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Assessment of Outcomes of Inpatient or Clinic-Based vs Home-Based Rehabilitation After Total Knee Arthroplasty
A Systematic Review and Meta-analysis

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Abstract

IMPORTANCE Recent publication of the largest trials to date investigating rehabilitation after total knee arthroplasty (TKA) necessitate an updated evidence review.

OBJECTIVE To determine whether inpatient or clinic-based rehabilitation is associated with superior function and pain outcomes after TKA compared with any home-based program.

DATA SOURCES MEDLINE, Embase, CINAHL, and PubMed were searched from inception to November 5, 2018. Search terms included *knee arthroplasty*, *randomized controlled trial*, *physiotherapy*, and *rehabilitation*.

STUDY SELECTION Published randomized clinical trials of adults who underwent primary unilateral TKA and commenced rehabilitation within 6 postoperative weeks in which those receiving postacute inpatient or clinic-based rehabilitation were compared with those receiving a home-based program.

DATA EXTRACTION AND SYNTHESIS Two reviewers extracted data independently and assessed data quality and validity according to the PRISMA guidelines. Data were pooled using a random-effects model. Data were analyzed from June 1, 2015, through June 4, 2018.

MAIN OUTCOMES AND MEASURES Primary outcomes were mobility (6-minute walk test [6MWT]) and patient-reported pain and function (Oxford knee score [OKS] or Western Ontario and McMaster Universities Osteoarthritis Index) reported at 10 to 12 postoperative weeks. The GRADE assessment (Grading of Recommendations, Assessment, Development, and Evaluation) was applied to the primary outcomes.

RESULTS Five unique studies involving 752 unique participants (451 [60%] female; mean [SD] age, 68.3 [8.5] years) compared clinic- and home-based rehabilitation, and 1 study involving 165 participants (112 [68%] female; mean [SD] age, 66.9 [8.0] years) compared inpatient and home-based rehabilitation. Low-quality evidence showed no clinically important difference between clinic- and home-based programs for mobility at 10 weeks (6MWT favoring home program; mean difference [MD], −11.89 m [95% CI, −35.94 to 12.16 m]) and 52 weeks (6MWT favoring home program; MD, −25.37 m [95% CI, −47.41 to −3.32 m]). Moderate-quality evidence showed no clinically important difference between clinic- and home-based programs for patient-reported pain and function at 10 weeks (OKS MD, −0.15 [95% CI, −0.35 to 0.05]) and 52 weeks (OKS MD, 0.10 [95% CI, −0.14 to 0.34]).

(continued)

Key Points

Question Is inpatient or clinic-based rehabilitation associated with superior outcomes after total knee arthroplasty compared with home programs?

Findings This systematic review and meta-analysis included 5 unique studies involving 752 unique participants comparing clinic- and home-based rehabilitation and 1 study comparing inpatient rehabilitation with a home-based program. Based on low- to moderate-quality evidence, no associations between settings, no clinically important differences for mobility or patient-reported pain and function at 10 and 52 postoperative weeks, and no significant differences in quality of life or range of motion were found.

Meaning For adults who underwent total knee arthroplasty, clinic or inpatient vs home-based rehabilitation appeared to offer no clinically important advantages.

+ Supplemental content

Author affiliations and article information are listed at the end of this article.

Abstract (continued)

CONCLUSIONS AND RELEVANCE Based on low- to moderate-quality evidence, no superiority of clinic-based or inpatient programs compared with home-based programs was found in the early subacute period after TKA. This evidence suggests that home-based rehabilitation is an appropriate first line of therapy after uncomplicated TKA for patients with adequate social supports.

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Introduction

Total knee arthroplasty (TKA) was the most frequently performed inpatient operating room procedure in the United States in 2012.[1] From 2003 to 2012, the incidence of TKA increased from 145.4 to 223.0 per 100 000 population (a 4.9% mean annual increase), with the total number performed in the United States projected to increase from 711 000 in 2011 to 3.48 million by 2030.[2] Similarly in Australia, the incidence increased from 108.3 per 100 000 population in 2003 to 222.3 per 100 000 population in 2017, with more than 54 000 TKAs performed in 2017.[3]

The increased volume of surgery constitutes a significant burden on the acute health care budget, but because the surgery is typically followed by a protracted rehabilitation period, the latter can add significantly to the cost of care. Several studies[4-6] describe a significant cost differential among rehabilitation pathways involving inpatient rehabilitation after TKA, ranging from a 5-fold to a 26-fold cost differential between a rehabilitation pathway that included inpatient therapy and one that did not despite no differences in outcomes between groups. Concern about the total episode-of-care costs for arthroplasty, including the rehabilitation period, has led to the introduction of bundled payments in the United States, consisting of a single bundled payment to health care organizations for all services related to the TKA to 90 days after surgery.[7,8] This payment approach has subsequently driven health care providers to reconsider the use of the more expensive inpatient rehabilitation pathways.[7]

Outside inpatient rehabilitation, the setting, cost, and modes of provision vary greatly when rehabilitation is delivered in the community.[6,9] Available options include one-to-one or group-based interventions (land or water) and various iterations of home-based care, including domiciliary programs (physiotherapy visits in the home), telerehabilitation, or more simple monitored (via occasional clinic visits or telephone contact) or unmonitored home programs.[9-13] Previous systematic reviews of randomized clinical trials[14,15] have concluded that no single setting—clinic- or home-based, in water or on land—appears to be associated with better recovery across a range of outcomes. Despite this finding, to date, no evidence-based clinical practice guideline exists to promote the use of home-based programs after uncomplicated TKA. Trials published since the aforementioned reviews,[16-18] however, have included new comparisons (inpatient and 3-arm trials) and constitute the largest TKA rehabilitation trials to date. Thus, a more contemporary review is warranted, potentially as a precursor to development of a much-needed clinical practice guideline.

The aim of this systematic review and meta-analysis was to investigate the importance of the rehabilitation setting on outcomes for adults after elective, primary, unilateral TKA. Specifically, we aimed to determine whether inpatient or clinic-based rehabilitation is associated with superior function and pain outcomes after TKA compared with any home-based physiotherapy program (monitored or unmonitored, or domiciliary [physiotherapy home visitation]). Superiority was defined as a change considered to be clinically important for each outcome assessed.

Methods

This systematic review of randomized clinical trials follows the methods described in the *Cochrane Handbook for Systematic Reviews of Interventions, Version 5.1.0*[19] and is reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) reporting

Intervention Outcomes and Comparisons

The results for all outcomes and comparisons of clinic-based rehabilitation with monitored or unmonitored home-based programs are summarized in eTable 2 in the Supplement. Because only 1 study assessed inpatient rehabilitation,[16] meta-analysis was not possible, and a brief narrative summary is provided.

Primary Outcomes

Mobility

Two studies[17,37] reported the 6MWT at 1 or more follow-up points (eTable 2 and eFigure 1 in the Supplement). Participants who received clinic-based rehabilitation (n = 231) had walked an MD in 6MWT of −11.89 m (95% CI, −35.94 to 12.16 m; *P* = .33) compared with those who received a home-based program (n = 142) at 10 to 12 weeks and an MD in 6MWT of −3.05 m (95% CI, −29.75 to 23.66 m; *P* = .82) compared with those receiving a home-based program in both studies with 243 participants at 26 weeks. At 52 weeks, participants who had undergone clinic-based rehabilitation had walked an MD in 6MWT of −25.37 m (95% CI, −47.41 to −3.32 m; *P* = .02) compared with participants who had undergone clinic-based rehabilitation. Based on GRADE assessment,

Table 1. Summary of Included Studies

Source (Country)	No. of Participants	Diagnosis	Primary Focus of Intervention	Setting	Intervention Condition	Control Condition	Outcome Assessment	Follow-up Point, wk
Buhagiar et al,[16] 2017 (Australia)	165	TKA and osteoarthritis	Simple and advanced functional, aerobic, and strengthening exercises	Inpatient rehabilitation and home-based groups	Inpatient rehabilitation and home: 10 d of twice-daily inpatient PT; 2-3 OP physiotherapy sessions for 10 wk, starting 2-3 wk after surgery	Home: 2-3 OP PT sessions for 10 wk, starting 2-3 wk after surgery	6MWT, 10MWT, OKS, knee ROM ≥100°, KOOS, EuroQol-5D, PO complications	10, 26, and 52
Ko et al,[17] 2013 (Australia)	249	TKA and osteoarthritis	Simple and advanced functional, aerobic, and strengthening exercises	1:1:1 Randomized clinic-, group clinic-, and home-based groups	Clinic and group clinic: 2 OP PT sessions per week for 6 wk, starting 2-3 wk after surgery	Home: 2 OP PT visits with follow-up telephone call for 6 wk, starting 2-3 wk after surgery	OKS, WOMAC function, knee ROM, 6MWT, timed stairs ascent and descent, SF-12 physical and mental scores, PO complications	2, 10, 26, and 52
Kramer et al,[37] 2003 (Canada)	160	TKA and osteoarthritis	Simple and advanced strengthening and ROM exercises	Clinic- and home-based groups	Clinic: two 1-h OP PT sessions per week for 10 wk, starting 1 wk after surgery. Home: exercise program upgraded by treating therapist	Home: monitored via 2 telephone calls between 2-12 wk after surgery	WOMAC, SF-36, Knee Society Scale, timed stair ascent and descent, 6MWT	12, 26, and 52
Madsen et al,[38] 2013 (Denmark)	80	TKA and osteoarthritis	Strengthening, endurance, functional, and ROM exercises	Group clinic- and home-based groups	Group clinic: 2 PT sessions per week for 6 wk, starting 4-8 wk after surgery. Strength and endurance training and patient education and discussion. Home: exercises twice weekly with strength training, endurance training on exercise bike, walking, and balance training	Home: 2 OP PT visits in total, with additional OP visits allowed (not exceeding 12) for participants with physical limitations	OKS, SF-36 physical function, EuroQol-5D, knee ROM, peak leg extensor power, balance test, 10MWT, sit-to-stand tests, VAS pain during leg extensor power test	12 and 26
Mockford et al,[39] 2008 (Northern Ireland)	143	TKA and osteoarthritis or rheumatoid arthritis	Functional, strengthening, and ROM exercises	Clinic- and home-based groups	Clinic: home exercise regime to follow on discharge; PT sessions for 6 wk, starting within 3 wk of hospital discharge	Given home exercise regime to follow on discharge, with no OP PT	OKS, Bartlett Patellar Score, SF-12, PO complications	12 and 52
Rajan et al,[40] 2004 (England)	120	TKA and monoarticular arthrosis	No information on primary focus of intervention	OP clinic vs unmonitored home-based group	Clinic: PT sessions (mean, 4-6) after discharge from hospital. No information on program content.	Home: No information on program. Patients from both groups given a home exercise regime on discharge	ROM	12, 26, and 52

Abbreviations: KOOS, Knee Injury and Osteoarthritis Outcome Score; OKS, Oxford knee score; OP, outpatient; PO, postoperative; PT, physiotherapy; ROM, range of motion; SF-12, 12-Item Short Form Health Survey; SF-36, 36-Item Short Form Health Survey; TKA, total knee arthroplasty; VAS, visual analog scale; WOMAC, Western Ontario and McMaster Universities Osteoarthritis Index; 6MWT, 6-minute walk test; 10MWT, 10-minute walk test.

low-quality evidence suggests that there may be no clinically important difference between clinic- and home-based programs for mobility at 10 and 52 weeks (**Table 2**). Minimal heterogeneity was found across studies reporting mobility outcomes.

Patient-Reported Pain and Function

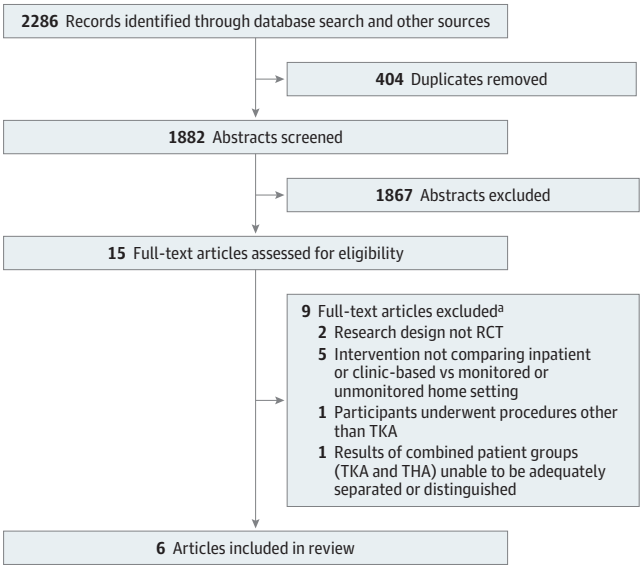
Three studies[17,38,39] reported a pain and function outcome at 1 or more follow-up points using the OKS (absolute values or change from baseline). Based on the GRADE component, moderate-quality evidence suggests little or no difference between clinic- and home-based programs for patient-reported pain and function in 457 patients at 10 weeks (MD, −0.15; 95% CI, −0.35 to 0.05) and in 388 patients at 52 weeks (MD, 0.10; 95% CI, −0.14 to 0.34) (Table 2 and eFigure 2 in the Supplement).

Secondary Outcomes

Patient-Reported Quality of Life

Two studies[17,38] reported quality-of-life outcomes at 1 or more follow-up points using the 12- or 36-Item Short Form Health Survey. No superiority of outcomes was found for patients receiving

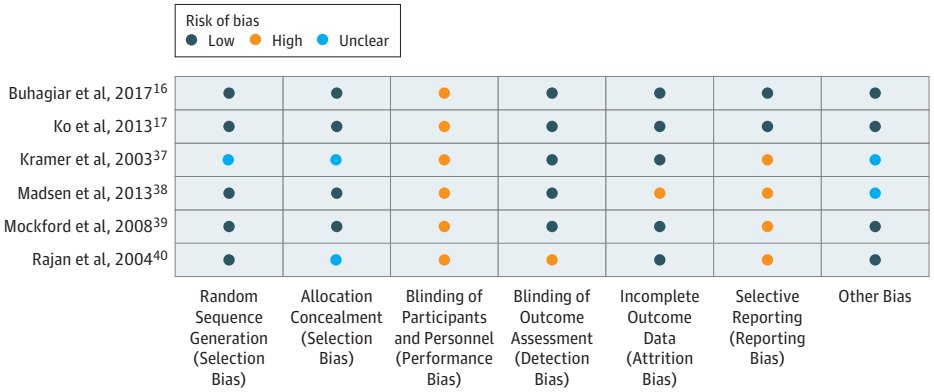
Figure 1. Flow of Studies Through the Review



RCT indicates randomized clinical trial; THA, total hip arthroplalsty; and TKA, total knee arthroplasty.

[a] Studies may have been excluded for failing to meet more than 1 inclusion criterion.

Figure 2. Cochrane Risk of Bias Table



Study quality was assessed using the Cochrane Collaboration Risk of Bias Tool.[30]

patient-reported pain and functional outcomes compared with the outcomes from a monitored home program; however, this result must be interpreted cautiously because it is based on a single study (**Table 3**).

Discussion

Summary of Main Findings

This systematic review and meta-analysis found that, based on low- to moderate-quality evidence, clinic-based rehabilitation after TKA was not associated with superior outcomes compared with a home-based program, whether monitored or unmonitored, when considering mobility, pain, function, quality of life, active knee flexion and extension, and passive knee ROM. Similarly, inpatient rehabilitation after TKA does not deliver superior outcomes compared with monitored home-based rehabilitation when considering mobility, pain, function, quality of life, and knee flexion.

Home-based rehabilitation provided greater mobility (approximately 25 m more in the 6MWT) at 52 weeks compared with a clinic-based program. However, research indicates that this difference is not clinically important. Using a triangulation of methods, including patient-perceived anchor-based thresholds and distribution-based thresholds, Naylor and colleagues[41] proposed that the threshold for minimal or more improvement for the 6MWT after TKA is expected to range from 26 to 55 m. For patients with chronic obstructive pulmonary disease, Rasekaba and colleagues[42] determined the minimal clinically important distance for the 6MWT is 54 m, with a similar figure (50 m) determined for a population of older adults and those with stroke by Perera et al.[43]

A single study provided evidence that inpatient rehabilitation is not associated with better mobility and patient-reported pain and function outcomes compared with a monitored home-based program among adults undergoing uncomplicated TKA.[16] This study reported that inpatient rehabilitation was associated with higher levels of patient-reported satisfaction. Understanding the reason for this finding would be useful for informing alternative models of rehabilitation provision.

Table 3. GRADE Component for Inpatient Compared With Home-Based Rehabilitation for Total Knee Arthroplasty at 10 and 52 Weeks

Outcomes	No. of Participants (No. of RCTs) in Follow-up	Certainty of the Evidence, GRADE Component[a]	Anticipated Absolute Effects[b]	
			Mean Value With Home-Based Rehabilitation	MD With Inpatient Rehabilitation (95% CI)
At 10- to 12-wk follow-up				
Mobility assessed with 6MWT	158 (1)	Moderate[c]	383.2 m	3.6 m (−23.2 to 30.4 m)
Pain and function assessed with OKS[d]	157 (1)	Moderate[c]	32.1 points	1.21 points (−1.45 to 3.88 points)
At 52-wk follow-up				
Mobility assessed with 6MWT	150 (1)	Moderate[c]	404.8 m	−13.5 m (−40.7 to 13.6 m)
Pain and function assessed with OKS[d]	160 (1)	Moderate[c]	37.0 points	−0.55 points (−3.21 to 2.1 points)

Abbreviations: GRADE, Grading of Recommendations, Assessment, Development and Evaluation; MD, mean difference; OKS, Oxford knee score; RCT, randomized clinical trial; 6MWT, 6-minute walk test.

[a] High indicates very confident that the true effect lies close to that of the estimate of the effect; moderate, moderately confident that the true effect is likely to be close to the estimate of the effect, but with a possibility that it is substantially different; low, limited confidence and the true effect may be substantially different from the estimate of the effect; and very low, very little confidence and the true effect is likely to be substantially different from estimate of effect.

[b] The risk in the intervention group (and its 95% CI) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).

[c] Only 1 study and a small sample size.

[d] Range of possible scores was 0 to 48, with higher scores indicating best outcomes.