in pain coping strategies into occupational therapy after TKR results in better Canadian Occupational Performance Measure (COPM) scores and understanding of pain management and coping techniques, which in turn, results in improved self-efficacy and goal achievement.[159]
- Integrating motivational interviewing by trained practitioners into rehabilitation strategies to address emotional and behavioral aspects of recovery can significantly improve both physical adjustment and quality of life post-TKR.[184]
- Continuous passive motion (CPM) when combined with physiotherapy does not appear to result in better functional outcomes than physiotherapy alone.[151,152]
- A standard rehabilitative exercise protocol taught and supervised by peer volunteers in addition to standard physiotherapy started on post-op Day 0 is feasible and safe after TKR and is associated with improved knee flexion range of motion on discharge. The feedback, encouragement, and improved quality of rehabilitative exercise training because of the 1-to-1 presence of trained peer volunteers may be particularly beneficial for a geriatric population.[149]

- Motor imagery practice, where the patient imagines a maximal voluntary isometric contraction of the quadriceps in addition to physiotherapy, can improve functional mobility (e.g., 15 min daily in hospital and 5x/week once home).[160]
- Interventions to reduce knee swelling may help improve quadriceps strength and gait speed.
- Enhancing conventional post-TKR rehabilitation by incorporating early hip muscle strengthening that especially targets muscles beyond the quadriceps results in greater improvements in pain and specific functional measures (i.e., knee extension range of motion; step test performance; strength of hip flexors, extensors, adductors and external hip rotation). [150]
- Extended reality interventions (e.g., virtual reality, augmented reality, and mixed reality)* can reduce anxiety and enhance engagement. They are most beneficial within the first 2 weeks post-TKR.[185] It has also been shown to reduce pain and improve range of motion, particularly within 2 weeks and 3 months postoperatively.[186]
- Balance training with non-immersive Virtual Reality-based serious games can improve clinical outcomes, gait, and postural outcomes in TKR patients. This is particularly important considering that the TUG score is correlated with fall risk in older people and that activities such as walking and getting up from a chair are common activities of daily living. This approach combined with the conventional treatment can intensify the rehabilitation program, thus potentially enhancing the treatment effect.[187]
- Virtual reality assisted rehab can enhance recovery outcomes post-TKR with respect to pain, physical function and stiffness, mobility, balance, range of motion,[188–190] gait and functional independence.[190] Equilibrium training using non-immersive virtual reality-based serious games can enhance gait, postural and clinical results.[190] Virtual reality games have the potential to be a useful tool for patients recovering from knee surgery in terms of motivational rehabilitation.[190]
- The integration of mental simulation practices (e.g., motor imagery, action observation, guided imagery) as adjunctive therapies in post-TKR rehabilitation for patients with knee osteoarthritis has demonstrated significant reduction in pain, significant improvement in quadriceps strength, and improved range of motion and quality of life.[190]

Total Hip Replacement:

- The goals of rehabilitation during the progressive function phase (e.g., up to the 6th week following THR for patients with minimal pain, i.e., NPRS≤3) according to expert consensus using the Delphi technique are to: [119]
  - regain mobility and strength of operated leg and flexibility of lower limb muscles
  - progress balance and proprioceptive training; initiate lower limb endurance training
  - normalize functional mobility
  - educate individuals about pain coping techniques.
- An accelerated physiotherapy protocol starting on postoperative Day 1 after THR (i.e., 3 sessions/day, gait training) leads to earlier mobilization, greater short-term muscle strength, and reduced hospital length of stay, without compromising safety.[162]
- One suggested protocol for rehabilitation in the early postoperative period following THR include the following: [85]

* Virtual reality can create a virtual 3-D environment and block out visual stimuli from the real world. Augmented reality allows users to see the real world, but overlays with virtual 3-D scene. Mixed reality combines virtual and augmented.

Days 0–2. Goals: controlling pain, thromboembolic prophylaxis, range of motion recovery, postural verticalization.
- Bed exercise
  - dorsal and plantar foot flexion
  - quadriceps, gluteus medius and adductor isometric contractions
  - passive mobilization in the allowed range of motion
  - postural transition from sitting to standing
- Walking with crutches or walker, as early as possible.

Days 3–7. Goals: maintain standing position, gain confidence in the use of crutches and in postural transitions (supine to sitting, sitting to standing).
- continue with previous exercises
- introduce concentric contractions (quadriceps, adductor and abductor)
- walking with crutches, reciprocal pattern

Weeks 2–4. Goals: increasing allowed range of motion and muscular tone, controlling standing position, walking pattern without deficit.
- continue with previous exercises
- abductor contraction in standing position
- squat in standing position (<90°)
- elevation on the toes
- bridge exercise
- training on treadmill from the 4th week, earlier if possible
- training in walking with one crutch (contralateral)

Weeks 5–7. Goals: absence of pain, regain pre-op lifestyle.
- continue with previous exercises
- free walking in protected situation
- introduce functional exercises like sit to stand, go up the stairs, climb over obstacles
- balance exercises on unstable boards, walking with changing of speed and direction.

- The presence of comorbidities may require a more tailored PT treatment approach with patients following THR as the physical complaints resulting from their comorbidities can have a more prominent role relative to the direct effects of the THR surgery.[191]
- Exercise interventions (e.g., hydrotherapy, progressive resistance, gait, task-based, upper-limb, and sports therapy training) can significantly improve self-reported physical function, pain intensity and gait velocity following THR in the short term (<6 months). Individuals who undertake exercise within post-THR rehabilitation may return sooner to higher levels of physical functioning compared to those receiving standard care.[192]

- For patients undergoing THR, maximal strength training interventions can improve muscle strength more than conventional PT after THR and strength gains persist for up to 6 months. [124] A combined approach of preoperative and postoperative progressive resistance training yields better and faster improvements in gait, balance, muscle strength, and hip joint function compared to preoperative or postoperative progressive resistance training alone. Targeted muscle training can effectively reverse muscle atrophy on the operated hip with hip muscle strength surpassing baseline levels by approximately three months postoperatively. [121]
- In the short term, the use of virtual reality exercises in addition to physiotherapy treatment supports improved outcomes in the function, balance, and regularization of the load distributed in the lower extremities, as well as distance covered during walking in these patients. It also can improve coping with environmental challenges, facilitating independence both in activities of daily living and in social participation and reducing the risk of falls.[193]

Pain

Use multimodal pain management and multimodal pain management education to maximize effect and outcomes.[128] Assess pain using a standardized pain assessment instrument, e.g., The Numeric Pain Rating Scale (NPRS), VAS. Consider strategic use of PRN (as needed) pain medications (i.e., 30-45 minutes prior to assessment/treatment) to maximize participation and improve rehabilitative benefit[165]

- A biopsychosocial patient education model, including content related to sleep and nutrition, can significantly improve central sensitization syndrome, sleep disturbance, and pain catastrophizing, which are key pain-related risk factors.[167] Pain catastrophizing is currently defined as an exaggerated negative mindset during an actual or anticipated painful experience. Pain catastrophizing is related to central sensitization, which is defined as pain enhancement triggered by modulation of the central nervous system.[129]
- Kinesio taping with post op rehab for TKR showed positive effects on pain, joint swelling and function, but no benefit in pain relief for THR.[168]
- For patients undergoing TKR, integrating CBT-based pain education into pre- and postoperative care for TKR patients, particularly in the early recovery phase, has been shown to be effective in reducing pain during activity and pain catastrophizing in the first three months post-op, both of which are critical for rehabilitation success.[131] Post-op sessions provided by a physiotherapist occur at post-op Day 2, 5-7 days and 2 weeks post-op. The content of the course can include the following:[131]
    - Introduce theoretical knowledge related to pain and that the generation of pain is a complicated process, which is affected by thoughts, feelings, and behaviours
    - Provide training skills for coping with pain, including relaxing behaviour, pleasant imagery, attention shifting, etc.
    - Teach how to apply the learned skills to daily life or challenging activities.
- Cryotherapy is a potentially beneficial adjunct in early postoperative rehabilitation following TKR, particularly for pain management.[147]
- For patients undergoing TKR, cryotherapy – with application times beginning from 14 days before surgery to 2 weeks postoperatively may be more suitable for pain relief compared with other alternative treatments to drug therapy.[130]

- Virtual reality-based rehabilitation on patients who have undergone TKR can improve pain and function but not postural control compared to conventional rehabilitation. Examples of virtual reality-based rehabilitation include Nintendo Wii-Fit; interactive virtual telerehabilitation kit; immersive boat-rowing VR environment; virtual exercise rehab assistant; phone-based balance game.[194]
- Virtual reality assisted rehab can enhance recovery outcomes post-TKR with respect to pain, physical function and stiffness, mobility, balance, range of motion, [188–190] gait and functional independence.[190] Virtual reality modifies pain perception by affecting focus, attention and emotions.

Transition Care Planning

Transition plans must be developed and agreed upon in partnership with the patient, their care partner/s and the health care team involved at each point of transition. Anticipate the expected date of discharge, and discuss it with the patient and care partner(s). Plan is provided in writing to the patient & care partner, primary care team, specialists and community rehab care providers and includes list of scheduled follow up rehab appointments. A communication liaison (such as a discharge planner or navigator) must be designated as part of the circle of care.

Transition Planning - General

- Review therapy goals, treatment expectations and discharge criteria with patient.
- If the patient is discharged to any provider other than the hospital where the surgery was performed, a Discharge Report must be completed, and provided to the receiving care provider. A discharge report should include information such as relevant post-op information (PT and/or MD note) and discharge date; treatment or weight-bearing restrictions; a discharge medication list; and date of follow-up appointment.[83]
- Criteria for discharge home:
  - Ambulates and transfers safely with mobility devices
  - Able to do stairs if needed
  - Able to perform safe/supported ADLs with or without assistive devices
  - Home exercise/education program has been provided to patient and/or caregiver
  - Rehabilitation plan is in place (Outpatient/Community Clinic/In-Home)
- If criteria for discharge are not met, consider alternate levels of care.
- Referral to outpatient or community service as needed.
- Make and confirm appointments and referrals prior to discharge.

Transition Planning – During hospital stay[174]

- Anticipate the expected date of discharge, and discuss it with the patient, his/her caregiver(s) and the post-discharge care provider(s).
- Implement individualized care and discharge plan(s); revise as required based on therapeutic progress, consultations, and new information.
- Based on discharge plan, schedule follow-up rehabilitative care and assessments. Confirm and document appointments in discharge plan.
- Rehabilitative care team to support follow-up with most appropriate medical care practitioner.

Transition Planning – At time of discharge[94]

- Schedule face-to-face and real time discharge conversations ("warm handoffs") with the patient and their family or informal caregivers.
- Provide the written individualized discharge plan to the patient and their caregiver(s) at the time of discharge from hospital. Provide written individualized care and discharge plans to patient's primary care team, specialists and other providers within 24 hours of discharge.
- Provide list of scheduled follow-up rehabilitation appointments and review with the patient and his/her family/caregiver(s) at time of discharge.
- Confirm patient's (and/or family and caregivers') understanding of the information discussed, and document in the patient's chart.

Clinical Outcome Measures

Based on the needs of the patient, range of motion (ROM), strength, gait speed, pain, Patient Reported Outcome Measures (PROMs) and Clinician Reported Outcome Measures (CROMs - aka Performance Outcome Measures) should be measured.

- PROMs and CROMs serve as valuable and complimentary clinical tools after TKR and THR and should not be used interchangeably. They provide a valid basis for interpreting patients' health outcomes across rehab settings and relying on either alone may lead to incomplete or misleading assessments. The integration of both types of measures facilitates more precise monitoring of progress, timely adjustment of rehabilitation strategies, and improved alignment between patient needs and clinical decision-making.[134]
- Performance Outcome Measure Examples:[66,135]
    - 30 Second Chair Stand Test (30CST)
    - Gait Speed (e.g., 4 Metre Walk Test, 10 Metre Walk Test, 6 Minute Walk Test, 40 Metre Fast-paced Walk Test)
    - Berg Balance Scale
    - Timed Up and Go (TUG)
    - Stair Climb Test
    - Functional Reach Test

It is also recommended that both a generic PROM tool and condition-specific PROM tool be utilized. In alignment with the directions of Ontario Health, the EQ-5D-5L and the Oxford Hip & Knee Score should be implemented. (For simultaneous bilateral TJR, complete separate Oxford Hip & Knee Score for each joint.)[136]

- Depending on the patient's needs, additional tools may be required to ensure shared decision making and collaborative goal setting.[137]
- Other Patient Reported Outcome Measures Examples[66,135]
    - Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)
    - Lower Extremity Functional Scale (LEFS)
    - Pain Visual Analogue Scale (VAS)/Numeric Pain Rating Scale (NPRS)
    - Hip Disability and Osteoarthritis Outcome Score (HOOS)/ Knee Injury and Osteoarthritis Outcome Score (KOOS)
    - Patient Specific Functional Scale (PSFS)

Rehabilitation in Outpatient/Community Clinics

For Rehabilitation in Outpatient/Community Clinics TJR Rehab Resources, please visit: https://rehabcarealliance.ca/ambulatory-rehab-tjr

An approach of trust, respect and accommodation should be recognized as essential to the provision of equitable and culturally appropriate rehabilitative care.

- Rehabilitative care providers must ensure a safe, inclusive space to provide rehabilitative care with consideration for the patient's intersecting identities, health beliefs, practices and values.[5,65]
- Rehabilitative care providers must use culturally appropriate language and a person-centred, history-taking approach, such as asking open-ended questions and ensuring privacy and confidentiality during interactions with all patients and care partners.[5,65]
- Rehabilitative care providers must learn about the health beliefs, practices and values of the cultural groups they serve and develop culturally responsive knowledge, skills and attitudes.[65]

Considerations

Rehabilitation to be provided or supervised by a regulated rehabilitative care professional with knowledge and clinical experience in arthritis and TJR surgery.
(Please see note on page 68.)

- Multidisciplinary community-based rehabilitation optimizes activity and participation outcomes.[195]
- Integrated care teams, coordinated management of biopsychosocial patient factors, and the concurrent delivery of exercise and self-management interventions can reduce pain, optimize outcomes, and improve function.[14,94,196]
- Coordinated interprofessional rehabilitative care can be more easily provided in a team-based outpatient setting than an in-home setting.
- Evidence shows that patients discharged directly to higher intensity outpatient/community clinic rehabilitation have a more rapid recovery compared with those who receive 2 weeks of in-home rehabilitation prior to undergoing outpatient rehabilitation.[197]
- Although home-based rehabilitation boasts significant advantages like convenience, personalized support, and the potential for remote treatments, outpatient rehabilitation has value by offering specific equipment and technique-based treatments. The ideal scenario might be an organic combination of home-based and outpatient rehabilitation, ensuring patients receive optimal support and recovery from multiple fronts. Outcomes can differ based on patient adherence, and the absence of direct supervision might pose risks. Implementing strict protocols, such as telemonitoring, can bolster safety and effectiveness during home-based rehabilitation.[198] When home-based rehab is required, it can provide comparable results to outpatient rehab following TKR.[199,200]

Patient and Care Partner Engagement/Education

Patients and care partners must be included in the circle of care communication and care planning. Multi-modal education should be provided to patients that can be tailored to their individual preferences and experiences.[65] Education on all of the following topics should be available and reviewed with patient and care partner(s) as appropriate: pain and swelling management (including post-hospital care)[135], mobility, fall prevention, expected progress, caregiving/coaching training, safe activity resumption, including return to sports[171–173],

resume driving[94], principles of healthy lifestyles and active living, provision of resources or referrals to external programs and sources of help (e.g., Arthritis Society), TJR precautions, if applicable.
• Following TJR, patients have stated that they wish to receive more information and coherence of care between the hospital and home care teams.[138] • Designated care partners who provide care to maintain the patient's mental and physical health and who advocate on the person's behalf must be considered essential to rehabilitation and transition care planning and should be allowed to remain with the patient and participate as part of the circle of care. • Patient education materials should be developed using plain language as a key strategy for improving health literacy and be compliant with the Accessibility for Ontarians with Disabilities Act (AODA)[68] requirements for accessibility.[174] • Information given to patients/caregivers needs to be paced to avoid overload during the preoperative and in-patient stages. Use of technology such as an app on their mobile phone, tablet etc. could support patients to revisit information at their own convenience and time of need.[82] • Patient education is best accomplished using a combination of methods. When education materials are provided in addition to verbal communication, patient education is more effective.[174] • Use of health literacy best practices to confirm understanding, such as teach-back and asking open ended questions can support the patient-provider verbal communication.[175] • Providing quality health information (accurate, accessible, and actionable) enables patients to better manage their health and wellbeing, and make fully informed decisions about their treatment and care.[174] • Structured postoperative education can address the knowledge gaps that patients have about the procedure, complications, postoperative precautions and self-care activities.[201] • Principles of healthy lifestyles and active living are incorporated in the rehabilitation program. This may include providing resources or referrals to external programs. Many patients do not increase physical activity post-surgery, highlighting the need for behavioral interventions and educating patients about the benefits of physical activity and the risks of sedentary behavior.[87] Educate and encourage patients to manage their own care and become more physically active following TJR surgery in order to achieve health-enhancing benefits associated with regular moderate-intensity exercise. For example, physical therapist-administered physical activity intervention may reduce sedentary time in adults after TKR.[202] • There is a mechanism in place to assess the patient's learning needs. • The majority of the patient's recovery will take place in the community; therefore, throughout the program, the patient needs to be provided with instruction and ongoing education regarding exercise and functional activities to be completed at home.[66] • Integrating self-efficacy-enhancing interventions and early, structured, and sustained support into routine post-THR care improves rehabilitation outcomes. For example, providing four health-coaching telephone follow up calls within 6 months post op (i.e., patients report the number of home exercises they had completed in the previous week, their level of pain, and their mental state; their efforts and successes are encouraged and reinforced) results in better exercise compliance and physical, psychological, and social functions after hip replacement compared with routine care.[141] • Providing a Transtheoretical model of health education, beginning on post-op Day 1 for 6 months, improves outcomes in elderly patients post-TKR. The model uses personalized intervention strategies aimed at addressing patients' maladaptive behavior. It seeks to gradually aid patients in altering detrimental behavior and psychological states, establishing appropriate behavior patterns, enhancing

their self-management capabilities, and achieving a positive prognosis. The theory has five distinct stages: the pre-intention stage, the intention stage, the preparation stage, the action stage, and the maintenance stage. It addresses kinesiophobia, a known barrier to rehabilitation, by tailoring education to psychological readiness and behavioral stages.[139]

- Patients may require education up to and beyond a year. Education should be consistent and available through many media including written materials, websites, primary care practitioners, telephone calls and teleconferences.[66]
- Additional references to inform patient & family education are included in the reference section.[203–205]

Assessment

Assessment should include development of an individualized therapy plan (1:1 or group setting) and goal setting. Outcome Measures should include performance measures, self-report measures, and clinical measures.

- Assessments are focused on patient safety at home as well as physical and functional abilities necessary for daily activities.[206]
- Assessment of function and ADL management with validated measurement tools.
- Goals need to be established in partnership with the individual, their family/carers and treating health professionals.[15]

Treatment/Interventions

Therapeutic interventions include: exercises for range of motion (ROM), strength and functional training (e.g., gait, stairs, balance, transfers). Both individual and group exercise programs can be beneficial, and the level of health professional supervision should be matched to the patient's needs.[94]

- Progressive resistance training with sufficient intensity and dosage to enable physiologic training effect should be a key component of rehab programs.[94]
- Progression of functional abilities towards patient's goals.[206]
- Hands-on therapy as required.
- Standardized, evidence-based training be available to health professionals to ensure they have the most up to date knowledge and skills to provide safe and effective rehabilitation care to individuals undergoing TJR.[15]
- Timing of rehabilitation is important for optimal patient outcome after TJR.[15]
- Immersive virtual reality therapy, in addition to conventional rehabilitation, can be an effective adjunct to standard rehabilitation, improving both mental health and functional recovery in older adults after total joint arthroplasty. The goal of the virtual reality program can be used to divert patients' attention to a serene virtual environment, allowing relaxation and fostering recognition of the patient's psychological strength.[207]

Total Knee Replacement

Initiation

- **Outpatient rehab should begin within 7 days of discharge from acute care**[15,89] [208]
- While there is no specific target timeframe for initiating outpatient rehabilitation following discharge from an inpatient rehabilitation program, patients who require ongoing rehabilitation should be enrolled in an outpatient or in-home rehab program as soon as it is clinically appropriate.

Duration/Frequency:

- ***Usual Progression (estimated ~80% of patients):*** **Treatments should be offered 2 times per week for 6-7 weeks, with variation in frequency and duration depending on the patient's progress and care needs.**[206,209]
- ***Slower Progression (estimated ~20% of patients):*** **Based on patient-specific factors, some patients may require up to 12 weeks of supervised rehabilitative care.**
- A 2 Delphi round consensus panel recommends that outpatient rehab be offered at a frequency of 2 times per week for the first postoperative month regardless of recovery status.[208] However, for the 2nd and 3rd postoperative months, the frequency of visits may be different (e.g., 2 times vs 1 time per week) depending on the patient's recovery status.[208]
- The greatest improvement in knee flexion occurs within the first 6-7 weeks postoperatively.[209]
- Rehabilitation for patients following knee replacement includes intensive exercise to achieve range of motion and function throughout the first 12 weeks post-surgery, including both supervised and independent exercise programs.[66]
- Duration is based on the achievement of functional goals of independence or plateau in progression.[66]
- Overall frequency of rehabilitation is important for optimal patient outcomes.[15]
- Personal and external factors be identified and considered for their influence on overall frequency of rehabilitation.[15] For example, physiotherapy beyond the initial 2 months post-TKR may offer limited benefit for patients with persistent pain. Increased physiotherapy use in patients with ongoing pain may not correlate with improved outcomes. Identifying patients at risk for poor outcomes (e.g., those with high pain catastrophizing) can inform targeted interventions and optimize rehabilitation strategies.[210] However, longer durations of exercise therapy may be of more benefit for older adults and those with functional limitations.[211]

Format:

- **Triage into class model vs. 1:1 treatment is based on the assessment of the regulated rehabilitative care professional** with the following considerations where class volumes permit[206]
  - Pre-Surgical Status
    - Longstanding contractures or muscle imbalances
    - Co-morbidities
  - Surgical Complexity
    - Fractures, osteotomy, bone graft reconstruction, non-routine follow-up.
  - Social/cultural factors
    - Language barriers, difficulty following instructions
- Hands-on treatment & manual therapy techniques are required to assist the patient achieve range of motion in the knee.

  - Interventions to reduce knee swelling may help improve quadriceps strength and gait speed[212]
  - Both 1:1 and individualized group-based exercise programs or a combination of both can be beneficial.[11] **[213]**
  - In regards to function, ROM and health -related Quality of Life, individualized group-based physiotherapy provides similar outcomes as 1:1 physiotherapy following total joint replacement surgery.[11,214]
  - Note: Patients who need close monitoring for surgical or medical concerns are not appropriate for group-based rehabilitative care.[215]
  - For the patients who require rehabilitative care in an outpatient/community clinic, the best practice guideline is:
    - Group based format provided to patients expected to follow usual progression based on initial assessment by the regulated rehabilitative care professional.[206] Group based format is especially beneficial for older adults and leads to better outcomes in physical activity, mobility, and quality of life compared to traditional one-on-one therapy.**[216]**
    - 1:1 individual treatment provided to patients expected to require slower progression based on initial assessment by the regulated rehabilitative care professional.[206]
- A Stepped Care Model — tailoring rehabilitation intensity based on patient progress — can significantly improve early-stage outcomes post-TKR.**[180]**
- The integration of mental simulation practices (e.g., motor imagery, action observation, guided imagery) as adjunctive therapies in post-TKR rehabilitation for patients with knee osteoarthritis has demonstrated significant reduction in pain, significant improvement in quadriceps strength, and improved range of motion and quality of life.**[217]**
- Integrating motivational interviewing by trained practitioners into rehabilitation strategies to address emotional and behavioral aspects of recovery can significantly improve both physical adjustment and quality of life post-TKR.**[184]**
- Application of Continuous Passive Motion in an early post-op treatment of patients after TKR does not have a significant impact on the clinical and functional evaluation after ten days of treatment (e.g., range of motion, clinical knee score, and functional activity).**[153,211]**
- Core stability exercises can be more effective compared to routine physical therapy exercises after TKR in making patients active by achieving gain in functional movement and performance of activities.**[177]** The integration of core exercises improves mobility, balance, and quality of life. This is particularly relevant for older adults as core strengthening may reduce fall risk post-TKR.**[178]**
- Patients who receive lower extremity active resistance exercise have better clinical effects in terms of pain relief, strength recovery, and knee ROM.**[179]**
- A combined approach of preoperative and postoperative progressive resistance training yields better and faster improvements in gait, balance, muscle strength, and hip joint function compared to preoperative or postoperative progressive resistance training alone. Targeted muscle training can effectively reverse muscle atrophy on the operated hip with hip muscle strength surpassing baseline levels by approximately three months postoperatively.**[121]**
- Combining manual therapy with exercise in postoperative TKR rehabilitation enhances pain relief, functional recovery, patient satisfaction and supports early gains in range of motion more effectively than exercise alone.**[183]**
- Cryotherapy is a potentially beneficial adjunct in early postoperative rehabilitation following total knee arthroplasty (TKR), particularly for pain management.**[147]**

- Combined balance training with general physical therapy has a positive effect on range of motion, static and dynamic balance, gait, functional outcomes and physical quality of life when begun in the acute phase post TKR.[181,218] An example of a combined balance exercise program includes: combined balance exercise with conventional physical therapy for 30 min per session, 5 times a week, for 4 weeks from the 3rd day after TKR. [181]
- Incorporating proprioception-based exercises in postoperative rehabilitation of TKR patients results in better outcomes (e.g., on 30-second chair-stand, stair climbing and 6-minute walk tests) than routine physiotherapy alone. Prioritizing neuromuscular control is essential for balance. Solely focusing on static and dynamic muscle strengthening does not adequately prepare the artificial joint for daily activities.[181]
- High-intensity exercise and high-velocity exercise are effective rehabilitation techniques. Balance control, neuromuscular electrical stimulation, and weight-bearing biofeedback can also be helpful additions to traditional rehabilitation.[152]
- Aquatic therapy improves quadriceps strength, walking speed, stair ascending time, and the use of early hydrotherapy (6 days after surgery with waterproof bandage applied to surgical site, with approval of surgeon) has shown a beneficial effect similar to the use of NSAIDs.[219] Aquatic exercise may offer superior pain relief and functional improvement due to water's properties (buoyancy, hydrostatic pressure, viscosity) and may be considered as a preferred option for early rehab, especially for patients with limited mobility or pain.[220]
- Motor imagery practice, where the patient imagines a maximal voluntary isometric contraction of the quadriceps in addition to physiotherapy, can improve functional mobility (e.g., 15 minutes daily in hospital and 5x/week once home.[160]
- Exercising and participation in moderate and high-level sport activities postoperatively can lead to improved clinical outcomes in elderly patients in term of ROM, KOOS scores, WOMAC index, KSS, pain, and rate of revision. [219]
- Virtual reality assisted rehab can enhance recovery outcomes post-TKR with respect to pain, physical function and stiffness, mobility, balance, and range of motion. [188]
- Balance training with non-immersive virtual reality-based serious games can improve clinical outcomes, gait, and postural outcomes in TKR patients.[187] This is particularly important considering that the TUG score is correlated with fall risk in older people and that activities such as walking and getting up from a chair are common activities of daily living. This approach combined with the conventional treatment can intensify the rehabilitation program, thus potentially enhancing the treatment effect.[187]
- Extended reality interventions (e.g., virtual reality, augmented reality, and mixed reality) can reduce anxiety and enhance engagement. They are most beneficial within the first 2 weeks post-TKR.[185] It has also been shown to reduce pain and improve range of motion, particularly within 2 weeks and 3 months postoperatively.[186]
- Neuromuscular training, resistance training and balance training from the early postoperative period to 8 weeks postoperatively significantly improves range of motion, pain, and function.[130]
- Early initiation of cryotherapy treatment – with application times beginning before surgery through to 12 weeks post-surgery – contributes to functional recovery, avoids complications caused by prolonged immobility, and increases joint range of motion and muscle strength.[130]
- Enhancing conventional post-TKR rehabilitation by incorporating early hip muscle strengthening that especially targets muscles beyond the quadriceps results in greater improvements in pain and specific functional measures (i.e., knee extension range of motion; step test performance; strength of hip flexors, extensors, adductors and external hip rotation). [150]

- OT-led cognitive-behavioral interventions significantly improve patient outcomes in TKR by reducing pain, anxiety, opioid use, and improving functional recovery and facilitates same-day discharge. This in turn can facilitate earlier discharge, which may reduce hospital costs and improve patient satisfaction.[114]
- A standard rehabilitative exercise protocol taught and supervised by peer volunteers in addition to standard physiotherapy started on post-op Day 0 is feasible and safe after TKR and is associated with improved knee flexion range of motion on discharge. The feedback, encouragement, and improved quality of rehabilitative exercise training because of the 1-to-1 presence of trained peer volunteers may be particularly beneficial for a geriatric population.[149]

Total Hip Replacement

- **Initiation**
  - **Class or 1:1 session scheduled at approximately 2-4 weeks post discharge from acute care.**[206]
  - Variation in initiation timeline is to account for differences in surgical practices, patient profiles and other environmental factors (e.g. degree of familiarity with the patient in the Outpatient Rehab setting; patient's geographical proximity for surgical follow-up, service availability in different geographical locations, patient's ability to receive home-care prior to rehabilitative care in outpatient/community clinic, availability of home support and safety concerns, etc.)

- **Duration/Frequency**
  - ***Typical Progression:*** **Average of 4 sessions (group or 1:1 format) will be suitable for the majority of patients post THR.**
  - ***Slower Progression:*** **Some patients may require 1:1 treatment up to 8 sessions after the initial class or follow up session to support exercise progression, provide re-checks and assess need for gait aid(s) and other functional needs.**[206]
  - Personal and external factors need to be identified and considered for their influence on overall dose of rehabilitation.[203]
  - Duration is based on the achievement of functional goals of independence or plateau in progression.[66]
  - Duration of the program and the need for subsequent sessions will vary and is dependent on patient needs.[206]
  - Rehabilitation for hip replacement patients may be limited by surgical restrictions.[66]
- **Format**
  - **Triage into group model vs. 1:1 treatment is based on the assessment of the regulated rehabilitative care professional** with the following considerations where class volumes permit[206]
    - Pre-Surgical Status
      - Longstanding contractures or muscle imbalances
      - Co-morbidities
    - Surgical Complexity
      - Fractures, osteotomy, bone graft reconstruction, non-routine follow-up, infection control practices
    - Social/cultural factors
      - Language barriers, difficulty following instructions, mental health concerns
  - Both 1:1 and individualized group-based exercise programs can be beneficial.[11]

- In regards to function, ROM and health-related Quality of Life, individualized group-based physiotherapy provides similar outcomes as 1:1 physiotherapy, following total joint replacement surgery.[11,21480]
- A model of care, which encourages and empowers patients to self-manage their care.
- Regardless of whether patients are attending individual or group sessions, 1-2 sessions should be used to assess the patient, review educational materials, help patient progress his/her home exercise program, review objectives of rehab with patient and address any concerns.[206]
- In addition to the 1-2 sessions above, some patients may require additional sessions to support progression of the patient's exercise program, provide re-checks, and to assess the need for gait aids and other functional needs.[206]
- The presence of comorbidities may require a more tailored physiotherapy treatment approach with patients following THR as the physical complaints resulting from their comorbidities can play a more prominent role relative to the direct effects of the THR surgery.[**191**]
- Timely communication of the patient's progress should be shared with patient, caregiver and patient's care team

- The goals of rehabilitation during the progressive function phase (e.g., up to the 6th week following THR for patients with minimal pain, i.e., NPRS≤3) according to expert consensus using the Delphi technique are to:[**119**]
  - regain mobility and strength of operated leg and flexibility of lower limb muscles;
  - progress balance and proprioceptive training; initiate lower limb endurance training;
  - normalize functional mobility
- One suggested protocol for rehabilitation in the early postoperative period following THR include the following:[85]

  <u>Days 0–2</u>. Goals: controlling pain, thromboembolic prophylaxis, range of motion recovery, postural verticalization.
  - Bed exercise
    - dorsal and plantar foot flexion
    - quadriceps, gluteus medius and adductor isometric contractions
    - passive mobilization in the allowed range of motion
    - postural transition from sitting to standing
    - walking with crutches or walker, as early as possible.

  <u>Days 3–7</u>. Goals: maintain standing position, gain confidence in the use of crutches and in postural transitions (supine to sitting, sitting to standing).
  - continue with previous exercises
  - introduce concentric contractions (quadriceps, adductor and abductor)
  - walking with crutches, reciprocal pattern

  <u>2–4 weeks</u>. Goals: increasing allowed range of motion and muscular tone, controlling standing position, walking pattern without deficit.
  - continue with previous exercises
  - abductor contraction in standing position

- squat in standing position (<90°)
- elevation on the toes
- bridge exercise
- training on treadmill from the 4th week, earlier if possible
- training in walking with one crutch (contralateral)

5–7 weeks. Goals: absence of pain, regain pre-op lifestyle.

- continue with previous exercises
- free walking in protected situation
- introduce functional exercises like sitting to standing, go up the stairs, climb over obstacles
- balance exercises on unstable boards, walking with changing of speed and direction.

From 8th week

- continue with previous exercises
- increasing ROM and strength
- go on with supervised rehabilitation

- Exercise interventions (e.g., hydrotherapy, and progressive resistance, gait, task-based, upper-limb, and sports therapy training) can significantly improve self-reported physical function, pain intensity and gait velocity following THR in the short term (<6 months). Individuals who undertake exercise within post-THR rehabilitation may return sooner to higher levels of physical functioning compared to those receiving standard care.[192]
- Rehabilitation for patients following THR through proprioceptive technological platforms (e.g., a stabilometric platform) improves static and dynamic balance, which are both crucial for the patient's safety and autonomy.[221]
- Maximal strength training interventions can improve muscle strength more than conventional physiotherapy after THR and strength gains persist for up to 6 months.[124] A combined approach of preoperative and postoperative progressive resistance training yields better and faster improvements in gait, balance, muscle strength, and hip joint function compared to preoperative or postoperative progressive resistance training alone. Targeted muscle training can effectively reverse muscle atrophy on the operated hip with hip muscle strength surpassing baseline levels by approximately three months postoperatively.[121]
- Aquatic exercises are considered safe and an efficacious intervention to improve self-reported function, pain, quality of life and muscle strength. Early initiation (14 days post-op with waterproof bandage applied to surgical site and approval of surgeon) of aquatic therapy is a safe and effective rehabilitation strategy. The rehab protocol should include proprioceptive, coordination, and resistance exercises. Aquatic exercise sessions can be offered for 30-minute sessions, three times per week.[222]
- For patients over 65 years of age, aquatic therapy, ergometer cycling, and fast-track protocols have a beneficial effect on muscle strength, gait speed, and main clinical scores after total hip arthroplasty.[219]

- In the short term, the use of virtual reality exercises (e.g., via Nintendo Wii) in addition to physiotherapy treatment supports improved outcomes in the function, balance, and regularization of the load distributed in the lower extremities, as well as distance covered during walking in these patients. It also can improve coping with environmental challenges, facilitating independence both in activities of daily living and in social participation and reducing the risk of falls.[193]

Simultaneous Bilateral TJR Considerations: Treatment and interventions for simultaneous bilateral TJR patients are similar to the primary unilateral best practices outlined above with the following considerations

- The length of each session, frequency and the duration of rehabilitative care may be adjusted with consideration for the rehabilitative care needs of the bilateral TJR patient. For example:
  - For group therapy, 1 simultaneous bilateral TJR patient may be allotted 2 spots in the group
  - For 1:1 therapy sessions, a simultaneous bilateral TJR patient may be booked for a longer session as compared to a patient with a primary unilateral TJR
  - Duration of outpatient rehabilitation may be extended and frequency adjusted for simultaneous bilateral TJR, as needed

Virtual Care Considerations: Virtual rehab may be recommended for most patients following TJR, but limitations must be considered including: slow recovery, difficulty assessing red flags, equipment barriers, lack of access or digital literacy. A hybrid approach may be advisable. Smartphone applications and wearable devices have shown many benefits, including improved activity levels, optimized pain management, enhanced functional outcomes and accountability, and remote care monitoring.

- A 2 Delphi round consensus panel agreed that telerehabilitation can be recommended for most patients after TKR, but not for patients recovering slowly.[208]
- As most patients undergoing TKR are older adults, a session that educates them on the technical set-up and a trial run of the telerehabilitation under the therapists' supervision is recommended.[47]
- Where mobile technology, such as an app, has been used to facilitate more communication and interaction, patient activation has been shown to be increased and outcomes improved by[50]:
  - Delivering the 'right information at the right time'.
  - Actively integrating patients into the healthcare team and encouraging them to take control of their own care.
- Smartphone application benefits following TKR include improved patient satisfaction, better gait, optimized pain management, cost savings, and enhanced functional outcomes and adherence to protocols.[223]
- There is some evidence that smartphone apps and wearable devices are helpful for monitoring physical activity and patient status after TKR.[224] Comparable patient-reported outcomes have been found at a one-year follow-up period between patients receiving mobile app-based rehabilitation and traditional rehabilitation after both TKR and THR.[55,225] Mobile app-based rehab was also found to demonstrate potentially positive effects on patient's self-efficacy, health-related quality of life and levels of anxiety and depression.[226] However, post-op knee range of motion was found to be better with traditional rehabilitation at the one-year follow-up period.[227]
- Wearable devices are effective in monitoring and analyzing gait and motion. They improve recovery outcomes, enhance return to function, reduce costs, and result in better pain management.[223] Following TKR, wearable sensors can effectively supplement traditional rehabilitation. They improve compliance and monitoring by offering objective data and personalized feedback and enhancing patient engagement and outcomes.[59,60,228,229]

- Following THR, patients who received feedback from a commercial activity tracker or smartphone app had significantly higher activity levels compared to patients who did not receive feedback.[58,230] Technology-assisted rehabilitation, especially telerehabilitation, have been shown to improve the physical function of patients (e.g., Harris score and walk test results) following THR compared to conventional rehabilitation.[42,231]
- The key period for improving postsurgical recovery is immediately post-discharge from acute care. For example, automated text messages improved time spent on home exercises, improved mood, decreased narcotics use and minimized calls to the surgeon's office.[50]
- Hybrid rehab care models which include both in-person and virtual care may also be considered. For example:[232–234]:
    - Virtual assessment with in person follow-up
    - Adjunct virtual exercise programs
    - Text/telephone connection with PT
- Digital technology's rehabilitation limitations should not be ignored (e.g., difficulty in assessing red flags, equipment barriers, problems with reimbursement of telerehabilitation services, medicolegal aspects, a lack of digital literacy and skills, and a lack of access). A few solutions such as a face-to-face visit must be done for complex cases to screen for any red flags or other limiting factors.[234]

Pain

Use multimodal pain management and multimodal pain management education to maximize effect and outcomes.[128] Assess pain using a standardized pain assessment instrument, e.g., The Numeric Pain Rating Scale (NPRS), VAS. Consider strategic use of PRN (as needed) pain medications (i.e., 30-45 minutes prior to assessment/treatment) to maximize participation and improve rehabilitative benefit[165]

- Integrate pain management into care of patient to allow active participation in rehabilitation.[66]
- A biopsychosocial patient education model, including content related to sleep and nutrition, can significantly improve central sensitization syndrome, sleep disturbance, and pain catastrophizing, which are key pain-related risk factors.[167] Pain catastrophizing is currently defined as an exaggerated negative mindset during an actual or anticipated painful experience. Pain catastrophizing is related to central sensitization, which is defined as pain enhancement triggered by modulation of the central nervous system.[129]
- For patients undergoing TKR: Physiotherapy beyond the initial 2 months post-TKR may offer limited benefit for patients with persistent pain. Increased physiotherapy use in patients with ongoing pain does not seem to correlate with improved outcomes. Identifying patients at risk for poor outcomes (e.g., those with high pain catastrophizing) can inform targeted interventions and optimize rehabilitation strategies.[210]
- For patients undergoing TKR, integrating CBT-based pain education into pre- and postoperative care, particularly in the early recovery phase, has been shown to be effective in reducing pain during activity and pain catastrophizing in the first three months post-op, both of which are critical for rehabilitation success.[131] Post-op sessions provided by a physiotherapist occur at post-op Day 2, 5-7 days post-op; and 2 weeks post-op. The content of the course can include the following:[131]
    - Introduce theoretical knowledge related to pain and that the generation of pain is a complicated process, which is affected by thoughts, feelings, and behaviours
    - Provide training skills for coping with pain, including relaxing behaviour, pleasant imagery, attention shifting, etc.

  - Teach how to apply the learned skills to daily life or challenging activities.
- Kinesio taping with post op rehab for TKR showed positive effects on pain, joint swelling and function, but no benefit in pain relief for THR.[168]
- A patient's pain management goals should be related to returning to ADLs/ IADLs.
- Provide individualized multi-modal pain management education[128] (e.g., oral, written, audiovisual, and digital)[166] and resources to patients, including patient and/or family on pain management, and where needed, redirection to the most appropriate health care provider for pain management.
- Educational content should integrate pain management and mobility/exercise support. The use of IT devices (e.g., apps, smartwatches, automated text messaging) significantly enhances the effectiveness of educational interventions.[166]
- Virtual reality-based rehabilitation on patients who have undergone TKR can improve pain and function but not postural control compared to conventional rehabilitation. Examples of virtual reality-based rehabilitation include Nintendo Wii-Fit; interactive virtual telerehabilitation kit; immersive boat-rowing VR environment; virtual exercise rehab assistant; phone-based balance game.[188,194]
- Extended reality interventions (an umbrella term for three different technologies, including virtual reality, augmented reality, and mixed reality[†]) that include both augmented reality and virtual reality is effective as a non-pharmacological adjunct, especially in the acute postoperative phase. Extended reality interventions are most beneficial within the first 2 weeks post-TKR.[185]

Transition Care Planning

Transition plans must be developed and agreed upon in partnership with the patient, their care partner/s and the health care team involved at each point of transition. Plan is provided in writing to the patient & care partner, primary care team and specialists. Consider referral to community resources programs. A communication liaison (such as a discharge planner or navigator) must be designated as part of the circle of care.

- Review therapy goals, treatment expectations, benefits of a healthy, active lifestyle and discharge criteria with patient.
- Communicate to the full care team, including but not limited to the Orthopaedic Surgeon[1] and primary care practitioner.[66]
- Refer to community resources/programs as appropriate (e.g., Arthritis Society, falls prevention clinics (e.g. Stand Up), fitness and wellness centres)
- Provide patient with name, date, and time of next care provider appointment.
- If the patient is discharged to any provider other than the hospital where the surgery was performed, a Discharge Report must be completed, and provided to the receiving care provider. A discharge report should include information such as relevant post-op information (PT and/or MD note) and discharge date; treatment or weight-bearing restrictions; a discharge medication list; and date of follow-up appointment.[83]

[†] Virtual reality can create a virtual 3-D environment and block out visual stimuli from the real world. Augmented reality allows users to see the real world, but overlays with virtual 3-D scene. Mixed reality combines virtual and augmented.

- Discharge Criteria:
  - Functional active ROM (consider pre-op status and lifestyle)
  - Functional strength (consider pre-op status and lifestyle)
  - Independent ambulation (indoors and outdoors, with/without ambulation aid as required – consider pre-op status)
  - Safe transfers as required (home, vehicle)
  - Safe use of stairs, if required
  - Swelling resolved or self-managed; wound healed or self-managed; pain self-managed with/without medications
  - Long-term equipment needs identified; vendors, funding and safe use understood
  - Knowledge of prescribed home exercise program and how to progress his/her prescribed home exercise program.[206]
  - Knowledge of resumption of safe activities and a return to an active lifestyle.
  - Patients are discharged when they have achieved their discharge goals or they have reached a plateau, rather than based on a maximum number of visits.
  - If patient's personal goals exceed the program goals beyond that of a home exercise program, a patient may be referred to a private clinic or other community exercise facilities.

Clinical Outcome Measures

Based on the needs of the patient, range of motion (ROM), strength, gait speed, pain, Patient Reported Outcome Measures (PROMs) and Clinician Reported Outcome Measures (CROMs - aka Performance Outcome Measures) should be measured.

- PROMs and CROMs serve as valuable and complimentary clinical tools after TKR and THR and should not be used interchangeably. They provide a valid basis for interpreting patients' health outcomes across rehab settings and relying on either alone may lead to incomplete or misleading assessments. The integration of both types of measures facilitates more precise monitoring of progress, timely adjustment of rehabilitation strategies, and improved alignment between patient needs and clinical decision-making.[134]
- Performance Outcome Measure Examples:[66,135]
  - 30 Second Chair Stand Test (30CST)
  - Gait Speed (e.g., 4 Metre Walk Test, 10 Metre Walk Test, 6 Minute Walk Test, 40 Metre Fast-paced Walk Test)
  - Berg Balance Scale
  - Timed Up and Go (TUG)
  - Stair Climb Test
  - Functional Reach Test

It is also recommended that both a generic PROM tool and condition-specific PROM tool be utilized. In alignment with the directions of Ontario Health, the EQ-5D-5L and the Oxford Hip & Knee Score should be implemented as part of a provincial community-rehab data collection and reporting system. (For simultaneous bilateral TJR, complete separate Oxford Hip & Knee Score for each joint.)[136]

- Depending on the patient's needs, additional tools may be required to ensure shared decision making and collaborative goal setting.[137]

- Other Patient Reported Outcome Measures Examples[66,135]
    - Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)
    - Lower Extremity Functional Scale (LEFS)
    - Pain Visual Analogue Scale (VAS)/Numeric Pain Rating Scale (NPRS)
    - Hip Disability and Osteoarthritis Outcome Score (HOOS)/ Knee Injury and Osteoarthritis Outcome Score (KOOS)
    - Patient Specific Functional Scale (PSFS)

In-Home Rehabilitative Care

For In-Home Rehabilitation TJR Rehab Resources, please visit: https://rehabcarealliance.ca/in-home-rehabilitation-tjr

An approach of trust, respect and accommodation should be recognized as essential to the provision of equitable and culturally appropriate rehabilitative care.

- Rehabilitative care providers must ensure a safe, inclusive space to provide rehabilitative care with consideration for the patient's intersecting identities, health beliefs, practices and values.[5,65]
- Rehabilitative care providers must use culturally appropriate language and a person-centred, history-taking approach, such as asking open-ended questions and ensuring privacy and confidentiality during interactions with all patients and care partners.[5,65]
- Rehabilitative care providers must learn about the health beliefs, practices and values of the cultural groups they serve and develop culturally responsive knowledge, skills and attitudes.[65]

Considerations

The patient may require a short-term "Transition to Outpatient from Home" service to overcome physical barriers of their home setting (e.g., stairs) in order to attend rehabilitative care in outpatient/community clinic. Patients receiving in-home rehabilitation should be monitored for their progress and regularly reassessed to determine whether their functional goals can be met in an outpatient/community setting outside of the home.

- The rehab setting should be based on the care needs of the patient (e.g., pain level, limitations, mobility, frailty, etc.).
- Coordinated interprofessional rehabilitative care can be more easily provided in a team-based outpatient setting, than an in-home setting. Although home-based rehabilitation boasts significant advantages like convenience, personalized support, and the potential for remote treatments, outpatient rehabilitation has value by offering specific equipment and technique-based treatments. The ideal scenario might be an organic combination of home-based and outpatient rehabilitation, ensuring patients receive optimal support and recovery from multiple fronts. Outcomes can differ based on patient adherence, and the absence of direct supervision might pose risks. Implementing supports, such as telemonitoring, can bolster safety and effectiveness during home-based rehabilitation.[198] When home-based rehab is required, it can provide comparable results to outpatient rehab following TKR.[199,200,235,236]
- Sociodemographic and health factors affecting adherence to home rehabilitation should be considered. Depression is a negative factor while high educational level and social support can improve adherence. Telerehabilitation has a positive effect and reduces the influence of social and economic factors.[237]
- For information on eligibility criteria, refer to Ontario Health atHome: https://ontariohealthathome.ca/home-care/

Patient and Care Partner Engagement/Education

Patients and care partners must be included in the circle of care communication and care planning. Multi-modal education should be provided to patients that can be tailored to their individual preferences and experiences.[65] Education on all of the following topics should be available and reviewed with patient and care partner(s) as appropriate: pain and swelling management (including post-hospital care)[135], mobility, fall prevention, expected progress, caregiving/coaching training, safe activity resumption, including return to sports[171–173],

resume driving[94], principles of healthy lifestyles and active living, provision of resources or referrals to external programs and sources of help (e.g., Arthritis Society), TJR precautions, if applicable.

• Following TJR, patients have stated that they wish to be well informed and coherence of care between the hospital and home care teams.[138,238]
• Designated care partners who provide care to maintain the patient's mental and physical health and who advocate on the person's behalf must be considered essential to rehabilitation and transition care planning and should be allowed to remain with the patient and participate as part of the circle of care.
• Consider use of a Family Centred Empowerment Model. This model provides structured education, psychological support, personalized care planning and continuous follow-up via phone, digital apps and home visits. This empowers primary family caregivers with greater rights to participate in the patient's care, resulting in better post-op outcomes.[239]
• Patient education materials should be developed using plain language as a key strategy for improving health literacy and be compliant with the Accessibility for Ontarians with Disabilities Act (AODA) requirements for accessibility.[68]
• Information given needs to be paced to avoid overload during the preoperative and in-patient stages. Use of technology such as an app on their mobile phone, tablet etc. could support patients to revisit information at their own convenience and time of need.[82]
• Education on all of the following topics should be made available:
  ○ Caregiver/coaching training
  ○ Safe activity resumption
  ○ Mobility and precautions, if applicable
  ○ Expected progress
  ○ Pain Management
  ○ Community Resources
• Education on the principles of a healthy lifestyle and active living should be incorporated into the rehabilitation program. This may include providing resources or referrals to external programs.
• Patient education should reinforce the benefits of ongoing independent participation in exercise.
• Patient education is best accomplished using a combination of methods. When education materials are provided in addition to verbal communication, patient education is more effective.[174]
• Use of health literacy best practices to confirm understanding, such as teach-back and asking open ended questions can support the patient-provider verbal communication.[175]
• Providing quality health information (accurate, accessible, and actionable) enables patients to better manage their health and wellbeing, and make fully informed decisions about their treatment and care.[174]
• Structured postoperative education can address the knowledge gaps that patients have about the procedure, complications, postoperative precautions and self-care activities.[201]

- Principles of healthy lifestyles and active living are incorporated in the rehabilitation program. This may include providing resources or referrals to external programs. Many patients do not increase physical activity post-surgery, highlighting the need for behavioral interventions and educating patients about the benefits of physical activity and the risks of sedentary behavior.[87] Educate and encourage patients to manage their own care and become more physically active following TJR surgery in order to achieve health-enhancing benefits associated with regular moderate-intensity exercise. For example, physical therapist-administered physical activity intervention may reduce sedentary time in adults after TKR.[202]
- Providing a Transtheoretical model of health education, beginning on post-op Day 1 for 6 months, improves outcomes in elderly patients post-TKR. The model uses personalized intervention strategies aimed at addressing patients' maladaptive behavior. It seeks to gradually aid patients in altering detrimental behavior and psychological states, establishing appropriate behavior patterns, enhancing their self-management capabilities, and achieving a positive prognosis. The theory has five distinct stages: the pre-intention stage, the intention stage, the preparation stage, the action stage, and the maintenance stage. It addresses kinesiophobia, a known barrier to rehabilitation, by tailoring education to psychological readiness and behavioral stages.[139]
- Integrating self-efficacy-enhancing interventions and early, structured, and sustained support into routine post-THR care improves rehabilitation outcomes. For example, providing four health-coaching telephone follow up calls within 6 months post op (i.e., patients report the number of home exercises they had completed in the previous week, their level of pain, and their mental state; their efforts and successes are encouraged and reinforced) results in better exercise compliance and physical, psychological, and social functions after hip replacement compared with routine care.[141]
- A self-management component should be included in the treatment plan to empower patients to continue post-discharge of rehabilitative care.

Assessment

Assessment should include development of an individualized therapy plan (1:1 or group setting) and goal setting. Outcome measures should include performance measures, self-report measures, and clinical measures.

- Assessments are focused on physical and functional abilities as well as safety at home necessary for daily activities
- Goals need to be established in partnership with the individual, their family/carers and treating health professionals.
- Assessment of function and ADL management with appropriate intervention as required is recommended.
- Assessment of fall risk with appropriate intervention as required is recommended.
- Ensure that a measurement of cognitive status is completed when needed/indicated and the results are considered for potential impact.

Treatment/Interventions

Total Knee Replacement

Initiation

- **Patient care, as defined by delivery of direct services by a PT and/or OT, should be started within 7 days of discharge from acute care or earlier if patient has been identified as high risk. This does not include in-home Care Coordinator assessment or equipment delivery.[240]**

- Postoperatively, patients are evaluated at home within 1-7 days after discharge for a mobility assessment and to identify potential issues that may lead to re-admissions (e.g., concerns with mobility, wound care, general medical issues etc.), and coordinate interventions accordingly.[93]
- First post-discharge patient care visit should be based on patient's need and circumstances (wound care, safety issues or other concerns). The first visit could be needed as early as 24-48 hours but should be no later than 7 days from discharge from acute care.[240]
- While there is no specific target timeframe for initiating outpatient rehabilitation following discharge from an inpatient rehabilitation program, patients who require ongoing rehabilitation should be enrolled in an outpatient or in-home rehab program as soon as it is clinically appropriate.

Frequency

- **Frequency is more intense in the first few weeks (2-3 times per week, as needed[128]) as there is a risk of contracture or loss of range of motion and is based on the progress of the patient.**
- Personal and external factors should be identified and considered for their influence on overall dose of rehabilitation.[15]
- Overall dose of rehabilitation is important for optimal patient outcomes.[206]

Duration

- **Rehabilitation for knee replacement patients includes intensive treatment to achieve range of motion and function up to the first 12 weeks post-surgery if patient is unable to access outpatient clinics.[66]**
- The greatest improvement in knee flexion occurs within the first 6-7 weeks postoperatively.[214]
- Duration is based on the achievement of functional goals of independence or plateau in progression.[66]
- Duration of the program and the need for subsequent sessions will vary and is dependent on patient needs.[206]

Format

- **Model of care which encourages and empowers patients to self-manage their care.**
- Timely communication of the patient's progress should be shared with patient, caregiver and patient's care team.
- Hands-on treatment & manual therapy techniques are required to assist the patient achieve range of motion in the knee.
- Interventions to reduce knee swelling may help improve quadriceps strength and gait speed[212]
- Personal and external factors should be identified and considered for their influence on overall frequency of rehabilitation.[15] For example, physiotherapy beyond the initial 2 months post-TKR may offer limited benefit for patients with persistent pain. Increased physiotherapy use in patients with ongoing pain may not correlate with improved outcomes. Identifying patients at risk for poor outcomes (e.g., those with high pain catastrophizing) can inform targeted interventions and optimize rehabilitation strategies.[210] However, longer durations of exercise therapy may be of more benefit for older adults and those with functional limitations.[211]

- OT-led cognitive-behavioral interventions significantly improve patient outcomes in TKR by reducing pain, anxiety, opioid use, and improving functional recovery.[114]
- Integrating motivational interviewing by trained practitioners into rehabilitation strategies to address emotional and behavioral aspects of recovery can significantly improve both physical adjustment and quality of life post-TKR.[184]

- The integration of mental simulation practices (e.g., (motor imagery, action observation, guided imagery) as adjunctive therapies in post-TKR rehabilitation for patients with knee osteoarthritis has demonstrated significant reduction in pain, significant improvement in quadriceps strength, and improved range of motion and quality of life.[217]
- Combined balance training with general physical therapy has a positive effect on range of motion, static and dynamic balance, gait, functional outcomes and physical quality of life when begun in the acute phase post TKR.[181,218] An example of a combined balance exercise program includes: combined balance exercise with conventional physical therapy for 30 min per session, 5 times a week, for 4 weeks from the 3rd day after TKR.[181]
- Core stability exercises can be more effective compared to routine physical therapy exercises after TKR in making patients active by achieving gain in functional movement and performance of activities.[177] The integration of core exercises improves mobility, balance, and quality of life. This is particularly relevant for older adults as core strengthening may reduce fall risk post-TKR.[178]
- Incorporating proprioception-based exercises in postoperative rehabilitation of TKR patients results in better outcomes (e.g., on 30-second chair-stand, stair climbing and 6-minute walk tests) than routine physiotherapy alone. Prioritizing neuromuscular control is essential for balance. Solely focusing on static and dynamic muscle strengthening does not adequately prepare the artificial joint for daily activities.[182]
- Patients who receive lower extremity active resistance exercise have better clinical effects in terms of pain relief, strength recovery, and knee ROM.[179]
- Combining manual therapy with exercise in postoperative TKR rehabilitation enhances pain relief, functional recovery, patient satisfaction and supports early gains in range of motion more effectively than exercise alone.[183]
- Cryotherapy is a potentially beneficial adjunct in early postoperative rehabilitation following total knee arthroplasty (TKR), particularly for pain management. It also results in improved range of motion. [130]
- Early initiation of cryotherapy treatment – with application times beginning before surgery through to 12 weeks post-surgery – contributes to functional recovery, avoids complications caused by prolonged immobility, and increases joint range of motion and muscle strength.[130]
- Enhancing conventional post-TKR rehabilitation by incorporating early hip muscle strengthening that especially targets muscles beyond the quadriceps results in greater improvements in pain and specific functional measures (i.e., knee extension range of motion; step test performance; strength of hip flexors, extensors, adductors and external hip rotation).[150]
- Virtual reality-based rehabilitation on patients who have undergone TKR can improve pain and function but not postural control compared to conventional rehabilitation. Examples of virtual reality-based rehabilitation include Nintendo Wii-Fit; interactive virtual telerehabilitation kit; immersive boat-rowing VR environment; virtual exercise rehab assistant; phone-based balance game.[188,194]
- Extended reality interventions (e.g., virtual reality, augmented reality, and mixed reality) can reduce anxiety and enhance engagement. They are most beneficial within the first 2 weeks post-TKR.[185] It has also been shown to reduce pain and improve range of motion, particularly within 2 weeks and 3 months postoperatively.[186]
- Balance training with non-immersive virtual reality-based serious games can improve clinical outcomes, gait, and postural outcomes in TKR patients. This is particularly important considering that the TUG score is correlated with fall risk in older people and that activities such as walking and getting up from a chair are common activities of daily living. This approach combined with the conventional treatment can intensify the rehabilitation program, thus potentially enhancing the treatment effect.[187]

Total Hip Replacement

- **Initiation**
  - **Patient care, as defined by delivery of direct services by a PT and/or OT should be started within 7 days of discharge from acute care. This does not include in-home Care Coordinator assessment or equipment delivery. High risk patients should be identified as per normal hospital process for earlier initiation of service.**[240]
  - First post-discharge visit should be based on patient's need and circumstances (wound care, safety issues or other concerns). The first visit could be needed as early as 24-48 hours but should be no later than 7 days from discharge from acute care.[240]
  - An accelerated physiotherapy protocol starting on postoperative Day 1 after total hip arthroplasty (i.e., 3 sessions/day, gait training) leads to earlier mobilization, greater short-term muscle strength, and reduced hospital length of stay, without compromising safety.[162]
- **Frequency**
  - **Typical number of visits is once per week in the first few weeks and then based on the progress of the patient thereafter**.
  - Personal and external factors should be identified and considered for their influence on overall dose of rehabilitation.[15]
- **Format**
  - **Model of care which encourages and empowers patients to self-manage their care should be considered.**
  - Timely communication of the patient's progress should be shared within the patient's circle of care.
- **Duration**
  - **The typical maximum duration of therapy is up to 12 weeks if patient is unable to access outpatient clinic.**
  - Duration is based on the achievement of functional goals of independence or plateau in progression.
  - Duration of the program and the need for subsequent sessions will vary and is dependent on patient needs.[206]
- The goals of rehabilitation during the progressive function phase (e.g., up to the 6th week following THR for patients with minimal pain, i.e., NPRS≤3) according to expert consensus using the Delphi technique are to:[119]
  - regain mobility and strength of operated leg and flexibility of lower limb muscles
  - progress balance and proprioceptive training; initiate lower limb endurance training
  - normalize functional mobility
- One suggested protocol for rehabilitation in the early postoperative period following THR include the following:[85]

  Days 0–2. Goals: controlling pain, thromboembolic prophylaxis, range of motion recovery, postural verticalization.
  - Bed exercise
    - dorsal and plantar foot flexion
    - quadriceps, gluteus medius and adductor isometric contractions
    - passive mobilization in the allowed range of motion
    - postural transition from sitting to standing
    - walking with crutches or walker, as early as possible.

  Days 3–7. Goals: maintain standing position, gain confidence in the use of crutches and in postural transitions (supine to sitting, sitting to standing).

- continue with previous exercises
- introduce concentric contractions (quadriceps, adductor and abductor)
- walking with crutches, reciprocal pattern

Weeks 2–4. Goals: increasing allowed range of motion and muscular tone, controlling standing position, walking pattern without deficit.

- continue with previous exercises
- abductor contraction in standing position
- squat in standing position (<90°)
- elevation on the toes
- bridge exercise
- training on treadmill from the 4th week, earlier if possible
- training in walking with one crutch (contralateral)

Weeks 5–7. Goals: absence of pain, regain pre-op lifestyle.

- continue with previous exercises
- free walking in protected situation
- introduce functional exercises like sitting to standing, go up the stairs, climb over obstacles
- balance exercises on unstable boards, walking with changing of speed and direction.

Week 8 & Onward

- continue with previous exercises
- increasing ROM and strength

- Exercise interventions (e.g., hydrotherapy, progressive resistance, gait, task-based, upper-limb, and sports therapy training) can significantly improve self-reported physical function, pain intensity and gait velocity following THR in the short term (<6 months). Individuals who undertake exercise within post-THR rehabilitation may return sooner to higher levels of physical functioning compared to those receiving standard care.[192]
- The presence of comorbidities may require a more tailored physiotherapy treatment approach with patients following THR as the physical complaints resulting from their comorbidities can have a more prominent role relative to the direct effects of the THR surgery.[191]
- Maximal strength training interventions can improve muscle strength more than conventional physiotherapy after THR and strength gains persist for up to 6 months.[124] A combined approach of preoperative and postoperative progressive resistance training yields better and faster improvements in gait, balance, muscle strength, and hip joint function compared to preoperative or postoperative progressive resistance training alone. Targeted muscle training can effectively reverse muscle atrophy on the operated hip with hip muscle strength surpassing baseline levels by approximately three months postoperatively.[121]

- Motor imagery practice, where the patient imagines a maximal voluntary isometric contraction of the quadriceps in addition to physiotherapy, can improve functional mobility (e.g., 15 minutes daily in hospital and 5x/week once home).[160]

Virtual Care Considerations: Virtual Rehab may be recommended for most patients following TJR, but limitations must be considered including: slow recovery, difficulty assessing red flags, equipment barriers, lack of access or digital literacy. A hybrid approach may be advisable. Smartphone applications and wearable devices have shown many benefits, including improved activity levels, optimized pain management, enhanced functional outcomes and accountability, and remote care monitoring.

- Where mobile technology, such as an app, has been used to facilitate more communication and interaction, patient activation has been shown to be increased and outcomes improved by[50]:
  - Delivering the 'right information at the right time'.
  - Actively integrating patients into the healthcare team and encouraging them to take control of their own care.
- The key period for improving postsurgical recovery is immediately post-discharge from acute care. For example, automated text messages improved time spent on home exercises, improved mood, decreased narcotics use and minimized calls to the surgeon's office.[50]
- A digital pre and postoperative physiotherapy program delivered via digital application can be a useful option for remote patients undergoing TKR. Once discharged home, patients complete a daily, individualized, and progressive rehabilitation exercise program via the digital application on their tablet. Daily pain scores and compliance are recorded. Additionally, twice a week, patients participate in a 30-minute telehealth video consultation where the physiotherapist reviews their pain, swelling, function, daily well-being, as well as monitoring physical outcome measures, such as gait, knee range of motion and functional activities.[126]
- As most patient undergoing TKR are older adults, a session that educates them on the technical set-up and a trial run of the telerehabilitation under the therapist's supervision is recommended.[47]
- There is some evidence that smartphone apps and wearable devices are helpful for monitoring physical activity and patient status after TKR.[224]
- Comparable patient-reported outcomes have been found at a one-year follow-up period between patients receiving mobile app-based rehabilitation and traditional rehabilitation after both TKR and THR.[55,225] Mobile app-based rehab was also found to demonstrate potentially positive effects on patient's self-efficacy, health-related quality of life and levels of anxiety and depression.[226] However, post-op knee range of motion was found to be better with traditional rehabilitation at the one-year follow-up period.[227]
- Wearable devices are effective in monitoring and analyzing gait and motion and improve recovery outcomes, enhance return to function, reduce costs, and result in better pain management.[223] Following TKR, wearable sensors can effectively supplement traditional rehabilitation. They improve compliance and monitoring by offering objective data and personalized feedback and enhancing patient engagement and outcomes.[59,229,241]
- Following THR, patients who received feedback from a commercial activity tracker or smartphone app had significantly higher activity levels compared to patients who did not receive feedback[58,230]. Technology-assisted rehabilitation, especially telerehabilitation, have been shown to improve the physical function of patients (e.g., Harris score and walk test results) following THR compared to conventional rehabilitation.[42,231]
- Remote, in-home clinician-controlled therapy (i.e., with remote device) has been shown to result in lower pain, greater knee range of motion and higher functional scores for over traditional outpatient physiotherapy in early recovery post-TKR.[242]

- Hybrid rehab care models which include both in-person and virtual care may also be considered. For example:[232–234]:
    - Virtual assessment with in person follow-up
    - Adjunct virtual exercise programs
    - Text/telephone connection with PT
- Digital technology's rehabilitation limitations should not be ignored (e.g., difficulty in assessing red flags, equipment barriers, problems with reimbursement of telerehabilitation services, medicolegal aspects, a lack of digital literacy and skills, and a lack of access). A few solutions such as a face-to-face visit must be done for complex cases to screen for any red flags or other limiting factors.[234]
- Telerehabilitation appears to be a feasible and effective strategy for providing remote rehabilitation services and ensuring continuity of care following THR. Clients adhere to the established exercise program and perform exercises regularly.[243,244]

Pain

Use multimodal pain management and multimodal pain management education to maximize effect and outcomes.[128] Assess pain using a standardized pain assessment instrument, e.g., The Numeric Pain Rating Scale (NPRS), VAS. Consider strategic use of PRN (as needed) pain medications (i.e., 30-45 minutes prior to assessment/treatment) to maximize participation and improve rehabilitative benefit[165]

- Integrate pain management into care of patient to allow active participation in rehabilitation.[66]
- A biopsychosocial patient education model, including content related to sleep and nutrition, can significantly improve central sensitization syndrome, sleep disturbance, and pain catastrophizing, which are key pain-related risk factors.[167] Pain catastrophizing is currently defined as an exaggerated negative mindset during an actual or anticipated painful experience. Pain catastrophizing is related to central sensitization, which is defined as pain enhancement triggered by modulation of the central nervous system.[129]
- Provide individualized multi-modal pain management education[128] (e.g., oral, written, audiovisual, and digital)[166] and resources to patients, including patient and/or family on pain management, and where needed, redirection to the most appropriate health care provider for pain management.
- Educational content should integrate pain management and mobility/exercise support. The use of IT devices (e.g., apps, smartwatches, automated text messaging) significantly enhances the effectiveness of educational interventions.[166] For patients undergoing TKR, integrating CBT-based pain education into pre- and postoperative care, particularly in the early recovery phase, has been shown to be effective in reducing pain during activity and pain catastrophizing in the first three months post-op, both of which are critical for rehabilitation success.[131] Post-op sessions provided by a physiotherapist occur at post-op Day 2, 5-7 days post-op; and 2 weeks post-op. The content of the course can include the following:[131]
    - Introduce theoretical knowledge related to pain and that the generation of pain is a complicated process, which is affected by thoughts, feelings, and behaviours
    - Provide training skills for coping with pain, including relaxing behaviour, pleasant imagery, attention shifting, etc.
    - Teach how to apply the learned skills to daily life or challenging activities.
- Kinesio taping with post op rehab for TKR showed positive effects on pain, joint swelling and function, but no benefit in pain relief for THR.[168]

- Virtual reality assisted rehab can enhance recovery outcomes post-TKR with respect to pain, physical function, stiffness, mobility, balance, and range of motion,[188–190] gait and functional independence.[190] Virtual reality modifies pain perception by affecting focus, attention and emotions. It also enhances motivation. Equilibrium training using non-immersive virtual reality-based serious games can enhance gait, postural and clinical results.[190] Virtual reality games have the potential to be a useful tool for patients recovering from knee surgery in terms of motivational rehabilitation.[190]
- Virtual reality integrated with exercise helps reduce pain, kinesiophobia and pain catastrophizing and improves functional outcomes [245]
- Extended reality interventions (an umbrella term for three different technologies, including virtual reality, augmented reality, and mixed reality[‡]) that include both augmented reality and virtual reality is effective as a non-pharmacological adjunct, especially in the acute postoperative phase. Extended reality interventions are most beneficial within the first 2 weeks post-TKR.[185]

Transition Care Planning

Transition plans must be developed and agreed upon in partnership with the patient, their care partner/s and the health care team involved at each point of transition. Plan is provided in writing to the patient & care partner, primary care team, specialists and community rehab care providers and includes list of scheduled follow up community rehab appointments, if applicable. A communication liaison (such as a discharge planner or navigator) must be designated as part of the circle of care.

- There may be a need for equipment and/or assistive devices to be in place within the home to assist with function. These may include but are not limited to[66]:
  - Raised toilet seat/Versa frame
  - Bath seat/chair/bench
  - Grab bars
  - Non-slip surfaces
  - Raised cushion
  - Long-handled Reachers
  - Elastic shoe laces
  - Long handled scrub brush
  - Long handled shoe horn
  - Gait aid
  - Furniture risers
- If patient's personal goals exceed the rehab goals beyond that of a home exercise program, a patient may explore other community resources that best meet his/her needs (e.g., YMCA Program or private services).
- Refer to community resources/programs as appropriate.

[‡] Virtual reality can create a virtual 3-D environment and block out visual stimuli from the real world. Augmented reality allows users to see the real world, but overlays with virtual 3-D scene. Mixed reality combines virtual and augmented.

- Patients are discharged when they have achieved their discharge goals or they have reached a plateau, rather than based on a maximum number of visits.
- If the patient is discharged to any provider other than the hospital where the surgery was performed, a Discharge Report must be completed, and provided to the receiving care provider. A discharge report should include information such as relevant post-op information (PT and/or MD note) and discharge date; treatment or weight-bearing restrictions; a discharge medication list; and date of follow-up appointment.[83]
- Discharge Criteria:
    - If the patient's in-home community rehabilitation is temporary, the discharge criterion is:
        - Patient is able to get in and out of home and vehicle safely to attend outpatient clinic.
    - If the patient's entire rehabilitation is provided in a home environment, the discharge criteria are:
        - Functional active ROM (consider pre-op status and lifestyle)
        - Functional strength (consider pre-op status and lifestyle)
        - Independent ambulation (indoors and outdoors, with/without ambulation aid as required – consider pre-op status)
        - Safe transfer as required (home, vehicle)
        - Safe use of stairs as required
        - Swelling resolved or self-managed; wound healed or self-managed
        - Pain is self-managed with/without medications
        - Long-term equipment needs identified; vendors, funding sources and safe use are understood

Clinical Outcome Measures

Based on the needs of the patient, range of motion (ROM), strength, gait speed, pain, Patient Reported Outcome Measures (PROMs) and Clinician Reported Outcome Measures (CROMs - aka Performance Outcome Measures) should be measured.

- PROMs and CROMs serve as valuable and complimentary clinical tools after TKR and THR and should not be used interchangeably. They provide a valid basis for interpreting patients' health outcomes across rehab settings and relying on either alone may lead to incomplete or misleading assessments. The integration of both types of measures facilitates more precise monitoring of progress, timely adjustment of rehabilitation strategies, and improved alignment between patient needs and clinical decision-making.[134]
- Performance Outcome Measure Examples:[66,135]
    - 30 Second Chair Stand Test (30CST)
    - Gait Speed (e.g., 4 Metre Walk Test, 10 Metre Walk Test, 6 Minute Walk Test, 40 Metre Fast-paced Walk Test)
    - Berg Balance Scale
    - Timed Up and Go (TUG)
    - Stair Climb Test
    - Functional Reach Test

It is also recommended that both a generic PROM tool and condition-specific PROM tool be utilized. In alignment with the directions of Ontario Health, the EQ-5D-5L and the Oxford Hip & Knee Score should be implemented as part of a provincial community-rehab data collection and reporting system. (For simultaneous bilateral TJR, complete separate Oxford Hip & Knee Score for each joint.)[136]

• Depending on the patient's needs, additional tools may be required to ensure shared decision making and collaborative goal setting.[137]
• Other Patient Reported Outcome Measures Examples[66,135]
  ○ Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)
  ○ Lower Extremity Functional Scale (LEFS)
  ○ Pain Visual Analogue Scale (VAS)/Numeric Pain Rating Scale (NPRS)
  ○ Hip Disability and Osteoarthritis Outcome Score (HOOS)/ Knee Injury and Osteoarthritis Outcome Score (KOOS)
  ○ Patient Specific Functional Scale (PSFS)

Please Note:

As per the Physiotherapy Act 1991, the practice of physiotherapy is the assessment of neuromuscular, musculoskeletal and cardio respiratory systems, the diagnosis of diseases or disorders associated with physical dysfunction, injury or pain and the treatment, rehabilitation and prevention or relief of physical dysfunction, injury or pain to develop, maintain, rehabilitate or augment function and promote mobility. Where a physiotherapist is not otherwise available, assessment and treatment may be provided by another regulated rehabilitative care professional with experience and expertise with this patient population to determine the breadth of deficits and intensity of rehabilitation required and to provide orthopaedic assessment and treatment. While most of the current evidence supports rehabilitation provided by a physiotherapist, it is acknowledged that in the province of Ontario, kinesiologists are registered professionals. Therefore, kinesiologists with knowledge and clinical experience in arthritis and TJR surgery may also provide rehab for patients with hip and knee replacement. The Kinesiology Act, 2007 defines their scope of practice as "the assessment of human movement and performance, and its rehabilitation and management to maintain, rehabilitate, or enhance movement and performance."

Best Practice References

1. Health Quality Ontario & Ministry of Health and Long-Term Care. Quality-Based Procedures: Clinical Handbook for Primary Hip and Knee Replacement. *http://www.hqontario.ca/Portals/0/Documents/evidence/clinical-handbooks/hip-knee-140227-en.pdf* (2013).

2. Ontario Health. Equity, Inclusion, Diversity and Anti-Racism Framework. *https://www.ontariohealth.ca/sites/ontariohealth/files/2020-12/Equity%20Framework.pdf* (2021).

3. Bove, A. *et al.* Beyond Discharge Disposition: A Scoping Review on Sociodemographic Disparities in Rehabilitation Use After Hip and Knee Arthroplasty. *PTJ: Physical Therapy & Rehabilitation Journal* **104**, 1–12 (2024).

4. Cancer Care Ontario. Equity in Engagement Framework. *https://hqontario.ca/Portals/0/documents/pe/cco-equity-in-engagement-framework.pdf* Preprint at (2018).

5. RNAO. Promoting 2SLGBTQI+ Health Equity. *https://rnao.ca/sites/rnaoca/files/bpg/2SLGBTQI_BPG_June_2021.pdf* (2021).

6. Ontario Centres for Learning, R. & I. in L.-T. C. Embracing Diversity: A Toolkit for Supporting Inclusion in Senior Living. *https://clri-ltc.ca/files/2020/03/Retirement-Version_Embracing-Diversity-Toolkit_20210415.pdf* Preprint at (2020).

7. Ontario Health Quality. *Quality Standard: Osteoarthritis: Care for Adults With Osteoarthritis of the Knee, Hip, Hand, or Shoulder*. (2024).

8. GLA:D Canada. Managing Hip & Knee Osteoarthritis. *https://gladcanada.ca/* (2022).

9. Health Quality Ontario. *Physiotherapy Rehabilitation after Total Knee or Hip Replacement OHTAC Recommendation Physiotherapy Rehabilitation after Total Knee or Hip Replacement*. (2005).

10. Waddell, J. P. & Frank, C. *Hip and Knee Replacement Surgery Toolkit. Bone & Joint Canada. VP* (2011).

11. Coulter CL, Weber JM & Scarvell JM. Group physiotherapy provides similar outcomes for participants after joint replacement surgery as 1-to-1 physiotherapy: a sequential cohort study. *Arch Phys Med Rehabil* **90**, 1727–1733 (2009).

12. Ko V, et al. One-to-one therapy is not superior to group or home-based therapy after total knee arthroplasty: a randomized, superiority trial. *J Bone Joint Surg Am* **95**, 1942–1949 (2013).

13. Khan, F., Ng, L., Gonzalez, S., Hale, T. & Turner-Stokes, L. Multidisciplinary rehabilitation programmes following joint replacement at the hip and knee in chronic arthropathy. *Cochrane Database of Systematic Reviews* Preprint at https://doi.org/10.1002/14651858.CD004957.pub3 (2008).

14. Hurley MV & Walsh N. Effectiveness and clinical applicability of integrated rehabilitation programs for knee osteoarthritis. *Curr. Opin. Rheumatol.* **21**, 171–176 (2009).

15. Westby, M., Brittain A. & Backman C. Expert consensus on best practices for post-acute rehabilitation after total hip and knee arthroplasty; a Canada and United States delphi study. *Arthritis Care Res. (Hoboken).* **6**, (2014).

16. Issa, K. *et al.* Evaluation of patient satisfaction with physical therapy following primary THA. *Orthopedics* **36**, (2013).

17. Debbi, E. M. *et al.* Same-Day Discharge Total Hip and Knee Arthroplasty: Trends, Complications, and Readmission Rates. *J. Arthroplasty* **37**, 444-448.e1 (2022).

18. Crawford, D. A. *et al.* Is an "Outpatient Arthroplasty Risk Assessment Score" Needed for Predicting Safe Selection of Outpatient Arthroplasty Candidates? *Journal of Arthroplasty* **38**, 13–17 (2023).

19. Prinsloo, R.-M. & Keller, M. M. Same-day discharge after early mobilisation and increased frequency of physiotherapy following hip and knee arthroplasty. *South African Journal of Physiotherapy* **78**, 1755 (2022).

20. Patel, O. V & Scuderi, G. R. Update on current enhanced recovery after surgery (ERAS) pathways for hip and knee arthroplasty: a review of the literature. *Curr. Orthop. Pract.* **33**, 178–185 (2022).

21. Xu, S. *et al.* Enhanced recovery after day surgery total knee arthroplasty, the new standard of care: An Asian perspective. *Knee* **44**, 158–164 (2023).

22. Mouli, V. H. *et al.* Post-Operative Remote Monitoring for Same-Day Discharge Elective Orthopedic Surgery: A Pilot Study. *Sensors (Basel)* **21**, (2021).

23. Bradbury, T. L. *et al.* A Remote Physical Therapy Program Demonstrates Similar Outcomes Compared to In-Person, Supervised Physical Therapy After Same-Day Discharge Total Knee Arthroplasty: A Randomized Clinical Trial. *J. Arthroplasty* https://doi.org/https://dx.doi.org/10.1016/j.arth.2024.05.040 (2024) doi:https://dx.doi.org/10.1016/j.arth.2024.05.040.

24. Bodrogi, A., Dervin, G. F. & Beaulé, P. E. Management of patients undergoing same-day discharge primary total hip and knee arthroplasty. *Can. Med. Assoc. J.* **192**, E34–E39 (2020).

25. Pansard, E. *et al.* Can primary total hip arthroplasty be performed in an outpatient setting? Prospective feasibility and safety study in 321 patients in a day-surgery unit. *Orthopaedics and Traumatology: Surgery and Research* **106**, 551–555 (2020).

26. Bric, J. D. *et al.* Outpatient total hip and knee arthroplasty - Patient expectations versus experience. *J. Orthop.* **51**, 109–115 (2024).

27. Ontario Health. Recommendations for Regional Health Care Delivery during the COVID-19 Pandemic: Outpatient Care, Primary Care, and Home and Community Care. (2020).

28. Eichler, S. *et al.* The effectiveness of telerehabilitation as a supplement to rehabilitation in patients after total knee or hip replacement: Randomized controlled trial. *JMIR Rehabil. Assist. Technol.* **6**, (2019).

29. Shukla, H., Nair, S. & Thakker, D. Role of telerehabilitation in patients following total knee arthroplasty: Evidence from a systematic literature review and meta-analysis. *J. Telemed. Telecare* **23**, 339–346 (2017).

30. Jiang, S., Xiang, J., Gao, X., Guo, K. & Liu, B. The comparison of telerehabilitation and face-to-face rehabilitation after total knee arthroplasty: A systematic review and meta-analysis. *J. Telemed. Telecare* **24**, 257–262 (2018).

31. Piqueras, M. *et al.* Effectiveness of an interactive virtual telerehabilitation system in patients after total knee arthoplasty: A randomized controlled trial. *J. Rehabil. Med.* **45**, 392–396 (2013).

32. Wang, Q., Lee, R. L. T., Hunter, S. & Chan, S. W.-C. The effectiveness of internet-based telerehabilitation among patients after total joint arthroplasty: An integrative review. *Int. J. Nurs. Stud.* **115**, 103845 (2021).

33. Mohammadi, S., Miller, W. C., Wu, J., Pawliuk, C. & Robillard, J. M. Effectiveness of eHealth Tools for Hip and Knee Arthroplasty: A Systematic Review. *Frontiers in rehabilitation sciences* **2**, 696019 (2021).

34. McKeon, J. F. *et al.* Expanding Role of Technology in Rehabilitation After Lower-Extremity Joint Replacement: A Systematic Review. *JBJS Rev.* **9**, 16 (2021).

35. Bäcker, H. C. *et al.* A Review of Functional Outcomes after the App-Based Rehabilitation of Patients with TKA and THA. *J. Pers. Med.* **12**, 1342 (2022).

36. Ouendi, N., Avril, E., Dervaux, B., Pudlo, P. & Wallard, L. Effectiveness of Telerehabilitation Programs in Elderly with Hip or Knee Arthroplasty: A Systematic Review. *Telemed. J. E. Health.* **30**, 1507EP – 1521 (2024).

37. Pua, Y. H. *et al.* Cost and outcomes of Hospital-based Usual cAre versus Tele-monitor self-directed Rehabilitation (HUATR) in patients with total knee arthroplasty: a randomized, controlled, non-inferiority trial. **32**, 601 (2024).

38. Zhao, R. *et al.* A Smartphone Application-Based Remote Rehabilitation System for Post-Total Knee Arthroplasty Rehabilitation: a Randomized Controlled Trial. **39**, 575 (2024).

39. Prvu Bettger, J. *et al.* Effects of Virtual Exercise Rehabilitation In-Home Therapy Compared with Traditional Care After Total Knee Arthroplasty. *Journal of Bone and Joint Surgery* **102**, 101–109 (2020).

40. Crawford, D. et al. Early outcomes of primary total hip arthroplasty with use of a smartphone-based care platform: a prospective randomized controlled trial. *Bone Joint J.* **103-B**, 91–97 (2021).

41. Nelson, M., Russell, T., Crossley, K., Bourke, M. & McPhail, S. Cost-effectiveness of telerehabilitation versus traditional care after total hip replacement: a trial-based economic evaluation. **27**, 359 (2021).

42. Nelson, M., Bourke, M., Crossley, K. & Russell, T. Telerehabilitation is non-inferior to usual care following total hip replacement - a randomized controlled non-inferiority trial. **107**, 19 (2020).

43. Tripuraneni, K. R., Foran, J. R. H., Munson, N. R., Racca, N. E. & Carothers, J. T. A Smartwatch Paired With A Mobile Application Provides Postoperative Self-Directed Rehabilitation Without Compromising Total Knee Arthroplasty Outcomes: A Randomized Controlled Trial. *J. Arthroplasty* **36**, 3888–3893 (2021).

44. Şahin, A., Agar, A. & Erturk, C. The effect of telerehabilitation on early outcomes in patients undergoing primary total knee replacement: A prospective randomized study. *Journal of Surgery and Medicine* **6**, 139–143 (2022).

45. Liu, X. *et al.* Efficacy of telerehabilitation for total knee arthroplasty: a meta-analysis based on randomized controlled trials combined with a bibliometric study. *J. Orthop. Surg. Res.* **19**, 874 (2024).

46. Zhou, Z. *et al.* Effectiveness of tele-rehabilitation after total hip replacement: a systematic review and meta-analysis of randomized controlled trials. *Disabil. Rehabil.* **46**, 4611–4616 (2024).

47. Tsang, M. P. *et al.* The effectiveness of telerehabilitation in patients after total knee replacement: A systematic review and meta-analysis of randomized controlled trials. *J. Telemed. Telecare* **30**, 795–808 (2024).

48. Zhang, H. *et al.* Home-based tele-rehabilitation versus hospital-based outpatient rehabilitation for pain and function after initial total knee arthroplasty: A systematic review and meta-analysis. *Medicine* **102**, 1–8 (2023).

49. Wang, Q., Lee, R. L., Hunter, S., Zhu, A. & Chan, S. W. Patient Engagement in a Mobile App-Based Rehabilitation Program for Total Hip or Knee Arthroplasty: secondary Data Analysis of a Randomized Controlled Trial. **12**, e57635- (2024).

50. Wolfstadt, J. I., Soong, C. & Ward, S. E. Improving patient outcomes following total joint arthroplasty: is there an app for that? *BMJ Qual. Saf.* **28**, 775–777 (2019).

51. Hoogland, J. *et al.* Feasibility and patient experience of a home-based rehabilitation program driven by a tablet app and mobility monitoring for patients after a total hip arthroplasty. *JMIR Mhealth Uhealth* **7**, (2019).

52. Antón, D., Nelson, M., Russell, T., Goñi, A. & Illarramendi, A. Validation of a Kinect-based telerehabilitation system with total hip replacement patients. *J. Telemed. Telecare* **22**, 192–197 (2016).

53. Li, K. Y. *et al.* The role of telemedicine in joint replacement surgery? An updated review. *Arthroplasty* **5**, 39 (2023).

54. Özden, F. & Sarı, Z. The effect of mobile application-based rehabilitation in patients with total knee arthroplasty: A systematic review and meta-analysis. *Arch. Gerontol. Geriatr.* **113**, 105058 (2023).

55. Alexander, J. S. *et al.* Use of a smartphone-based care platform after primary partial and total knee arthroplasty: 1-year follow-up of a prospective randomized controlled trial. **38**, S208- (2023).

56. Zhang, W. *et al.* Patients' needs and experiences of telerehabilitation after total hip and knee arthroplasty: A qualitative systematic review and meta-synthesis. *Digit. Health* **10**, 20552076241256756- (2024).

57. Bahadori, S., Collard, S., Williams, J. M. & Swain, I. A review of current use of commercial wearable technology and smartphone apps with application in monitoring individuals following total hip replacement surgery. *J. Med. Eng. Technol.* **44**, 324–333 (2020).

58. Babaei, N., Hannani, N., Dabanloo, N. J. & Bahadori, S. A Systematic Review of the Use of Commercial Wearable Activity Trackers for Monitoring Recovery in Individuals Undergoing Total Hip Replacement Surgery. *Cyborg and bionic systems (Washington, D.C.)* **2022**, 9794641 (2022).

59. Hameed, D. *et al.* Integrating Smartphone Applications and Wearable Devices for Postoperative Rehabilitation in Total Knee Arthroplasty: A Critical Review. *Journal of Arthroplasty* **39**, 2028EP-2039.e1 (2024).

60. Duong, V. *et al.* Combined Digital Interventions for Pain Reduction in Patients Undergoing Knee Replacement: a Randomized Clinical Trial. **6**, e2333172- (2023).

61. Irish Society of Chartered Physiotherapists. Guide for treating older people post COVID-19 in hospital, post-acute care and the community. (2020).

62. Ontario Health. Pan-LHIN Guidelines for Virtual Home Care. (2020).

63. St. Joseph's Care Group Thunder Bay. Tele-Rehab: Practical tips for using telemedicine to conduct remote rehabilitation consultations.

64. Davies, L. *et al.* An international core capability framework for physiotherapists to deliver quality care via videoconferencing: a Delphi study. *J. Physiother.* **67**, 291–297 (2021).

65. Stanford School of Medicine. Culturally Appropriate Geriatric Care: Promoting Cross-Cultural Understanding. *https://geriatrics.stanford.edu/ethnomed/hmong/understanding.html* (2021).

66. Bone and Joint Canada. Hip and Knee Replacement Toolkit. *http://boneandjointcanada.com/wp-content/uploads/2014/05/11-2821-RR_HipKnee_Replacement_Toolkit_V3.pdf* (2011).

67. Kim, T. W. & Kim, S. H. Effectiveness of patient education on total knee arthroplasty: A systematic review and meta-analysis. *Journal of Clinical Nursing* vol. 32 2383–2398 Preprint at https://doi.org/10.1111/jocn.16324 (2023).

68. *Accessibility for Ontarians Act*. *https://www.ontario.ca/laws/statute/05a11* (2005).

69. Hardy, A. *et al.* Comparing ERAS-outpatient versus standard-inpatient hip and knee replacements: a mixed methods study exploring the experience of patients who underwent both. *BMC Musculoskelet. Disord.* **22**, (2021).

70. Patel, S. & Buller, L. T. Outpatient Hip and Knee Arthroplasty Can be Safe in Patients With Multiple Medical Comorbidities via Use of Evidence-Based Perioperative Protocols. *HSS J.* **20**, 75–82 (2024).

71. Mohammed, N. S. A. E. S. E. A. S. A. S. S. A. Knowledge and Self Care Practices Among Elderly Patients after Total Hip Joint Replacement. *Zagazig Nursing Journal* **18**, 29–39 (2022).

72. Ho, C. J., Chen, Y. T., Wu, H. L., Huang, H. T. & Lin, S. Y. The Effects of a Patient-Specific Integrated Education Program on Pain, Perioperative Anxiety, and Functional Recovery following Total Knee Replacement. *J. Pers. Med.* **12**, (2022).

73. Szilágyiné Lakatos, T., Lukács, B., Nagy, A. C., Jenei, Z. & Veres-Balajti, I. Efficiency of Printed Patient Information Leaflets Written for Total Knee and Hip Arthroplasty Patients to Reduce Their Fear of Surgery. *Geriatrics (Switzerland)* **8**, (2023).

74. Li, R. *et al.* Insight Into the Effect of Hospital-Based Prehabilitation on Postoperative Outcomes in Patients With Total Knee Arthroplasty: A Retrospective Comparative Study. *Arthroplast. Today* **10**, 93–98 (2021).

75. Marques, C. J., Bohlen, K. & Lampe, F. Participation in a Preoperative Patient Education Session Is a Significant Predictor of Better WOMAC Total Index Score and Higher EQ-5D-5L Health Status Index 1 Year After Total Knee and Hip Arthroplasties. *Am. J. Phys. Med. Rehabil.* **100**, 972–977 (2021).

76. Jones, E. D., Davidson, L. J. & Cline, T. W. The Effect of Preoperative Education Prior to Hip or Knee Arthroplasty on Immediate Postoperative Outcomes. *Orthopaedic Nursing* **41**, 4–12 (2022).

77. Pinskiy, M., Lubovsky, O. & Kalichman, L. The effect of a preoperative physical therapy education program on short-term outcomes of patients undergoing elective total hip arthroplasty: A controlled prospective clinical trial. *Acta Orthop. Traumatol. Turc.* **55**, 306–310 (2021).

78. Atabaki, S., Haghani, S., Dorri, S. & Farahani, M. A. The effect of rehabilitation education on anxiety in knee replacement patients. *J. Educ. Health Promot.* **9**, (2020).

79. Mariorenzi, M., Levins, J., Marcaccio, S., Orfanos, A. & Cohen, E. Outpatient Total Joint Arthroplasty: A Review of the Current Stance and Future Direction. *R. I. Med. J. (2013)* **103**, 63–67 (2020).

80. Crawford, A. M., Chen, A. F., Sabeti, A., Jay, J. F. & Shah, V. M. Team Approach: Same-Day Discharge of Patients Undergoing Total Joint Arthroplasty. *JBJS Rev.* **8**, e0176 (2020).

81. A, P. de A. M. *et al.* A new methodology for patient education in total knee arthroplasty: a randomized controlled trial. **32**, 107 (2022).

82. Specht, K., Agerskov, H., Kjaersgaard-Andersen, P., Jester, R. & Pedersen, B. D. Patients' experiences during the first 12 weeks after discharge in fast-track hip and knee arthroplasty – a qualitative study. *Int. J. Orthop. Trauma Nurs.* **31**, 13–19 (2018).

83. GTA Rehab Network. Guidelines for Pre-Admission Rehabilitative Care Processes: Primary, Elective, Unilateral Total Joint Replacement. *https://gtarehabnetwork.ca/wp-content/uploads/2022/08/Guideline_for_Pre-Admission_TJR_Rehab_Processes.pdf* (2019).

84. Naito, K., Matsumoto, M., Andrews, S. N., Mathews, K. & Nakasone, C. K. Can a community hospital successfully transition to outpatient total knee arthroplasty in unselected patients?. *Knee* **41**, 322–328 (2023).

85. Colibazzi, V., Coladonato, A., Zanazzo, M. & Romanini, E. Evidence based rehabilitation after hip arthroplasty. *Hip International* **30**, 20–29.

86. Khatri, C. *et al.* What's important for recovery after a total knee replacement? A systematic review of mixed methods studies. *Arch. Orthop. Trauma Surg.* **144**, 2213–2221 (2024).

87. Latijnhouwers, D. A. J. M. *et al.* Adherence to the Dutch recommendation for physical activity: prior to and after primary total hip and knee arthroplasty. *Disabil. Rehabil.* **46**, 2862–2870 (2024).

88. Konopka, J. et. al. Risk Assessment Tools Used to Predict Outcomes of Total Hip and Total Knee Arthroplasty. *Orthopedic Clinics of North America* **46**, (2015).

89. Jette, D. U. *et al.* Physical Therapist Management of Total Knee Arthroplasty. *Phys. Ther.* **100**, 1603–1631 (2020).

90. Ochandorena-Acha, M., Escribà-Salvans, A., Hernández-Hermoso, J. A. & Terradas-Monllor, M. Perioperative experiences of patients with high pain catastrophizing and knee arthroplasty after receiving or not preoperative physiotherapy: qualitative study. **70**, 102918 (2024).

91. North East Specialized Geriatric Centre. Baseline Functional Status. *http://rehabcarealliance.ca/uploads/File/Initiatives_and_Toolkits/Frail_Seniors/NESGC_-_Baseline_Functional_Status.pdf* (2021).

92. Australian Health Service Alliance. Risk Assessment and Prediction Tool (RAPT). *https://www.ahsa.com.au/web/patient_info/rapt_form/download* · (2017).

93. Menon, N. *et al.* Outpatient, Home-Based Physical Therapy Promotes Decreased Length of Stay and Post-Acute Resource Utilization After Total Joint Arthroplasty. *Journal of Arthroplasty* **35**, 1968–1972 (2020).

94. Westby, M. Rehabilitation and Total Joint Arthroplasty. *Clin Geriatr Med* **28**, 489–508 (2012).

95. Weyker, P. D. & Webb, C. A.-J. Establishing a patient centered, outpatient total joint home recovery program within an integrated healthcare system. *Pain Manag.* **10**, 23–41 (2020).

96. Keogh, J. A. J. *et al.* The Effects of Structured Prehabilitation on Postoperative Outcomes Following Total Hip and Total Knee Arthroplasty: An Overview of Systematic Reviews and Meta-analyses of Randomized Controlled Trials. *J. Orthop. Sports Phys. Ther.* **55**, 1EP – 22 (2025).

97. Healthcare Excellence Canada. Clinical Pathway for Inpatient and Outpatient Hip and Knee Arthroplasty: Enhanced Recovery Canada: A Collaborative to Improve Surgical Care. *https://www.healthcareexcellence.ca/media/qydkk40o/20220919_erc_hipknee_clinicalpathway_en.pdf* (2021).

98. Ageberg, E., Link, A. & Roos, E. M. Feasibility of neuromuscular training in patients with severe hip or knee OA: The individualized goal-based NEMEX-TJR training program. *BMC Musculoskelet. Disord.* **11**, 126 (2010).

99. Zywiel MG & McGlasson R. *GLA:DTM Canada Implementation and Outcomes: 2019 Annual Report.* . https://gladcanada.ca/ (2020).

100. Sutton, E. L. *et al.* Do pre-operative therapeutic interventions affect outcome in people undergoing hip and knee joint replacement? A systematic analysis of systematic reviews. *Physical Therapy Reviews* **28**, 175–187 (2023).

101. Anderson, A. M. *et al.* Content and delivery of pre-operative interventions for patients undergoing total knee replacement: a rapid review. *Syst. Rev.* **11**, 184 (2022).

102. Su, W., Zhou, Y., Qiu, H. & Wu, H. The effects of preoperative rehabilitation on pain and functional outcome after total knee arthroplasty: a meta-analysis of randomized controlled trials. *J. Orthop. Surg. Res.* **17**, 1–17 (2022).

103. Vasileiadis, D., Drosos, G., Charitoudis, G., Dontas, I. & Vlamis, J. Does preoperative physiotherapy improve outcomes in patients undergoing total knee arthroplasty? A systematic review. *Musculoskeletal Care* **20**, 487–502 (2022).

104. Konnyu, K. J. *et al.* Prehabilitation for Total Knee or Total Hip Arthroplasty: A Systematic Review. *Am. J. Phys. Med. Rehabil.* **102**, 1–10 (2023).

105. Yaqub, A. *et al.* IMPACT OF PREOPERATIVE REHABILITATION ON FUNCTIONAL OUTCOMES FOLLOWING TOTAL KNEE ARTHROPLASTY; A RANDOMIZED CONTROLLED TRIAL. **31**, 1066 (2024).

106. Zhou, Y. & Wang, S. Efficacy of preoperative exercise rehabilitation for patients after total knee arthroplasty: An updated systematic review and meta-analysis. *International Journal of Osteopathic Medicine* **55**, N.PAG-N.PAG (2025).

107. Zhang, W., Lu, X., Yang, N., Zhu, X. & Hu, H. Prehabilitation is effective in relieving pain after knee arthroplasty, but has little effect on length of stay and knee function: a meta-analysis of randomized controlled trials. *Front. Med. (Lausanne).* **12**, 1457407 (2025).

108. Zahed, M. *et al.* A Comparison Between Intensive and Conventional Therapies: A Systematic Review and Meta-Analysis Regarding the Pre-operative Outcomes After Total Knee Replacement. *Cureus* **16**, e75141- (2024).

109. Wang, D. *et al.* A systematic review and meta-analysis of the effect of preoperative exercise intervention on rehabilitation after total knee arthroplasty. *Ann. Palliat. Med.* **10**, 10986EP – 10996 (2021).

110. Zheng, Y. *et al.* The Effect of Preoperative Rehabilitation Training on the Early Recovery of Joint Function after Artificial Total Knee Arthroplasty and Its Effect Evaluation. **2022**, 3860991 (2022).

111. Terradas-Monllor, M. *et al.* Preoperative Home-Based Multimodal Physiotherapy in Patients Scheduled for a Knee Arthroplasty Who Catastrophize About Their Pain: a Randomized Controlled Trial. **14**, (2025).

112. Ohno, C. *et al.* Effect of 3-week preoperative rehabilitation on pain and daily physical activities in patients with severe osteoarthritis undergoing total knee arthroplasty. *Br. J. Pain* **16**, 472EP – 480 (2022).

113. Kim, S., Hsu, F. C., Groban, L., Williamson, J. & Messier, S. A pilot study of aquatic prehabilitation in adults with knee osteoarthritis undergoing total knee arthroplasty - short term outcome. **22**, 388 (2021).

114. Meyer, V., Goble, N. & Hunter, M. M. Enhancing OT's Role in Preoperative Total Joint Education: A Cognitive-Behavioral Approach to Care...American Occupational Therapy Association, INSPIRE Conference, March 31-April 3, 2022, San Antonio, Texas. *American Journal of Occupational Therapy* **76**, 1.

115. Okpara, C. *et al.* Getting fit for hip and knee replacement: the Fit-Joints multimodal intervention for frail patients with osteoarthritis - a pilot randomized controlled trial. **14**, 100028 (2025).

116. Y.-Q., W., G.-B., Q. & J.-F., Y. Impact of preoperative balance training on postoperative functional recovery of patients after total knee arthroplasty: a systematic review and meta-analysis. *Eur. Rev. Med. Pharmacol. Sci.* **28**, 3154EP – 3164 (2024).

117. Vasileiadis, D., Drosos, G., Charitoudis, G., Dontas, I. A. & Vlamis, J. The Efficacy of High-Intensity Preoperative Physiotherapy Training on Postoperative Outcomes in Greek Patients Undergoing Total Knee Arthroplasty: A Quasi-Experimental Study. *Cureus* **14**, e23191- (2022).

118. Gorton, J. H. Introducing Virtual Prehabilitation to a UK Elective Total Hip Replacement service to improve patient outcomes: An overview of the literature and proposed implementation plan. *Journal of Orthopaedics, Trauma & Rehabilitation* **29**, 1–11 (2022).

119. Nandini, V. *et al.* Structured Exercise Program for Hip Arthroplasty: An Expert Consensus Using the Delphi Technique. *Indian J. Orthop.* **59**, 539–548 (2025).

120. Widmer, P., Oesch, P. & Bachmann, S. Effect of Prehabilitation in Form of Exercise and/or Education in Patients Undergoing Total Hip Arthroplasty on Postoperative Outcomes-A Systematic Review. *Medicina (Kaunas)* **58**, (2022).

121. Chen, G. *et al.* A Prospective Randomized Controlled Trial Assessing the Impact of Preoperative Combined with Postoperative Progressive Resistance Training on Muscle Strength, Gait, Balance and Function in Patients Undergoing Total Hip Arthroplasty. **19**, 745 (2024).

122. Holsgaard-Larsen, A., Hermann, A., Zerahn, B., Mejdahl, S. & Overgaard, S. Effects of progressive resistance training prior to total HIP arthroplasty - a secondary analysis of a randomized controlled trial. **28**, 1038 (2020).

123. Svinøy, O. E. *et al.* The effect of prehabilitation for older patients awaiting total hip replacement. A randomized controlled trial with long-term follow up. **26**, 227 (2025).

124. Chui, K. K., Tudini, F., Corkery, M. B. & Yen, S.-C. Power Training in Older Adults With Hip Osteoarthritis and Total Hip Arthroplasty. *Top. Geriatr. Rehabil.* **37**, 28–37 (2021).

125. Sun, J. *et al.* Preoperative high-intensity strength training combined with balance training can improve early outcomes after total knee arthroplasty. *J. Orthop. Surg. Res.* **18**, 1–9 (2023).

126. Hardwick-Morris, M., Carlton, S., Twiggs, J., Miles, B. & Liu, D. Pre- and postoperative physiotherapy using a digital application decreases length of stay without reducing patient outcomes following total knee arthroplasty. *Arthroplasty* **4**, 30 (2022).

127. An, J., Ryu, H. K., Lyu, S. J., Yi, H. J. & Lee, B. H. Effects of Preoperative Telerehabilitation on Muscle Strength, Range of Motion, and Functional Outcomes in Candidates for Total Knee Arthroplasty: a Single-Blind Randomized Controlled Trial. **18**, (2021).

128. Kennedy, D. *et al.* A qualitative study of patient education needs for hip and knee replacement. *BMC Musculoskelet. Disord.* **18**, 413 (2017).

129. Koh, H. S., Choi, Y. H., Park, D. J. & Jeong, M. G. Association Between Pain Catastrophizing and Central Sensitization Among Patients With Severe Knee Osteoarthritis Awaiting Primary Total Knee Arthroplasty. *Orthopedics* **45**, 197–202 (2022).

130. Jin, Z. *et al.* Comparison of Therapeutic Effects of Different Rehabilitation Methods on Patients Undergoing Total Knee Arthroplasty: A Network Meta-Analysis of Randomized Controlled Trials. *Orthop. Surg.* **17**, 348EP – 360 (2025).

131. J-N, S. *et al.* Does cognitive behavioral education reduce pain and improve joint function in patients after total knee arthroplasty? A randomized controlled trial. *International Orthopaedics 2020 Oct;44(10):2027-2035* (2020).

132. Hanley, A. W., Gililland, J. & Garland, E. L. To be mindful of the breath or pain: comparing two brief preoperative mindfulness techniques for total joint arthroplasty patients [with consumer summary]. *Journal of Consulting and Clinical Psychology 2021 Jul;89(7):590-600* (2021).

133. Hanley, A. W. *et al.* Brief preoperative mind-body therapies for total joint arthroplasty patients: a randomized controlled trial. *Pain 2021 Jun;162(6):1749-1757* (2021).

134. Unger, A., Prufer, F., Matko, S., Fischer, M. J. & Grote, V. Same but Different? Exploring the Role of Patient-Reported Outcome Measures and Clinician-Reported Outcome Measures in Postoperative Knee and Hip Arthroplasty Rehabilitation. *J. Clin. Med.* **14**, 2322 (2025).

135. University of British Columbia. Total Joint Arthroplasty and Outcome Measures Toolkit. *https://physicaltherapy.med.ubc.ca/physical-therapy-knowledge-broker/tjaom-toolkit/* (2024).

136. CIHI. PROMs Data Collection Manual: Hip and Knee Arthroplasty . *https://www.cihi.ca/sites/default/files/document/proms-data-collections-manual-2021-en.pdf* (2021).

137. Rehabilitative Care Alliance. *Community-Based Rehabilitation PROM & PREM Selection & Implementation Tool Kit*. https://rehabcarealliance.ca/wp-content/uploads/2025/04/RCA-Community-Based-Rehab-PROM-PREM-Selection-Implementation-Toolkit.pdf (2025).

138. Hardy, A. *et al.* Comparing ERAS-outpatient versus standard-inpatient hip and knee replacements: a mixed methods study exploring the experience of patients who underwent both. *BMC Musculoskelet. Disord.* **22**, 1–11 (2021).

139. Song, L.-X. *et al.* Influence of health education based on the transtheoretical model on kinesiophobia levels and rehabilitation outcomes in elderly patients undergoing total knee arthroplasty. *Heliyon* **10**, e32445- (2024).

140. Atabaki, S., Haghani, S., Dorri, S. & Farahani, M. A. The effect of rehabilitation education on anxiety in knee replacement patients. *J. Educ. Health Promot.* **9**, 115 (2020).

141. Meng, Y. *et al.* Effectiveness of self-efficacy-enhancing interventions on rehabilitation following total hip replacement: a randomized controlled trial with six-month follow-up. **17**, 225 (2022).

142. Accreditation Canada. *Integrated Community Health Services Centres (ICHSC) Surgical/Medical Standard Addendum for Centres Providing Orthopaedic Surgery Rehabilitation Services*. (2025).

143. Foley, D. P., Ghosh, P., Ziemba-Davis, M., Sonn, K. A. & Meneghini, R. M. Predictors of Failure to Achieve Planned Same-Day Discharge after Primary Total Joint Arthroplasty: a Multivariable Analysis of Perioperative Risk Factors. *J. Am. Acad. Orthop. Surg.* **32**, e219–e230 (2024).

144. Rodriguez-Merchan, E. C. Outpatient total knee arthroplasty: is it worth considering?. *EFORT Open Rev.* **5**, 172–179 (2020).

145. Leite, A. G., Vicente, B. B., Cavina, A. P. de S., Mantovani, A. M. & Fregonesi, C. E. P. T. PHYSICAL THERAPY EXERCISE IN EARLY AND LATE POST-OPERATIVE PERIOD OF TOTAL KNEE ARTHROPLASTY: SYSTEMATIC REVIEW WITH META-ANALYSIS...1st Student Scientific Conference of the Brazilian Association for Research and Postgraduate in Physiotherapy (ABRAPG-FT),. *Braz. J. Phys. Ther.* **28**, N.PAG-N.PAG.

146. Thwin, L., Chee, B. R. K., Yap, Y. M. & Tan, K. G. Total knee arthroplasty: does ultra-early physical therapy improve functional outcomes and reduce length of stay? A retrospective cohort study. *J. Orthop. Surg. Res.* **19**, 1–6 (2024).

147. Krampe, P. T., Bendo, A. J. P., Barros, M. I. G., Bertolini, G. R. F. & Buzanello Azevedo, M. R. Cryotherapy in Knee Arthroplasty: Systematic Review and Meta-Analysis. *Ther. Hypothermia Temp. Manag.* **13**, 45–54 (2023).

148. Liang, Z. *et al.* Cryotherapy for Rehabilitation After Total Knee Arthroplasty: A Comprehensive Systematic Review and Meta-Analysis. *Orthop. Surg.* **16**, 2897EP – 2915 (2024).

149. Neoh, E. C. *et al.* Short-Term Effect of Peer Volunteers in Providing Inpatient Rehabilitative Exercises for Patients After Total Knee Arthroplasty. *Arch. Phys. Med. Rehabil.* **102**, 1361–1367 (2021).

150. Khanli, M. M., Akbari, M. & Amiri, A. The Effect of Early Hip-strengthening on Physical Function in Patients With Unilateral Total Knee Arthroplasty. *Arak Medical University Journal* **23**, 912–925 (2021).

151. Jia, Z., Zhang, Y., Zhang, W., Xu, C. & Liu, W. Efficacy and safety of continuous passive motion and physical therapy in recovery from knee arthroplasty: a systematic review and meta-analysis. *J. Orthop. Surg. Res.* 1–9 (2024) doi:10.1186/s13018-024-04536-y.

152. Dutta, S., Ambade, R., Wankhade, D. & Agrawal, P. Rehabilitation Techniques Before and After Total Knee Arthroplasty for a Better Quality of Life. *Cureus* **16**, e54877- (2024).

153. Richter, M., Trzeciak, T. & Kaczmarek, M. Effect of continuous passive motion on the early recovery outcomes after total knee arthroplasty. *Int. Orthop.* **46**, 549EP – 553 (2022).

154. Wirries, N., Ezechieli, M., Stimpel, K. & Skutek, M. Impact of continuous passive motion on rehabilitation following total knee arthroplasty. **25**, e1869- (2020).

155. Riga, M., Altsitzioglou, P., Saranteas, T. & Mavrogenis, A. F. Enhanced recovery after surgery (ERAS) protocols for total joint replacement surgery. *SICOT-J* vol. 9 Preprint at https://doi.org/10.1051/sicotj/2023030 (2023).

156. Liao, X. & Xu, X. The effect of cold therapy combined with ERAS in the postoperative care of patients undergoing total knee arthroplasty. *Am. J. Transl. Res.* **14**, 3154EP – 3163 (2022).

157. Núñez-Cortés, R. *et al.* Acute effects of in-hospital resistance training on clinical outcomes in patients undergoing total knee arthroplasty: a randomized controlled trial. **103**, 401 (2024).

158. Kubota, M. *et al.* Effects of knee extension exercise starting within 4 h after total knee arthroplasty. **32**, 803 (2022).

159. Hara, R., Hiraga, Y., Hirakawa, Y. & Babazono, A. Effects of Integrating Pain Coping Strategies into Occupational Therapy After Total Knee Arthroplasty: A Parallel Mixed-Method Study. *Healthcare (2227-9032)* **13**, 627 (2025).

160. Paravlic, A. H., Maffulli, N., Kovac, S. & Pisot, R. Home-based motor imagery intervention improves functional performance following total knee arthroplasty in the short term: a randomized controlled trial. **15**, 451 (2020).

161. Sivaloganathan, S., Blakeney, W. G. & P.-A., V. Modernizing Total Hip Arthroplasty Perioperative Pathways: The Implementation of ERAS-Outpatient Protocol. *J. Clin. Med.* **11**, 3293 (2022).

162. Marchisio, A. E. *et al.* Accelerated rehabilitation versus conventional rehabilitation in total hip arthroplasty (ARTHA): a randomized double blinded clinical trial. *Rev. Col. Bras. Cir.* **47**, e20202548- (2020).

163. Gotz, J. *et al.* Better early outcome with enhanced recovery total hip arthroplasty (ERAS-THA) versus conventional setup in randomized clinical trial (RCT). *Arch. Orthop. Trauma Surg.* **144**, 439EP – 450 (2024).

164. Deak N & Varacallo MA. Hip Precautions. *Stat Pearls* (2026).

165. McDonough, C. M. *et al.* Physical Therapy Management of Older Adults With Hip Fracture. *Journal of Orthopaedic & Sports Physical Therapy* **51**, CPG1–CPG81 (2021).

166. Kim, T. W. & Kim, S. H. Effectiveness of patient education on total knee arthroplasty: A systematic review and meta-analysis. *J. Clin. Nurs.* **32**, 2383–2398 (2023).

167. Nishimoto, J., Deguchi, N., Tanaka, S., Inoue, Y. & Tanaka, R. Effects of Biopsychosocial Model-Based Patient Education on Pain and Pain-Related Risk Factors After Total Knee Arthroplasty: A Retrospective Propensity Score-Matched Study. *Cureus* **17**, e78707- (2025).

168. Mei, T., Shuai, Y., Wu, D. & Yu, H. Effects of kinesio taping in patients undergoing knee or hip arthroplasty: a systematic review and meta-analysis of randomized controlled trials. *J. Rehabil. Med.* **57**, jrm40784- (2025).

169. GTA Rehab Network. Outpatient Rehab Referral Form. *https://gtarehabnetwork.ca/wp-content/uploads/2026/01/OUTPATIENT-REHAB-REFERRAL-FORM-Final-Fillable.pdf* (2026).

170. Access to Care & Ministry of Health & Long Term Care. *Orthopaedic Quality Scorecard*. (2014).

171. Canadian Orthopaedic Foundation. Patient information, “Get moving, maximizing your activity after hip or knee replacement” . *https://movepainfree.org/wp-content/uploads/Get-Moving-Booklet_2015-EN.pdf* (2015).

172. Vogel L, Carontenuto G, Basti J & Levine W. Physical Activity After Total Joint Arthroplasty. *Sports Health* **3**, 441–450 (2011).

173. Golant A, Christoforou DC, Slover JD, Zuckerman JD & Bull. Athletic participation after hip and knee arthroplasty. *NYU Hosp Jt Dis* **68**, 76–83 (2010).

174. Health Quality Ontario. Evidence Informed Improvement Package – Transitions of Care. *http://www.hqontario.ca/Portals/0/documents/qi/health-links/bp-improve-package-transitions-en.pdf* (2012).

175. Tsai, H. Y., Lee, S. Y. D., Coleman, C., Sørensen, K. & Tsai, T. I. Health literacy competency requirements for health professionals: a Delphi consensus study in Taiwan. *BMC Med. Educ.* **24**, (2024).

176. Rehabilitative Care Alliance. RCA Framework for Bedded Levels of Rehabilitative Care. *https://rehabcarealliance.ca/wp-content/uploads/2023/04/RCA-Framework-for-Bedded-Levels-of-Rehabilitative-Care.pdf* (2023).

177. Warner, S. *et al.* Comparison of routine physical therapy exercises with and without core stability exercises in total knee replacement patients. **45**, 842 (2020).

178. Shetty, S., Maiya, G. A., KG, M. R., Vijayan, S. & George, B. M. Effect of Core Exercises on Clinical and Functional Outcomes After Total Knee Arthroplasty in Individuals With Knee Osteoarthritis: A Systematic Review. *Musculoskeletal Care* **22**, 1–13 (2024).

179. Wei, G., Shang, Z., Li, Y., Wu, Y. & Zhang, L. Effects of lower-limb active resistance exercise on mobility, physical function, knee strength and pain intensity in patients with total knee arthroplasty: a systematic review and meta-analysis. *BMC Musculoskelet. Disord.* **25**, 730 (2024).

180. Hu, X., Jiang, H., Liu, P., Li, Z. & Zhang, R. Continued stepped care model improves early-stage self-report quality of life and knee function after total knee arthroplasty. **32**, 4593 (2024).

181. An, J., Cheon, S. J. & Lee, B. H. The Effect of Combined Balance Exercise on Knee Range of Motion, Balance, Gait, and Functional Outcomes in Acute Phase Following Total Knee Arthroplasty: a Single-Blind Randomized Controlled Trial. **60**, (2024).

182. Palanisamy, Y. *et al.* Does Proprioception-Based Rehabilitation Enhance Functional Outcome in Total Knee Arthroplasty? A Prospective Randomised Study. **58**, 1375 (2024).

183. S, K. A., Celik, D. & Kilicoglu, O. I. The Combination of Exercise and Manual Therapy Versus Exercise Alone in Total Knee Arthroplasty Rehabilitation: a Randomized Controlled Clinical Trial. **13**, 1069 (2021).

184. Kubat Bakir, G. & Göktas, S. The Effects of Motivational Interviews About Activities of Daily Living on Physical Adjustment and Quality of Life in Elderly Total Knee Arthroplasty Patients: A Randomised-Controlled Trial. *Healthcare (2227-9032)* **12**, 2472 (2024).

185. Su, S., Wang, R., Chen, Z., Zhou, F. & Zhang, Y. The effectiveness of extended reality on relieving pain after total knee arthroplasty: a systematic review and meta-analysis of randomized controlled trials. *Arch. Orthop. Trauma Surg.* **144**, 3217EP – 3226 (2024).

186. Su, S., He, J., Wang, R., Chen, Z. & Zhou, F. The Effectiveness of Virtual Reality, Augmented Reality, and Mixed Reality Rehabilitation in Total Knee Arthroplasty: A Systematic Review and Meta-Analysis. *Journal of Arthroplasty* **39**, 582 (2024).

187. Pournajaf, S. *et al.* Effect of balance training using virtual reality-based serious games in individuals with total knee replacement: a randomized controlled trial. **65**, 101609 (2022).

188. H.-W., L. & S.-D., L. Virtual Reality-Assisted Rehabilitation for Patients Undergoing Total Knee Arthroplasty: A Systematic Review and Meta-Analysis. *Am. J. Phys. Med. Rehabil.* (2025) doi:https://dx.doi.org/10.1097/PHM.0000000000002747.

189. Blasco, J. M. *et al.* The efficacy of virtual reality tools for total knee replacement rehabilitation: A systematic review. *Physiother. Theory Pract.* **37**, 682–692 (2021).

190. Nishitha, K., Anitha, A. & Thaheera, D. Effectiveness of Virtual Reality-based Rehabilitation and High-intensity Exercise Program for Total Knee Arthroplasty Patients: a Randomised Controlled Trial. **18**, YC01- (2024).

191. Groot, L. *et al.* Recovery and the use of postoperative physical therapy after total hip or knee replacement. *BMC Musculoskelet. Disord.* **23**, 1–14 (2022).

192. Tang, W., Flavell, C. A., Grant, A. & Doma, K. The effects of exercise on function and pain following total hip arthroplasty: a systematic literature review and meta-analysis. *Physical Therapy Reviews* **27**, 247–266 (2022).

193. Zavala-González, J., Martínez, D. & Gutiérrez-Espinoza, H. Effectiveness of adding virtual reality to physiotherapeutic treatment in patients with total hip arthroplasty. A randomized controlled trial. **36**, 660 (2022).

194. Peng, L., Zeng, Y., Wu, Y., Si, H. & Shen, B. Virtual reality-based rehabilitation in patients following total knee arthroplasty: a systematic review and meta-analysis of randomized controlled trials. *Chin. Med. J. (Engl).* **135**, 153–163 (2021).

195. Khan F, Ng L, Gonzalez S, Hale T & Turner-Stokes L. Multidisciplinary rehabilitation programmes following joint replacement at the hip and knee in chronic arthropathy. *Cochrane Database of Systematic Reviews* **2**, (2008).

196. Quack V, Ippendorf AV & Betsch M, et al. Multidisciplinary rehabilitation and fast-track rehabilitation after knee replacement: faster, better, cheaper? A survey and systematic review of literature. *Rehabilitation* **54**, 245–251 (2015).

197. Christensen, J. C. *et al.* Benefits of direct patient discharge to outpatient physical therapy after total knee arthroplasty. *Disabil. Rehabil.* **42**, 660–666 (2020).

198. Zhao, B., Liu, H., Du, K., Zhou, W. & Li, Y. Effectiveness and safety of outpatient rehabilitation versus home-based rehabilitation after knee arthroplasty: a systematic review and meta-analysis. *J. Orthop. Surg. Res.* **18**, 704 (2023).

199. Hamilton, D. F. *et al.* Targeting rehabilitation to improve outcomes after total knee arthroplasty in patients at risk of poor outcomes: randomised controlled trial. **371**, m3576- (2020).

200. Oldrini, L. M. *et al.* Home-Based vs. Conventional Rehabilitation Following Total Knee Arthroplasty. *Prosthesis (2673-1592)* **7**, 34 (2025).

201. Mohammed, N. S., Abdallah, E. S., Elmohsen, A. S. A. & Shafik, S. A. Knowledge and Self Care Practices Among Elderly Patients after Total Hip Joint Replacement. *Zagazig Nursing Journal* **18**, 29–39 (2022).

202. Coleman, G. *et al.* Does a physical therapist-administered physical activity intervention reduce sedentary time after total knee replacement: An exploratory study? *Musculoskeletal Care* **19**, 142–145 (2021).

203. Webster, F. *et al.* Understanding why people do or do not engage in activities following total joint replacement: a longitudinal qualitative study. *Osteoarthritis Cartilage* **23**, 860–867 (2015).

204. Groen, J. W., Stevens, M., Kersten, R. F. M. R., Reininga, I. H. F. & van den Akker-Scheek, I. After total knee arthroplasty, many people are not active enough to maintain their health and fitness: An observational study. *J. Physiother.* **58**, 113–116 (2012).

205. Harding P, Holland AE, Delany C & Hinman RS. Do activity levels increase after total hip and knee arthroplasty? . *Clin Orthop Relat Res* **472**, 1502e11 (2014).

206. GTA Rehab Network. Outpatient Rehab Process Maps for Total Knee and Total Hip Replacements. *https://drive.google.com/file/d/0By4k4zop-0eOYng4QlNoVFBCcEk/view?pref=2&pli=1* (2014).

207. Mazurek, J., Cieslik, B., Wrzeciono, A., Gajda, R. & Szczepanska-Gieracha, J. Immersive Virtual Reality Therapy Is Supportive for Orthopedic Rehabilitation among the Elderly: a Randomized Controlled Trial. **12**, (2023).

208. Graber, J. *et al.* Expert Consensus for the Use of Outpatient Rehabilitation Visits After Total Knee Arthroplasty: A Delphi Study. *J. Orthop. Sports Phys. Ther.* 1EP – 9 (2023) doi:https://dx.doi.org/10.2519/jospt.2023.11840.

209. Ebert J, Munsie C & Joss B. Guidelines for the Early Restoration of Active Knee Flexion After Total Knee Arthroplasty: Implications for Rehabilitation and Early Intervention. *Archives Of Phys Med & Rehab* **95**, 1135–1140 (2014).

210. Orndahl, C. M., Perera, R. A. & Riddle, D. L. Associations Between Physical Therapy Visits and Pain and Physical Function After Knee Arthroplasty: a Cross-Lagged Panel Analysis of People Who Catastrophize About Pain Prior to Surgery. **101**, (2021).

211. Karimijashni, M. *et al.* Postoperative Rehabilitation Interventions in Patients at Risk of Poorer Outcomes Following Total Knee Arthroplasty: A Systematic Review. *Musculoskeletal Care* **23**, 1–15 (2025).

212. Yong-Hao Pua, P. The Time Course of Knee Swelling Post Total Knee Arthroplasty and Its Associations with Quadriceps Strength and Gait Speed. *J. Arthroplasty* **30**, 1215–1219 (2015).

213. Lenguerrand, E. *et al.* Effect of Group-Based Outpatient Physical Therapy on Function After Total Knee Replacement: results From a Multicenter Randomized Controlled Trial. **72**, 768 (2020).

214. Artz et al. Physiotherapy Provision Following Discharge after Total Hip and Total Knee Replacement: A Survey of Current Practice at High-Volume NHS Hospitals in England and Wales. *Musculoskeletal Care* **11**, (2013).

215. Wainright, A. et al. The Group Experience: Remodeling Outpatient Physiotherapy after Knee Replacement Surgery. *Physiotherapy Canada* **67**, 350–356 (2015).

216. Krumov, J. *et al.* Is group-based physical therapy superior to individual rehabilitation in elderly adults after total knee arthroplasty? A prospective observational study. **32**, (2022).

217. T.-H., L. *et al.* Effectiveness of mental simulation practices after total knee arthroplasty in patients with knee osteoarthritis: A systematic review and meta-analysis of randomized controlled trials. *PLoS One* **17**, e0269296- (2022).

218. Lee, H. G., An, J. & Lee, B. H. The Effect of Progressive Dynamic Balance Training on Physical Function, The Ability to Balance and Quality of Life Among Elderly Women Who Underwent a Total Knee Arthroplasty: a Double-Blind Randomized Control Trial. **18**, (2021).

219. Papalia, R. *et al.* The role of physical activity and rehabilitation following hip and knee arthroplasty in the elderly. *J. Clin. Med.* **9**, 1401 (2020).

220. C.-H., L. & I.-H., K. Aquatic Exercise and Land Exercise Treatments after Total Knee Replacement Arthroplasty in Elderly Women: A Comparative Study. *Medicina (Kaunas)* **57**, (2021).

221. Aprile, I. *et al.* Technological rehabilitation versus conventional rehabilitation following hip replacement: a prospective controlled study. **33**, 561 (2020).

222. Centurião, J. H. V. M. *et al.* Effects of aquatic exercises in patients after total hip arthroplasty: A systematic review. *Physiotherapy Research International* **29**, 1–11 (2024).

223. Gordon, A. M., Nian, P., Baidya, J., Scuderi, G. R. & Mont, M. A. Randomized Controlled Studies on Smartphone Applications and Wearable Devices for Postoperative Rehabilitation after Total Knee Arthroplasty: A Systematic Review. *Journal of Arthroplasty* (2025) doi:https://dx.doi.org/10.1016/j.arth.2025.01.034.

224. Constantinescu, D. *et al.* The role of commercially available smartphone apps and wearable devices in monitoring patients after total knee arthroplasty: a systematic review. *EFORT Open Rev.* **7**, 481EP – 490 (2022).

225. Crawford, D. A. *et al.* Early outcomes of primary total hip arthroplasty with use of a smartphone-based care platform: a prospective randomized controlled trial. **103-B**, 91 (2021).

226. Wang, Q., Hunter, S., Lee, R. L. & Chan, S. W. The effectiveness of a mobile application-based programme for rehabilitation after total hip or knee arthroplasty: a randomised controlled trial. **140**, 104455 (2023).

227. Choudhury, A. K. *et al.* Conventional rehabilitation post-TKA achieves better knee flexion with higher resource utilization compared to application-based rehabilitation - a systematic review and meta-analysis. *J. Orthop.* **44**, 77–85 (2023).

228. King, S. W., Chapman, L. S., Smith, T. J., Palan, J. & Pandit, H. Wearable Sensors to Aid Rehabilitation Following Total Knee Arthroplasty: Experiences of Trial Participants. *Cureus* **17**, e80752- (2025).

229. Backer, H. C. *et al.* A Review of Functional Outcomes after the App-Based Rehabilitation of Patients with TKA and THA. *J. Pers. Med.* **12**, 1342 (2022).

230. Bahadori, S., Collard, S., Williams, J. M. & Swain, I. A review of current use of commercial wearable technology and smartphone apps with application in monitoring individuals following total hip replacement surgery. *J. Med. Eng. Technol.* **44**, 324–333 (2020).

231. Wu, L., Li, X., Hua, L. & Sun, Q. Effects of technology-assisted rehabilitation for patients with hip arthroplasty: A meta-analysis. *Medicine (United States)* **102**, E35921- (2023).

232. Zachwieja, E. *et al.* Web-Based Self-Directed Exercise Program Is Cost-Effective Compared to Formal Physical Therapy After Primary Total Knee Arthroplasty. *J. Arthroplasty* **35**, 2335–2341 (2020).

233. Wang, X., Hunter, D. J., Vesentini, G., Pozzobon, D. & Ferreira, M. L. Technology-assisted rehabilitation following total knee or hip replacement for people with osteoarthritis: a systematic review and meta-analysis. *BMC Musculoskelet. Disord.* **20**, 506 (2019).

234. Raje, S., Shetty, A. G., Shetty, S., Bhuptani, B. & Arun Maiya, G. Application of digital technology in rehabilitation of total knee arthroplasty: A systematic review. *J. Orthop.* **54**, 108–115 (2024).

235. Barker, K. L. *et al.* Home-based rehabilitation programme compared with traditional physiotherapy for patients at risk of poor outcome after knee arthroplasty: the CORKA randomised controlled trial. **11**, e052598- (2021).

236. Barker, K. L. *et al.* Outpatient physiotherapy versus home-based rehabilitation for patients at risk of poor outcomes after knee arthroplasty: CORKA RCT. **24**, 1 (2020).

237. Nuevo, M. *et al.* The influence of sociodemographic and health factors on adherence to home-based rehabilitation after fast-track total knee arthroplasty: secondary analysis of a randomized controlled trial. 1 (2025) doi:https://doi.org/10.1080/09638288.2025.2458191.

238. Wallis, J. A. *et al.* Barriers, enablers and acceptability of homebased care following elective total knee or hip replacement at a private hospital: A qualitative study of patient and caregiver perspectives. *PLoS One* **17**, e0273405- (2022).

239. Liang, H., Hou, J. & Xiong, J. Effect of family-centered empowerment model in home care of older adult patients after total knee arthroplasty. *Journal of Community Health Nursing 2024 Jul-Sep;41(3):162-174* (2024).

240. GTA Rehab Network. Selection of Key Criteria in the MSK Rehab Definitions Framework for TJR. *http://www.gtarehabnetwork.ca/uploads/File/tools/rehab-definitions-conceptual-framework-msk-totaljoint.pdf* (2010).

241. King, S. W. *et al.* 'Wearable Sensors to Guide Remote Rehabilitation Following Knee Arthroplasty Surgery'. *Indian J. Orthop.* **57**, 624–634 (2023).

242. Summers, S. H., Nunley, R. M. & Slotkin, E. M. A Home-Based, Remote-Clinician-Controlled, Physical Therapy Device Leads to Superior Outcomes When Compared to Standard Physical Therapy for Rehabilitation After Total Knee Arthroplasty. *Journal of Arthroplasty* **38**, 497–501 (2023).

243. Hamouzová, D. & Navrátil, L. Effectiveness of telerehabilitation in patients following hip joint arthroplasty. *KONTAKT - Journal of Nursing & Social Sciences related to Health & Illness* **25**, 235–245 (2023).

244. Wijnen, A. *et al.* Effectiveness of a Home-Based Rehabilitation Program After Total Hip Arthroplasty Driven by a Tablet App and Remote Coaching: Nonrandomized Controlled Trial

Combining a Single-Arm Intervention Cohort With Historical Controls. *JMIR Rehabil. Assist. Technol.* **7**, e14139- (2020).

245. Gur, O. & Basar, S. The effect of virtual reality on pain, kinesiophobia and function in total knee arthroplasty patients: a randomized controlled trial. *The Knee 2023 Dec;45:187-197* (2023).

246. Ontario. *Physiotherapy Act*. *https://www.ontario.ca/laws/statute/91p37.* (1991).