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Home-based tele-rehabilitation versus hospital-based outpatient rehabilitation for pain and function after initial total knee arthroplasty

A systematic review and meta-analysis

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Abstract

Background: This systematic review and meta-analysis aims to compare the effectiveness of home-based tele-rehabilitation programs with hospital-based rehabilitation programs in improving pain and function at various time points (≤6 weeks, ≤14 weeks, and ≤ 52 weeks) following the initial total knee arthroplasty.

Methods: This study used PRISMA and AMSTAR reporting guidelines. We systematically searched 5 databases (PubMed, Embase, Web of Science, Cochrane Library, and Medline) to identify randomized controlled trials published from January 1, 2019, to January 1, 2023. The primary outcomes were pain, knee injury and osteoarthritis outcome score, and mobility (knee range of motion).

Results: We included 9 studies involving 1944 patients. Low-quality evidence showed hospital-based rehabilitation was better than home-based tele-rehabilitation in knee injury and osteoarthritis outcome score (mean difference [MD], –2.62; 95% confidence interval [CI], –4.65 to –0.58; $P = .01$) at ≤ 14 weeks after total knee arthroplasty. Based on low-quality evidence, home-based tele-rehabilitation was better than hospital-based rehabilitation in knee range of motion (MD, 2.00; 95% CI, 0.60 to 3.40; $P = .005$). There was no significant difference between hospital-based rehabilitation and home-based tele-rehabilitation in knee pain at ≤ 6 weeks (MD, 0.18; 95% CI, –0.07 to 0.42; $P = .16$), 14 weeks (MD, 0.12; 95% CI, –0.26 to 0.49; $P = .54$), and ≤ 52 weeks (MD, 0.16; 95% CI, –0.11 to 0.43; $P = .24$).

Conclusion: Home-based tele-rehabilitation and hospital-based rehabilitation programs showed comparable long-term outcomes in pain, mobility, physical function, and patient-reported health status after primary total knee arthroplasty. Considering the economic costs, home-based tele-rehabilitation programs are recommended as a viable alternative to hospital-based rehabilitation programs.

Abbreviations: GRADE = grading of recommendations, assessment, development, and evaluation, Knee = ROM Knee range of motion, KOOS = knee injury and osteoarthritis outcome score, MD = mean difference, OKS = oxford knee score, TKA = total knee arthroplasty.

Keywords: based rehabilitation, based tele, home, hospital, knee osteoarthritis, pain and function, rehabilitation

1. Introduction

ROM Knee range of motion (Knee) osteoarthritis is a degenerative joint disease that causes pain and functional limitations in the knee. It is one of the major reasons for disability in the elderly and imposes a huge economic burden on individuals and society.[1,2] Total knee arthroplasty (TKA) was recognized as the most effective approach for end-stage knee osteoarthritis patients.[3] It substantially alleviated pain, enhanced function,

HZ and JW contributed equally to this work.

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Data sharing not applicable to this article as no datasets were generated or analyzed during the current study.

Ethical approval was not required for this meta-analysis as it involved the analysis of existing published studies, without the direct involvement of human participants or sensitive data.

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and improved overall quality of life. In recent years, with the continuous advancement of surgical techniques and the shortening of the rehabilitation process, the hospitalization time and cost after TKA surgery decreased significantly.[4] However, the effectiveness of post-discharge rehabilitation became a crucial concern as patients may still encounter substantial functional limitations.[5]

Traditionally, postoperative patients were required to attend expensive outpatient rehabilitation programs. Nevertheless, evidence suggested that clinic-based rehabilitation may not have offered significant advantages compared to other forms of rehabilitation.[6] Additionally, during outbreaks of epidemics (such as COVID-19), seeking hospital-based rehabilitation could be inconvenient. As a result, home or community-based rehabilitation was emerging as a viable alternative. Studies suggested that home or community-based rehabilitation methods, such as tai chi and yoga, along with aerobic exercises, not only enhanced balance and reduced the risk of falls but also effectively reduced the levels of systemic inflammatory factors (such as interleukin-6).[7–9] These methods offered patients more flexible rehabilitation options, particularly for those facing challenges accessing hospitals or outpatient clinics. Moreover, there has been remarkable progress in recent years in integrating digital smart devices with home-based rehabilitation.[10–12] This enhances the feasibility of rehabilitation and significantly reduces the cost for patients. This trend provides new opportunities and convenience in the field of rehabilitation, offering postoperative patients a more diverse and accessible range of rehabilitation choices.

The main objective of this systematic review and meta-analysis was to evaluate the effects of long-term home-based tele-rehabilitation on pain and function in patients after TKA (primary outcomes). Meanwhile, this meta-analysis also assessed the health status and mobility of patients as secondary outcomes.

2. Methods

2.1. Search strategy and data sources

The review protocol was registered on PROSPERO (CRD42022371111) and the work has been reported in line with PRISMA[13] (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) and AMSTAR (See Table S3, Supplemental Digital Content, http://links.lww.com/MD/L182, which assesses the methodological quality of systematic reviews) Guidelines. The clinical question was explored using the patients, intervention, comparison, outcomes, and study design approach.

Two reviewers searched and selected articles independently from PubMed, Embase, Web of Science, Cochrane Library, and Medline databases using the keywords "unsupervised exercise", "community-based train", "internet-delivered train", "remote monitoring train", "home exercise", "inpatient hospital rehabilitation", "outpatient hospital rehabilitation", "Self-Directed Rehabilitation", "Tele-rehabilitation", "Virtual Rehabilitation", "intelligent rehabilitation", "standard physical therapy", "Total Knee Arthroplasty", "Total Knee Replacement", "randomized controlled trials", "trials, randomized clinical", "controlled clinical trials, randomized" for articles on patients with knee osteoarthritis as for January 1, 2023. Any differences were resolved by a third reviewer, who made the final decision (See Supplemental Digital Content, http://links.lww.com/MD/L183, which illustrates the specific search strategy.).

2.2. Eligibility criteria

The inclusion criteria were as follows: Patients should be adults with primary knee arthroplasty surgery; Interventions should include an unsupervised exercise program or home-based exercise program or tele-rehabilitation or Internet-delivered exercise or any device that can be used by patients with or without supervised and should be compared to outpatient/inpatient physical treatments; Outcomes should include knee range of motion (ROM), pain intensity, physical function, and patient-reported health status; Study design, only randomized controlled trials were included; Restrictions were placed on language (English) and publication date (2019–2022).

2.3. Outcomes

The primary outcomes were patient-reported pain and physical function (KOOS) and mobility (knee range of motion). Patient-reported health status and physical function (the 5-level European Quality of Life Society 5 Dimensions Questionnaire and the Oxford Knee Score) were the second outcomes.

KOOS contains 51 components, each ranging from 0 (very poor) to 4 (perfectly normal), providing a percentage score of joint function. The Oxford Knee Score (0–48) highlights knee replacement outcomes, with higher scores indicating better results. The EQ-5D-5L scale evaluates the degree of difficulty, with 1 being no difficulty and 5 being extremely challenging.

2.4. Assessment of study quality

Two evaluators assessed independently the risk of bias in the trials using the Cochrane Collaboration Risk of Bias Tool version 2 (RoB 2).[14] It consists of 5 distinct domains that assess the methodological quality of randomized controlled trials, including the randomization process, deviations from intended interventions, missing outcome data, measurement of the outcome, and selection of the reported result. Within each domain, RoB2 users must answer 1 or more signaling questions. These answers result in judgments of "low risk of bias", "some concerns", or "high risk of bias". Included studies were also scored using the Physiotherapy Evidence Database Scale, which is used to assess the methodological quality of clinical trials and contains sufficient information to standardize clinical trials (see Table S1, Supplemental Digital Content, http://links.lww.com/MD/L180, which illustrates the results of the risk assessment).

Two reviewers, working individually, utilized the grading of recommendations, assessment, development, and evaluation (GRADE) method to evaluate the accuracy of evidence, carrying out a meta-analysis. Risk of bias, inconsistency, indirectness, imprecision, and publication bias were considered when categorizing postoperative knee range of motion and patient-reported pain and functional outcomes into high, moderate, low, or very low at ≤ 6 weeks, ≤14 weeks, and ≤ 52 weeks (Table 1). To ensure repeatability and consistency, GRADE Pro software was utilized to create a results summary table.

2.5. Data extraction

Two authors separately extracted data from the included studies. Basic participant information, including group sample size according to intention-to treat, country, mean age, mean body mass index, sex (female/male), intervention project, intervention duration, flow-up, and outcomes, was extracted from each randomized controlled trial. If the intervention group and the control group in the study were reversed, the 2 groups were included after adjusting the order.

The outcomes reported as continuous variables were extracted whenever possible, including the mean values, standard deviations, and the number of patients per group for each outcome at each time point before and after TKA. In the included studies, if the outcome measures were presented as mean and 95% confidence interval or as the mean and standard error, appropriate formula conversions were required.

Table 1

GRADE assessment for hospital-based versus home-based rehabilitation at 6, 14, and 52 weeks after total knee arthroplasty.

Outcomes	No. of participants (No. of studies)	Quality of the evidence (GRADE)*	MD with hospital-based rehabilitation (95% CI)
At ≤ 6 wk			
KOOS	906 (3)	Moderate†	−1.18 points (−2.57 to 0.20 points)
Knee range of motion	927 (5)	Moderate†	−0.32 degree (−2.38 to 1.75 degrees)
Pain	749 (4)	Low†‡	−0.08 points (−0.85 to 0.69 points)
At ≤ 14 wk			
KOOS	619 (3)	Low†§	−2.62 points (−4.65 to −0.58 points)
Knee range of motion	801 (5)	Low†‡	2.00 degrees (0.60 to 3.40 degrees)
Pain	710 (4)	Moderate†	0.73 points (−0.43 to 1.89 points)
At ≤ 52 wk			
KOOS	337 (1)	Low†‖¶	0.63 points (−2.33 to 3.59 points)
Knee range of motion	106 (1)	Low†‖¶	−1.40 degrees (−4.67 to 1.87 degrees)
Pain	407 (2)	Low†¶	−1.98 points (−4.20 to 0.24 points)

High quality: Fairly certain that the true effect value approach to that of the estimate of the effect; Moderate quality: Moderate certainty that the true effect value is likely to be close to the effect estimate, but substantial variation is possible; Low-quality: Limited certainty and the true effect value may be significantly different from the estimate effect value; Very low-quality: Hardly certainty that the true effect value may be significantly different from the estimate effect value.

CI = confidence interval, GRADE = grading of recommendations, assessment, development, and evaluation, KOOS = knee injury and osteoarthritis outcome score, MD = mean difference.

* GRADE Working Group grades of evidence.

† Patients/caregivers/recorders of results/assessors/data analysts may aware of the specific grouping of the experiment.

‡ Poor overlap between the confidence interval of one study and other studies.

§ 50% $< I^2 <$ 75%

‖ Total sample size < 400

¶ Wide range of 95% confidence interval.

2.6. Data analysis

All data were analyzed from the 8 included studies. Random or fixed effects meta-analysis was utilized to analyze data of the same type, and the continuous results were presented as the mean difference (MD) and 95% confidence interval (CI). Categorical outcomes were expressed as percentages. If the outcome measures in the included studies were the same but different scales were used, the study was removed to reduce the impact of measurement heterogeneity on the results.

This review used Chi-square tests to evaluate the heterogeneity of included studies and quantified by the I^2 statistic. Fixed effect model for $I^2 < 10\%$, random effect model for $10\% < I^2 < 50\%$, and $I^2 > 50\%$ indicate large heterogeneity and require analysis of heterogeneity. A sensitivity analysis was performed to account for the variability. Statistical significance was set at $P < .05$. Due to the small number of included studies, funnel plots were not used to explore publication bias. Data were edited and statistically analyzed using Review Manager software (version 5.4).

3. Results

3.1. Identified studies

A total of 377 articles were obtained from the electronic database search, with 376 records obtained through the keyword strategy and the remaining retrieved from references. After removing duplicates, 167 records were screened, and 89 were excluded based on article type. After the detailed scrutiny, 9 articles were selected for the meta-analysis, and specific exclusion reasons are as shown in Figure 1.

3.2. Quality assessment of included studies

Due to the nature of the intervention, blinding for patients and caregivers was not possible in almost all studies, but 4 studies were blinded to the assessor.[15–18] Deviations from intended interventions may have been possible in 1 study owing to control patients unsatisfied with the treatment program after randomization requesting to enter the intervention group or quitting the trial.[19] In another study, the findings may have been affected by the fact that the experiment was not blinded to the assessors.[20] The Physiotherapy Evidence Database scores ranged from 6 to 9 (maximum 10) for assessing study quality, including 2 studies with patient dropout rates > 15%[19,21] (see Table S2, Supplemental Digital Content, http://links.lww.com/MD/L181, which shows the results of the risk assessment).

3.3. General data about the included studies

A total of 1944 patients, 60.1% of whom were women were enrolled in the 9 studies, and the duration of the exercise intervention ranged from 1 week to 52 weeks after knee arthroplasty. The specific information of the studies included in this systematic review is illustrated in Table 2: author, year, country, total sample size, the Sample size of the groups, and patient characteristics. All studies were experimental, 3 of which included pre- and post-intervention evaluations,[20,22,23] and the follow-up period for all studies ranged from 10 to 52 weeks post-TKA.

However, the interventions in each study varied considerably (Table 3). Home-based tele-rehabilitation programs include supervised exercise[16,17,19,21–23] and self-directed exercise.[15,18,20] Outpatient physical therapy or standard usual care included strengthening exercise or progressive resistance exercise, stretching exercise, proprioception train, balance or gait train, cycling exercise, elastic band workout, moist heat, and transcutaneous electrical nerve stimulation. In general, exercise protocols varied across studies, but the goal of the trials was to promote patient physical function.

3.4. Primary outcomes

3.4.1. Patient-reported pain and function. The pain was measured in 7 studies and meta-analysis results showed no difference between the 2 groups in terms of patient-reported pain in 749 participants at ≤ 6 weeks after TKA (MD,0.18; 95% CI, −0.07 to 0.42; $P = .16$), in 710 patients at ≤ 14 weeks (MD, 0.12; 95% CI, −0.26 to 0.49; $P = .54$), and in 407 patients at ≤ 52 weeks (MD, 0.16; 95% CI, −0.11 to 0.43; $P = .24$). Following the GRADE assessment of the meta-analysis results, low-quality evidence suggested no clinical significance between home-based and hospital-based rehabilitation at ≤ 6 weeks and at ≤ 52 weeks (Table 3). Heterogeneity in studies that report pain outcomes at ≤ 14 weeks was only moderate ($I^2 = 41\%$) (Fig. 2).

In 619 patients from 3 studies, the meta-analysis results of KOOS after sensitivity analysis favored the hospital-based rehabilitation group compared to the tele-rehabilitation home-based exercise program at ≤ 14 weeks (MD, −2.62; 95% CI, −4.65 to −0.58; $P = .01$) (Fig. 3). Based on the GRADE assessment, moderate quality evidence indicated that there was no clinically important difference at ≤ 6 weeks (Table 1).

3.5. Mobility

3.5.1. Knee range of motion. Knee ROM obtained from 5 studies with a total of 1033 patients was no statistical difference between the home-based group and hospital-based group at ≤ 6

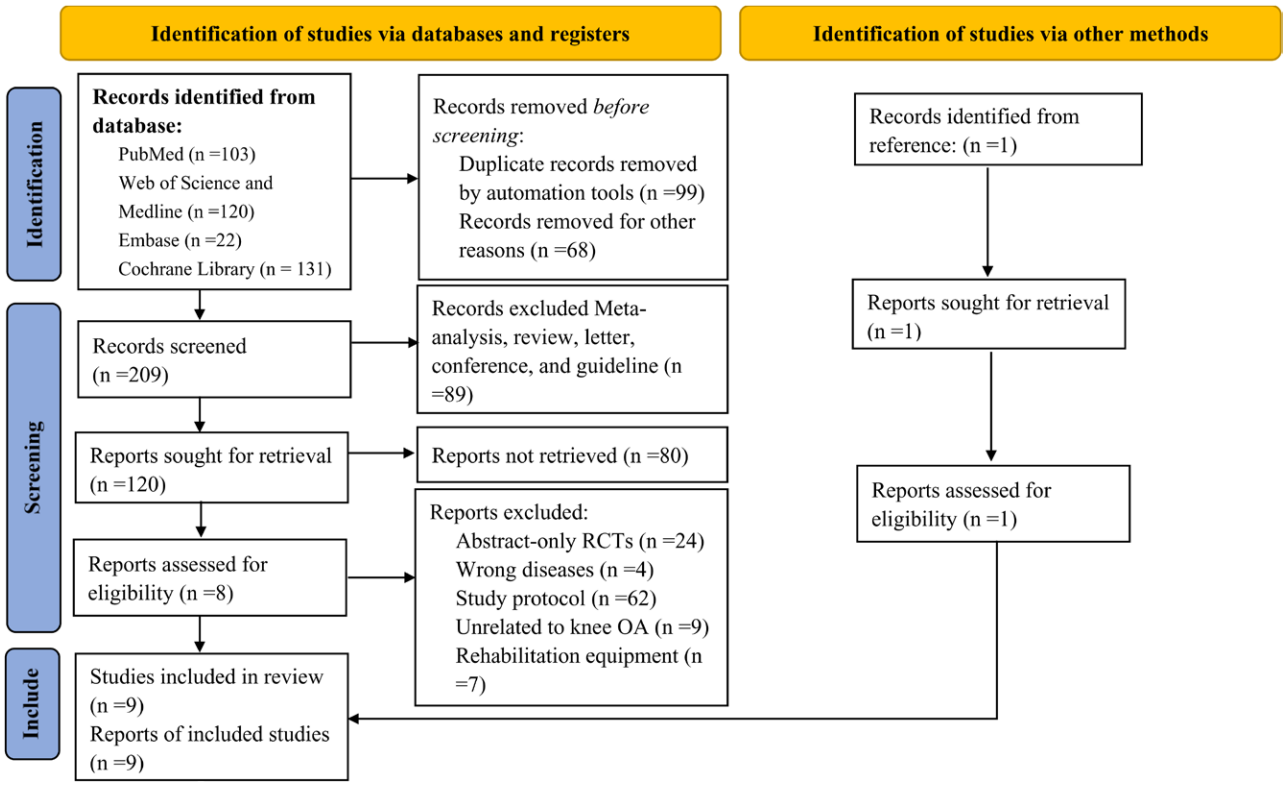

Figure 1. PRISMA Flowchart.

Table 2

General data about the included studies.

Study	Country	Sample size	Home-based patients	Mean age	Mean BMI	Sex (female/male)	Hospital-based patients	Mean age	Mean BMI	Sex (female/male)
Crawford 2021	America	345	160	63.2	32.3	106/54	185	64.5	31.3	110/75
Krishna 2021	Mexico	337	153	63.3	31.8	85/68	184	65.1	31.3	111/73
David 2020	Britain	334	171	68.2	31.5	108/63	163	66.8	31.2	97/66
Janet 2020	America	304	151	65.4	31.6	90/61	153	65.1	31.9	100/53
Xu 2021	China	106	55	68.4	21.1	44/11	51	67.3	21.5	43/8
Sara 2019	America	240	96	70.0	31.1	58/38	96	69.0	30.8	59/37
Larissa 2019	Australia	60	30	66.8	29.3	22/8	30	66	29.4	18/12
Karen 2021	Britain	621	309	70.7	31.3	184/125	312	70.2	31.7	187/125
Kevin 2020	America	38	19	64.0	31.8	9/10	19	65.3	31.3	9/10

BMI = body mass index (kg/m2).

weeks postoperatively, simultaneously there was no statistical difference between the 2 groups at ≤ 52 weeks. Nonetheless, the findings were in favor of the home-based group in 701 patients at ≤ 14 weeks (MD, 2.00; 95% CI, 0.60 to 3.40; $P = .005$). Heterogeneity was just moderate ($I^2 = 48\%$) in the results reporting knee ROM at ≤ 6 weeks (Fig. 4). Following meta-analysis of the results based on the GRADE assessment, low-quality evidence shows that overall outcomes benefit the tele-rehabilitation home-based exercise program compared to the hospital-based group at ≤ 14 weeks (Table 1).

3.6. Second outcomes

3.6.1. Patient-reported health status and physical function. Three studies reported the health status of patients using the EQ-5D-5L, and meta-analysis findings suggested no clinically important difference between home-based remote rehabilitation exercise and hospital-based exercise programs at ≤ 6 weeks, ≤14 weeks, and ≤ 52 weeks (see Figure S1, Supplemental Digital Content, http://links.lww.com/MD/L176, which presents the meta-analysis results of the EQ-5D-5L).

Meta-analyses of 3 trials after sensitivity to the results reported that no clinical statistical difference was observed between hospital-based rehabilitation and home-based exercise program in oxford knee score (OKS) at ≤ 1 week, ≤26 weeks, and ≤ 52 weeks (see Figure S2, Supplemental Digital Content, http://links.lww.com/MD/L177, which presents the meta-analysis results of the OKS). Similarly, no significant difference was found between timed up-and-go test (see Figure S3, Supplemental Digital Content, http://links.lww.com/MD/L178, which presents the meta-analysis results of the timed up-and-go test) and 6-minute walk test (see Figure S4, Supplemental Digital Content, http://links.lww.com/MD/L179, which presents the meta-analysis results of the 6-minute walk test).

4. Discussion

4.1. Main findings

The purpose of this systematic review and meta-analysis was to assess the effects of long-term home-based tele-rehabilitation on pain and function in patients after TKA. Our study suggested that in the long-term, home-based tele-rehabilitation is not inferior to hospital-based rehabilitation in pain and function. Unexpectedly, hospital-based rehabilitation was superior to home-based tele-rehabilitation in patient-reported function (KOOS) scores after TKA at ≤ 14 weeks. However, home-based tele-rehabilitation programs were superior to hospital-based rehabilitation programs in knee ROM at ≤ 14 weeks. Moreover, about additional indicators such as pain, 6-minute walk test, timed up-and-go test, and patient-reported health status, no significantly important difference was found between the 2 groups.

In this meta-analysis, 3 studies employed the KOOS assessment to evaluate patients' functional levels, and the findings favored hospital-based rehabilitation over home-based rehabilitation.[21–23] While this may not be heartening news for patients in the home-based group, the original research results revealed no significant differences in clinical outcomes between home-based and hospital-based patients. This could be attributed to potential biases within this meta-analysis. Furthermore, a substantial body of research suggests that KOOS assessments demonstrated no significant differences between the 2 groups, whether at the 6-week or 6-month post-surgery mark.[21,23] These results were in harmony with our findings, supporting the notion that home-based rehabilitation can serve as a viable alternative to hospital-based rehabilitation.

Knee ROM is often employed to evaluate patients satisfaction with TKA and rehabilitation outcomes. This is primarily because ROM profoundly impacts patients daily lives. For instance, normal walking necessitates 65° of

Table 3

Rehabilitation exercise program and outcome measure.

	Home-based exercise program		Hospital-based exercise program			
Study	Project	Intervention duration	Project	Intervention duration	Flow-up	Outcome measure
Crawford 2021	Mobile app-based rehabilitation	6 wk	Outpatient physiotherapy	4 wk	3 mo	KOOS, knee ROM, EQ-5D-5L
Krishna 2021	Smartwatch-based rehabilitation	12 mo	Outpatient physiotherapy	6 wk	12 mo	KOOS, knee ROM, EQ-5D-5L
David 2020	Home-based rehabilitation	6 wk	Outpatient physiotherapy	6 wk	52 wk	Oxford Knee Score, VAS
Janet 2020	Virtual exercise rehabilitation	12 wk	Outpatient physiotherapy	6 wk	12 wk	Total costs, KOOS, VAS
Xu 2021	Knee flexion exercise program	12 mo	Outpatient physiotherapy	12 mo	12 mo	WOMAC, knee ROM, VAS
Sara 2019	Community-based rehabilitation	12 wk	Outpatient physiotherapy	12 wk	6 mo	WOMAC, 6-minute walk test
Larissa 2019	Pedaling-based rehabilitation	2 wk	Standard Multi-Exercise	Unrestricted	4 mo	6-minute walk test, Oxford knee score
Karen 2021	Home-based rehabilitation	12 mo	Outpatient physiotherapy	4 wk	12 mo	Lower Extremity Functional Scale
Kevin 2020	Interaction remote rehabilitation	10 wk	Outpatient physiotherapy	10 wk	10 weeks	6-minute walk test, knee ROM, VAS

EQ-5D-5L = the 5-level European Quality of Life Society Five Dimensions Questionnaire, knee ROM = knee range of motion, KOOS = knee injury and osteoarthritis outcome score, VAS = visual analogue scale, WOMAC = The Western Ontario and McMaster Universities Osteoarthritis Index.

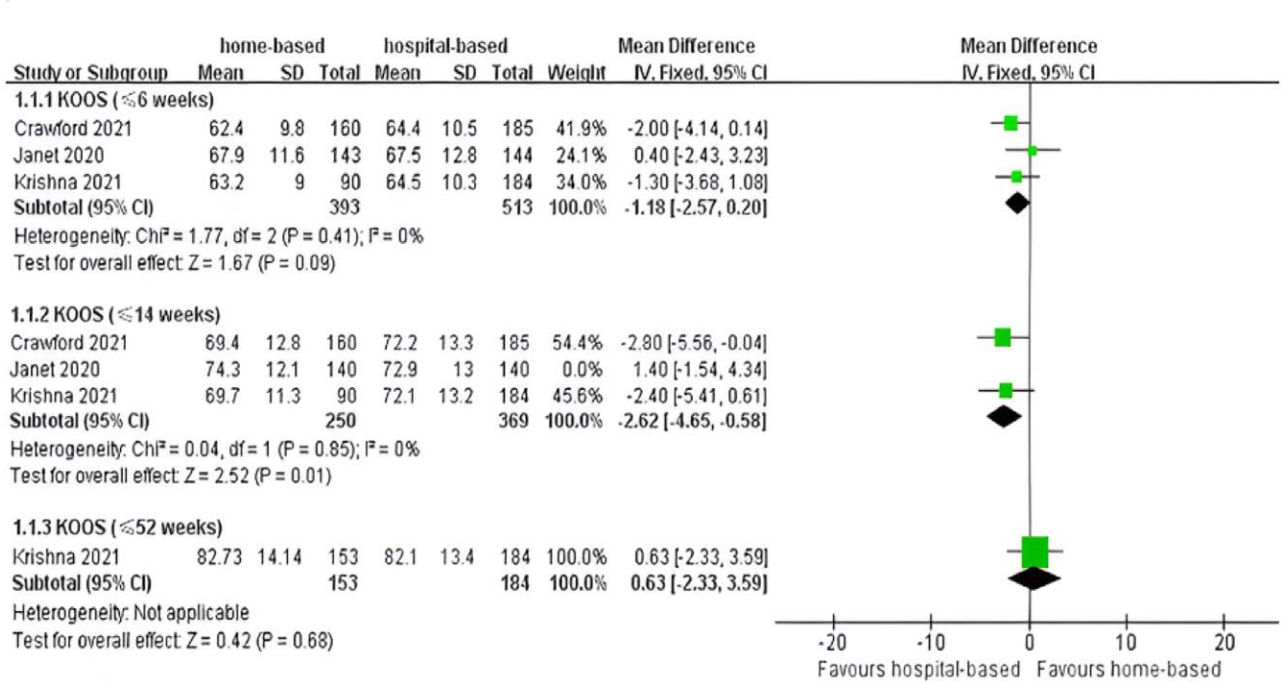

Figure 2. Effect of home-based exercise versus hospital-based rehabilitation on pain.

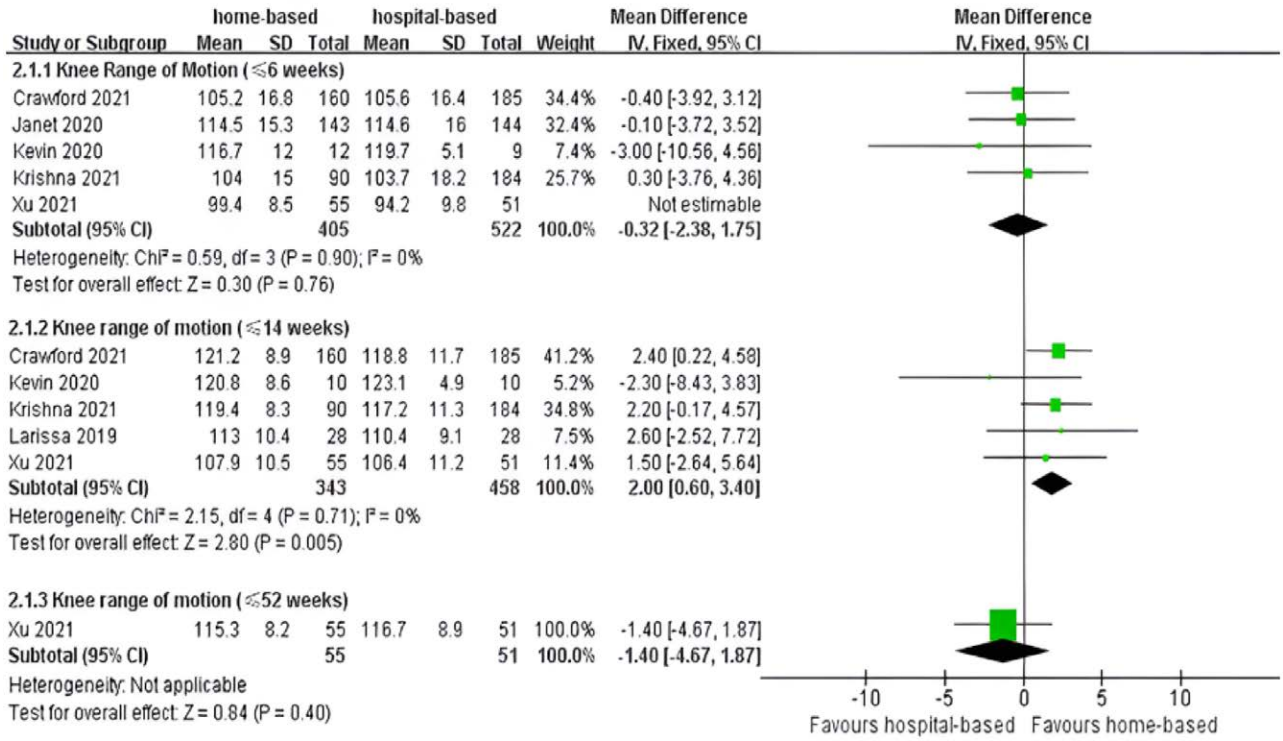

Figure 3. Effect of home-based exercise versus hospital-based rehabilitation on KOOS. KOOS = knee injury and osteoarthritis outcome score.

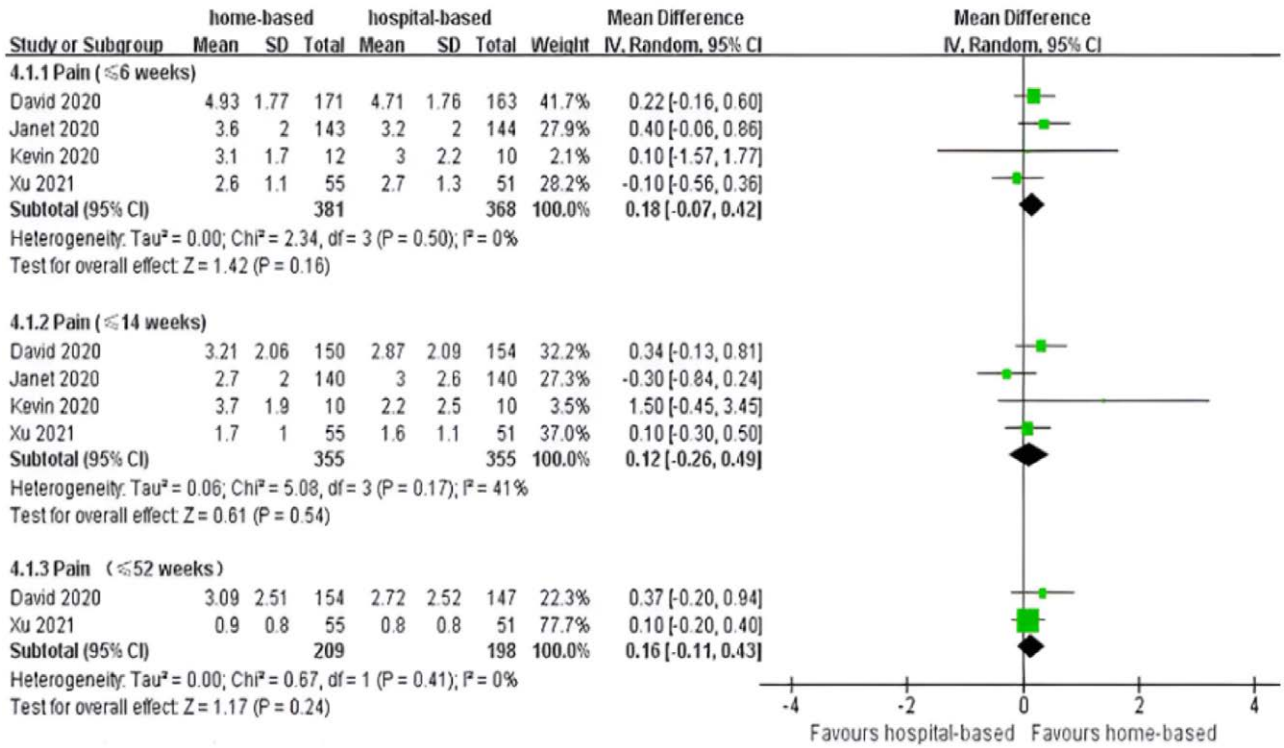

Figure 4. Effect of home-based exercise versus hospital-based rehabilitation on Knee ROM. Knee = ROM Knee range of motion.

ROM, climbing stairs requires 80°, descending stairs mandates 78°, rising from a chair demands 90°, and donning pants necessitates 119° of ROM.[24,25] Our meta-analysis results demonstrated that at approximately 3 months post-surgery, the home-based rehabilitation group displayed significantly enhanced knee ROM compared to the hospital-based group, and this level of mobility meets the essential demands of daily living (average mobility > 100°).

Moreover, our study encompassed assessments such as the 6-minute walking test, sit-to-stand test, patient-reported health status, and the OKS. The outcomes indicated that in these aspects, both groups achieved analogous results. Nevertheless, our study did not account for the cost factor between home-based and hospital-based rehabilitation. The primary reason is that the studies were conducted in different countries, where significant cost variations were observed. Furthermore, the specific methodologies of home-based rehabilitation varied across studies. Based on the studies we included, hospital-based rehabilitation generally incurred higher costs than home-based rehabilitation.[20–22] This can be attributed, to some extent, to the higher frequency of transportation and hospital care services required for hospital-based rehabilitation, resulting in elevated costs.

More importantly, it should be noted that home-based tele-rehabilitation program faces challenges in terms of patient adherence to exercise prescriptions compared to hospital-based rehabilitation. Therefore, improving adherence to home-based tele-rehabilitation programs could be a crucial strategy for maintaining the benefits of exercise outcomes.[9] Previous study concluded a strong association between adherence and exercise outcomes, with significant increases in improvements in pain, walking ability, and disability as the level of adherence to exercise increases.[26]

4.2. Future consideration

With the increasing prevalence of mobile devices and intelligent devices in daily life, there is an opportunity to improve adherence for home-based tele-rehabilitation after TKA. Physicians can leverage these devices to supervise patients exercise effectively, while patients can provide timely feedback to their physicians on the effectiveness of their treatment when they are far away or inconvenient to come to the hospital.

In the near future, intelligent devices (like exoskeleton robots) may enable combined artificial intelligence to provide real-time, automated assistance for patients. For example, exoskeleton robots may not only help patients reduce load and pain when walking but also help them perform rehabilitation exercises to restore muscle strength and motor function to return to normal life more quickly. Ultimately, smarter devices combined with healthcare data will be necessary to improve the function for post-TKA patients.

4.3. Comparison with prior reviews

A systematic review and meta-analysis[12] published in 2017 concluded considerably lower pain scores for hospital-based exercise programs than home-based exercise programs at 52 weeks after TKA ($P < .05$), however, the pain scores used in included studies in the meta-analysis were not completely consistent (both KOOS-pain score and visual analog scale were used), the validity of this result requires further examination. Another systematic review[27] published in 2019 showed no clinical statistical difference in knee ROM between the 2 groups at 10 to 12 weeks ($I^2 = 61\%$).

4.4. Limitations

This review has several limitations that need to be acknowledged. First, the accuracy of the results in this meta-analysis may be limited by the fact that the number of studies included in the review may be relatively small, due to possibly failure to identify all relevant studies and we only included ones published in English. Second, the risk of bias assessment revealed most studies had a significant risk of bias, including failure to blind patients, therapists, and assessors, and reported incomplete data that may not represent the overall sample size. Furthermore, the GRADE method showed low-quality evidence for these findings. Although the analysis shows that home-based tele-rehabilitation programs are as effective as hospital-based rehabilitation programs, there is still uncertainty in the outcomes.

Nevertheless, the strength of this meta-analysis is that only randomized controlled trials were included, moreover, all studies were analyzed using intention-to-treat analysis (except 1[17]).

5. Conclusion

The review found no strong evidence that hospital-based rehabilitation was superior to home-based tele-rehabilitation after TKA. However, the growing trend of an aging global population will make it possible for home-based or community-based tele-rehabilitation exercise as the first-line treatment after joint replacement. Hence, it is imperative to develop an elaborate clinical practice guideline for home-based tele-rehabilitation after TKA.

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