National Institute for Health and Care Excellence

Draft for Consultation

Joint replacement (primary): hip, knee and shoulder

[R] Evidence review for outpatient hip and knee postoperative rehabilitation

NICE guideline

Intervention evidence review

October 2019

Draft for Consultation

This evidence review was developed by the National Guideline Centre, hosted by the Royal College of Physicians

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ISBN

Contents

1 Postoperative outpatient hip and knee rehabilitation

1.1 Review question: In adults who have undergone primary elective hip or knee replacement, what is the clinical and cost effectiveness of self-directed outpatient rehabilitation versus supervised outpatient rehabilitation?

1.2 Introduction

People are typically discharged from hospital following hip and knee replacement once they can safely manage to walk and transfer, and are able to perform the essential daily activities they are required to carry out at home.

However, these individuals often still have physical problems and are not fully recovered. These problems may include: muscle weakness, low endurance, reduced joint range of motion, and difficulties in performing more strenuous activities of daily living (such as domestic activities, work, sports and exercise, and other leisure pursuits. To address these, individuals are either encouraged to self-rehabilitate or are referred to other health services.

Self-rehabilitation is largely through the advice and exercises given during the hospital stay, with the expectation that they will recover without further assistance from physiotherapy or occupational therapy services.

Alternatively, people may be referred to outpatient physiotherapy or occupational therapy services once discharged. Such outpatient services provide people with graded exercises or functional activities to increase their strength, range of motion and functional performance. In some instances, this is one-to-one and in others this may be in group sessions.

There is currently much variability in whether people following hip and knee replacement receive out-patient rehabilitation or if their rehabilitation is supervised or self-directed. When people do receive supervised rehabilitation in an outpatient setting, there is variability in what is delivered in terms of whether this is a one-to-one or group intervention, in what this consists of, when and where this is delivered, and for how long it is provided. Given this variability in the UK, this review seeks to discover the clinical and cost-effectiveness of self-directed outpatient rehabilitation compared to supervised out-patient rehabilitation for people following hip or knee replacement.

1.3 PICO table

For full details, see the review protocol in appendix A.

Table 1: PICO characteristics of review question

Population	Adults who have undergone primary hip or knee joint replacement.
Interventions	• Group based supervised post-operative rehabilitation commencing from first post-operative follow-up appointment • Individually supervised post-operative rehabilitation commencing from first post-operative follow-up appointment
Comparisons	• Self-directed rehabilitation
Outcomes	Critical • Quality of life at 6 to 24 months (continuous)

ISBN

	• Patient Reported Outcome Measures (PROMs) within at 6 to 24 (continuous) • Revision of joint replacement (time to event) • Reoperation including dislocation within 24 months (dichotomous) <u>Important</u> • Hospital readmissions: within 90 days (dichotomous) • Thromboembolic complications within 90 days (dichotomous) To be extracted when not included within a PROM: • Function at 6 to 24 months (continuous) • Pain within at 6 to 24 months (continuous)
Study design	Randomised controlled trials If no well-conducted RCTs are available, then observational studies with multivariate analysis will be investigated.

1.4 Clinical evidence

1.4.1 Included studies

A search was conducted for randomised trials comparing the effectiveness of supervised outpatient rehabilitation versus self-directed rehabilitation for adults who have undergone primary hip or knee joint replacement. Nineteen studies were included in the review; [3, 5, 8, 16, 21, 26, 30, 31, 38, 40, 45, 58, 62, 69, 70, 72, 81, 86, 89] these are summarised in Table 2 below. Evidence from these studies is summarised in the clinical evidence summary below (Table 3).

Six RCTs[3, 8, 16, 30, 38, 70] with extractable outcomes were included in the comparison for group-based supervised rehabilitation versus self-directed rehabilitation, and five RCTs[5, 21, 31, 70, 72] with extractable outcomes in the comparison for individually supervised rehabilitation versus self-directed rehabilitation.

8 RCTs[26, 40, 45, 58, 62, 69, 81, 86] were included in the review but did not report any relevant outcomes.

See also the study selection flow chart in appendix C, study evidence tables in appendix D, forest plots in appendix E and GRADE tables in appendix H.

1.4.2 Excluded studies

See the excluded studies list in appendix I.

ISBN

1.4.3 Summary of clinical studies included in the evidence review

Table 2: Summary of randomised controlled trials included in the evidence review

Study	Intervention and comparison	Population	Outcomes	Comments
Group-based supervised rehabilitation				
Artz 2017[3]	Group-based supervised rehabilitation, n=23 Versus Self-directed rehabilitation, n=23	Adults having a knee replacement Mean (range) age = 68.6 (51-82) years UK	Measured at 6 to 24 months: • KOOS scale – pain • KOOS scale – symptoms • KOOS scale – quality of life • KOOS scale – activities of daily living	Patients were referred to physiotherapy services on an individual basis at the discretion of the hospital's physiotherapy or orthopaedic team or by their GP.
Beaupre 2014[8]	Group-based supervised rehabilitation, n=11 Versus Self-directed rehabilitation, n=10	Adults having a hip replacement Mean (SD) age = 53.8 (9.1) years USA	Measured at 6 to 24 months: • WOMAC scale – pain • WOMAC scale – function	Downgraded for intervention indirectness. Control subjects continued with usual care after their six-week appointment, which varied from the home exercises provided in hospital to community-based rehabilitation programs for a total of four to six sessions at patients' discretion.
Coulter 2017[16]	Group-based supervised rehabilitation, n=56 Versus Self-directed rehabilitation, n=42	Adults having a hip replacement Median (IQR) age = 64 (54-88) years Australia	Measured at 6 to 24 months: • WOMAC scale – total • Quality of life	Patients were contacted by the physiotherapist for their follow-up reassessments. During these telephone calls, they were able to ask questions about recovery, troubling symptoms and commencement of activities or hobbies.
Galea, 2008[26]	Group-based supervised rehabilitation, n=11 Versus	Adults having a hip replacement	No extractable outcomes	Not extracted due to short time point: WOMAC at 8 weeks – (pain, stiffness, function, quality of

Study	Intervention and comparison	Population	Outcomes	Comments
	Self-directed rehabilitation, n=12	Mean age = 67.6 (8.8) years Australia		life)
Heiberg 2012[30]	Group-based supervised rehabilitation, n=35 Versus Self-directed rehabilitation, n=33	Adults having a hip replacement Mean (SD) age = 65.5 (8.17) years Norway	Measured at 6 to 24 months: • HOOS scale – pain • HOOS scale – symptoms • HOOS scale – quality of life • HOOS scale – activities of daily living • Reoperation including dislocation • Thromboembolic complications	
Johnsson 1988[38]	Group-based supervised rehabilitation, n=14 Versus Self-directed rehabilitation, n=16	Adults having a hip replacement Mean (range) age = 68 (50-76) years Sweden	Measured at 6 to 24 months: • Function – ROM	Organised physiotherapy started 2 months postoperatively.
Jokl, 1989[40]	Group-based supervised rehabilitation, n=15 Versus Self-directed rehabilitation, n=15	Adults having a knee replacement Mean (SD) age = 32.1 (10.35) years USA	No extractable outcomes	Not extracted due to short time point: knee function at 8 weeks
Piva 2019[70]	Group-based supervised rehabilitation, n=96	Adults having a knee replacement	Measured at 6 to 24 months: • PROMs – WOMAC	

Study	Intervention and comparison	Population	Outcomes	Comments
	Versus Self-directed rehabilitation, n=48	Mean (SD) age = 69.6 (6.6) years USA	scale • Quality of life	
Individually supervised rehabilitation				
Austin 2017[5]	Individually supervised rehabilitation, n=60 Versus Self-directed rehabilitation, n=60	Adults having a hip replacement Mean (SD) age = 61.75 (10.55) years USA	Measurement at baseline to 6 to24 months: • Quality of life	Downgraded for population indirectness. 30 patients (28%) crossed over between groups. 20 (37%) from the formal outpatient physical therapy group and 10 (19%) from the unsupervised home exercise group.
Fillingham, 2018[21]	Individually supervised rehabilitation, n=25 Versus Self-directed rehabilitation, n=22	Adults having a knee replacement Mean (SD) age = 60 (7.6) years USA	Measured at 6 weeks: • Reoperation including dislocation • Thromboembolic complications	Only thromboembolic complications and reoperation was extracted. Function – ROM and KOOS change at 6 weeks not extracted.
Heikkila 2017[31], Vuorenmaa 2014[89]	Individually supervised rehabilitation, n=53 Versus Self-directed rehabilitation, n=55	Adults having a knee replacement Mean (SD) age = 69 (9) years Finland	Measured at 6 to 24 months: • Quality of life • WOMAC scale – function • WOMAC scale – pain • Reoperation including dislocation within 24 months	Rehabilitation started 2 months later in intervention group. They received individual guidance at 2 months after TKA and at 1 and 4 months by the same physiotherapist.
Kramer, 2003[45]	Individually supervised rehabilitation, n=80	Adults having a knee replacement	No extractable outcomes	

ISBN

Study	Intervention and comparison	Population	Outcomes	Comments
	Versus Self-directed rehabilitation, n=80	Mean (SD) age = 68.4 (7.35) years Canada		
Mockford, 2008[58]	Individually supervised rehabilitation, n=71 Versus Self-directed rehabilitation, n=71	Adults having a knee replacement Mean age = 70.15 years UK	No extractable outcomes	Unclear whether outcomes were reported at 3 or 12 months and consequently were not extracted: quality of life via SF-12, Oxford knee score and thromboembolic complications
Monaghan, 2017[62]	Individually supervised rehabilitation, n=32 Versus Self-directed rehabilitation, n=31	Adults having a hip replacement Mean (SD) age = 68.5 (8.5) years UK	No extractable outcomes	Not extracted due to short time point: WOMAC – pain, stiffness, function and SF-12 PCS and MCS at 6 weeks
Piqueras, 2013[69]	Individually supervised rehabilitation, n=91 Versus Self-directed rehabilitation, n=90	Adults having a knee replacement Mean (SD) age = 73.3 (6.5) years Spain	No extractable outcomes	Not extracted due to short time point: WOMAC – pain, stiffness and function at 3 months
Piva 2019[70]	Individually supervised rehabilitation, n=96 Versus Self-directed rehabilitation, n=48	Adults having a knee replacement Mean (SD) age = 69.6 (6.6) years	Measured at 6 to 24 months: • PROMs – WOMAC scale • Quality of life	

Study	Intervention and comparison	Population	Outcomes	Comments
		USA		
Rajan 2004[72]	Individually supervised rehabilitation, n=59 Versus Self-directed rehabilitation, n=61	Adults having a knee replacement Mean (SD) age = 68.5 (9.65) years UK	Measured at 6 to 24 months: • Function – ROM	
Tousignant, 2011[81]	Individually supervised rehabilitation, n=24 Versus Self-directed rehabilitation, n=24	Adults having a knee replacement Mean (SD) age = 66 (11.5) years Canada	No extractable outcomes	
Unlu, 2007[86]	Individually supervised rehabilitation, n=8 Versus Self-directed rehabilitation, n=9	Adults having a hip replacement Mean (SD) age = 51.91 (8.82) years Singapore	No extractable outcomes	No extractable outcomes due to short time point and not meeting the protocol:gait speed, cadence, maximum isometric abduction torque at 6 weeks

1 See appendix D for full evidence tables.

1.4.4 2 Quality assessment of clinical studies included in the evidence review

3 **Table 3: Clinical evidence summary: Group-based supervised rehabilitation versus self-directed rehabilitation**

Outcomes	No of	Quality of the	Relativ	Anticipated absolute effects

ISBN

	Participants (studies) Follow up	evidence (GRADE)	e effect (95% CI)	Risk with Control	Risk difference with Group-based supervised rehabilitation versus self-directed rehabilitation (95% CI)
Quality of life at 6 to 24 months KOOS, HOOS scale. Scale from: 0 to 100.	104 (2 studies) 6-12 months	MODERATE[1] due to risk of bias		The mean quality of life at 6 to 24 months in the control groups was 64.05	The mean quality of life at 6 to 24 months in the intervention groups was 0.08 standard deviations higher (0.31 lower to 0.47 higher)
Quality of life at 6 to 24 months SF-36 scale, MCS. Scale from: 0 to 100.	98 (1 study) 6.5 months	LOW[1,2] due to risk of bias, imprecision		The mean quality of life at 6 to 24 months in the control groups was 78.6	The mean quality of life at 6 to 24 months in the intervention groups was 2.5 higher (6.72 lower to 11.72 higher)
Quality of life at 6 to 24 months SF-36, RAND-36 scale, PCS. Scale from: 0 to 100.	231 (2 studies) 6- 6.5 months	LOW due to risk of bias		The mean quality of life at 6 to 24 months in the control groups was 56.25	The mean quality of life at 6 to 24 months in the intervention groups was 0.10 standard deviations higher (0.16 lower to 0.37 higher)
PROMs - Pain at 6 to 24 months KOOS, WOMAC, HOOS scale. Scale from: 0 to 100.	125 (3 studies) 6-12 months	LOW[1,3] due to risk of bias, indirectness		The mean proms - pain at 6 to 24 months in the control groups was 70.03	The mean proms - pain at 6 to 24 months in the intervention groups was 0.03 standard deviations lower (0.39 lower to 0.32 higher)
PROMs - Function at 6 to 24 months WOMAC, HOOS, KOOS, WOMAC-PF scale. Scale from: 0 to 100.	258 (4 studies) 6-12 months	VERY LOW[1,2,3] due to risk of bias, indirectness		The mean proms - function at 6 to 24 months in the control groups was 53.725	The mean proms - function at 6 to 24 months in the intervention groups was 0.03 standard deviations lower (0.29 lower to 0.22 higher)
PROMs - Symptoms at 6 to 24 months KOOS, HOOS scale. Scale from: 0 to 100.	104 (2 studies) 6-12 months	MODERATE[1] due to risk of bias		The mean proms - symptoms at 6 to 24 months in the control groups was 34.85	The mean proms - symptoms at 6 to 24 months in the intervention groups was 0.10 standard deviations higher (0.29 lower to 0.48 higher)

ISBN

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with Control	Risk difference with Group-based supervised rehabilitation versus self-directed rehabilitation (95% CI)
PROMs - Total score WOMAC scale. Scale from: 0 to 100.	98 (1 study) 6.5 months	MODERATE[1] due to risk of bias		The mean proms - total score in the control groups was 19.7	The mean proms - total score in the intervention groups was 1.3 lower (11.05 lower to 8.45 higher)
Revision of joint replacement	Not reported				
Reoperation including dislocation within 24 months	68 (1 study) 12 months	MODERATE[1] due to risk of bias	RD 0.00 (-0.06 to 0.06)	0 fewer per 1000	0 fewer per 1000 (from 60 fewer to 60 more)
Function at 6 to 24 months Range of motion	30 (1 study) 6 months	VERY LOW[1,2] due to risk of bias, imprecision		The mean function at 6 to 24 months in the control groups was 88	The mean function at 6 to 24 months in the intervention groups was 4 higher (5.01 lower to 13.01 higher)
Thromboembolic complications within 90 days	68 (1 study) 12 months	MODERATE[1] due to risk of bias	RD 0.00 (-0.06 to 0.06)	0 fewer per 1000	0 fewer per 1000 (from 60 fewer to 60 more)

1 Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias.

2 Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs.

3 Downgraded by 1 or 2 increments for intervention indirectness.

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ISBN

Table 4: Clinical evidence summary: Individually supervised rehabilitation versus self-directed rehabilitation

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with Control	Risk difference with Individually supervised rehabilitation versus self-directed rehabilitation (95% CI)
Quality of life at 6 to 24 months RAND-36, SF-36 scale, physical health & functioning. Scale from: 0 to 100.	342 (3 studies) 6-12 months	VERY LOW[1,2,3] due to risk of bias, indirectness, imprecision		The median quality of life at 6 to 24 months in the control groups was 19.9	The mean quality of life at 6 to 24 months in the intervention groups was 1.65 higher (0.52 lower to 3.82 higher)
Quality of life at 6 to 24 months SF-36 scale, MCS. Scale from: 0 to 100.	104 (1 study) 12 months	MODERATE[1] due to risk of bias		The mean quality of life at 6 to 24 months in the control groups was 3	The mean quality of life at 6 to 24 months in the intervention groups was 1 higher (3.24 lower to 5.24 higher)
PROMs - Function at 6 to 24 months WOMAC, WOMAC-PF scale. Scale from: 0 to 100.	238 (2 studies) 12 months	VERY LOW[1,3] due to risk of bias, imprecision		The mean proms - function at 6 to 24 months in the control groups was -0.6	The mean proms - function at 6 to 24 months in the intervention groups was 0.25 standard deviations lower (0.52 lower to 0.01 higher)
PROMs - Pain at 6 to 24 months WOMAC scale. Scale from: 0 to 100.	104 (1 study) 12 months	MODERATE[1] due to risk of bias		The mean proms - pain at 6 to 24 months in the control groups was -14	The mean proms - pain at 6 to 24 months in the intervention groups was 1.00 lower (8.07 lower to 6.07 higher)
Revision of joint replacement	Not reported				
Reoperation including dislocation within 24 months	155 (2 studies) 14 months	VERY LOW[1,2,4] due to risk of bias, inconsistency, imprecision	RD 0.01 (-0.03 to 0.06)	0 per 1000	10 more per 1000 (from 30 fewer to 60 more)
Function at 6 to 24 months Range of motion	112 (1 study) 12 months	LOW[1,2] due to risk of bias,		The mean function at 6 to 24 months in the control groups was	The mean function at 6 to 24 months in the intervention groups was 2.2 higher

ISBN

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with Control	Risk difference with Individually supervised rehabilitation versus self-directed rehabilitation (95% CI)
		imprecision		96	(0.47 lower to 4.87 higher)
Thromboembolic complications within 90 days	47 (1 study) 6 weeks	MODERATE[1] due to risk of bias	RD 0.00 (-0.08 to 0.08)	0 per 1000	0 fewer per 1000 (from 80 fewer to 80 more)

1 Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias.

2 Downgraded by 1 or 2 increments because the majority of the evidence included an indirect or very indirect population respectively.

3 Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs.

4 Downgraded by 1 or 2 increments if as one study has zero events in both arms.

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2 See appendix F for full GRADE tables.

ISBN

1.5 Economic evidence

1.5.1 Included studies

No relevant health economic studies were identified.

1.5.2 Excluded studies

Two economic studies relating to this review question were identified but were excluded due to limited applicability.[25, 82] These are listed in appendix I, with reasons for exclusion given.

See also the health economic study selection flow chart in appendix G.

1.5.3 Unit costs

Some potentially relevant unit costs are provided below to aid consideration of cost effectiveness.

Table 5: Cost per hour of a hospital based physiotherapist or occupational therapist by band

Band 4	Band 5	Band 6	Band 7	Band 8a	Band 8b
£32	£35	£46	£55	£66	£78

(a) Source PSSRU 'Unit costs of Health and Social Care 2018[17]

1.6 Evidence statements

1.6.1 Clinical evidence statements

Group-based supervised rehabilitation versus self-directed rehabilitation

Evidence from 6 studies in adults having a knee or hip replacement showed no clinically important difference for 3 quality of life outcomes, 4 PROMS outcomes and 1 function outcome (very low to moderate quality, range of n=30-258). No evidence was identified for revision or reoperation of joint replacement or hospital readmissions.

Individually-based supervised rehabilitation versus self-directed rehabilitation

Evidence from 5 studies in adults having a knee or hip replacement showed no clinically important difference for 2 quality of life outcomes, 2 PROMs outcomes, 1 reoperation outcome and 1 function outcome (very low to moderate quality, n=47-134). No evidence was identified for revision of joint replacement or hospital readmissions.

1.6.2 Health economic evidence statements

No relevant economic evaluations were identified.

1.7 The committee's discussion of the evidence

1.7.1 Interpreting the evidence

1.7.1.1 The outcomes that matter most

The critical outcomes were agreed to be quality of life (QOL) at 6 to 24 months, Patient Reported Outcome Measures (PROMs) at 6 to 24 months, revision of joint replacement, and

reoperation including dislocation within 24 months. The follow up period of 6 to 24 months for QOL and PROMs was designed to pick up the benefits of rehabilitation beyond the immediate benefits that are apparent while engaged in the program. The reoperation outcome time point was within 24 months to indicate whether early problems in having a joint replacement are mitigated by the rehabilitation. The commissioning GP on the committee commented that readmission is a useful outcome from a commissioning standpoint

The important outcomes were hospital readmissions and thromboembolic events within 90 days. It was agreed function and pain would be extracted when not included within a PROM.

1.7.1.2 The quality of the evidence

Eighteen studies were include in the review, with overall quality ranging from moderate to very low quality due to risk of bias, imprecision or indirectness. The majority of the evidence was rated at low quality. One study was downgraded for indirectness as the control group intervention varied from the home exercises provided in hospital to community-based rehabilitation programs for a total of 4 to 6 sessions at the patients' discretion.

1.7.1.3 Benefits and harms

There were 2 comparisons within the review; group-based supervised rehabilitation compared to self-directed rehabilitation or individually-supervised rehabilitation compared to self-directed rehabilitation.

No clinically important difference was found for all outcomes in both comparisons which included; quality of life, a number of PROMs outcomes, reoperation including dislocation, thromboembolic complications and function.

The effectiveness of both forms of supervised rehabilitation was fairly similar though group supervised appeared to be slightly more effective than individually supervised when both are compare to self-directed. There were no circumstances in which self-directed showed a clinically important benefit over either form of supervised rehabilitation.

Reoperation, hospital readmissions and thromboembolic complications were outcomes designed to indicate the early positive and adverse reactions to types of outpatient rehabilitation. Reoperation and thromboembolic complications were reported but event rates were too low to allow the committee to draw any strong conclusions. The committee considered the lack of strong evidence in the shorter term outcomes to limit the interpretability of the results.

The committee were supportive of comparator groups where it was stated whom the person could contact if self-directed rehabilitation was not meeting their needs. This route of communication was formally stated in the majority of the included studies.

The delay in starting supervised rehabilitation in some studies, and the ability of people in comparator groups to refer themselves into supervised care when required led the committee to conclude the apparent benefits of supervised rehabilitation to have been compressed or reduced.

It is well known that joint replacements are very good operations and people tend to do well afterwards. Therefore, for many people, self-directed rehabilitation makes cost-effective sense as many people are well enough and have personal circumstances that do not require supervised rehabilitation. However there are likely to be subgroups of people who would benefit more from a supervised rehabilitation program.

ISBN

Therefore, more nuanced recommendations were required, avoiding a blanket recommendation for any single form of rehabilitation, and instead trying to capture the possible subgroups for whom the other forms may be required for effectiveness. The committee commented that it would be very useful if a tool existed that indicated those who would benefit from supervised rehabilitation or required adaptations to self-directed rehabilitation.

The committee were certain that some form of outpatient rehabilitation is essential and strongly believe there should be contact with the rehabilitation team after surgery, but before hospital discharge. The committee agreed that hospital discharge is a very important time as the postoperative hospital review may indicate specific rehabilitation techniques that people should follow based on their specific situation. This face to face contact will increase engagement with rehabilitation process after hospital discharge and would include explanations of the program they have been assigned, be it supervised or self-directed, and ways to contact the team if they have problems or questions.

Based on the evidence and informal consensus, it was decided that self-directed rehabilitation should be offered to people who have primary hip or knee replacement. This is in line with the basic care offered by orthopaedic centres in the NHS. A further recommendation was made to provide a contact for further advice and support for use if people have problems with self-directed rehabilitation.

In terms of subgroups who have different rehabilitation requirements, the committee made a recommendation to offer group or individually based rehabilitation in those with difficulties with activities of daily living, specific clinical needs, or are not responding well to self-directed rehabilitation. The committee stated it is currently unclear who will require supervised rehabilitation, but recognise there is a significant proportion who are included in the population stated above. These people would be better suited to a supervised rehabilitation environment.

The committee decided through consensus that people with cognitive impairments may in some cases require supervised rehabilitation. The recommendation addresses this with a recommendation to consider supervised rehabilitation for this population. In addition a research recommendation was made find out whether people with additional needs (such as people with dementia, learning difficulties or multiple disabling medical comorbidities) should be provided with supervised post-operative rehabilitation.

The choice of group based or individual rehabilitation was not addressed by the evidence review. These two rehabilitation approaches were not compared against each other and the evidence found did not give an indication as to who benefits most from each. The committee agreed that some people might benefit from group based and others individual. The committee therefore included both in the recommendation, to leave the option open to the rehabilitation team so they can ensure the most appropriate type is used given someone's clinical and personal situation. The committee decided this area should be addressed through a research recommendation to compared self-directed, group supervised, and individually supervised rehabilitations to each other to identify which is most effective.

A lay member commented it was important for the recommendation to be seen and understood by people who have joint replacement and this would encourage engagement with rehabilitation.

1.7.2 Cost effectiveness and resource use

No economic evaluations were found that compared supervised with self-directed rehabilitation. The hourly costs of a physiotherapist or occupational therapist time by band were presented to the committee.

ISBN

The committee suggested that everyone receives some form of self-directed outpatient rehabilitation as they are provided with exercises and advice before discharge as part of current practice. Therefore no resource impact should be expected from offering advice on self-directed rehabilitation before the person leaves the hospital, or ensuring people undertaking self-direct rehabilitation know who to contact for advice or support.

For many people, self-directed rehabilitation would be more cost-effective than supervised rehabilitation as many are well enough and have personal circumstances that allow for it to be just as effective as supervised rehabilitation. The committee noted that there was no national data on how many of these people receive supervised group or individual outpatient rehabilitation. Offering supervised rehabilitation to everyone would represent a considerable cost to the NHS in terms of therapists' time given that there were roughly 160,000 primary elective hip and knee operations in the UK in 2017. In addition to the concerns regarding resource impact of recommending supervised rehabilitation routinely for the whole hip and knee population, the committee did not consider the clinical evidence to be very strong. Therefore, they recommended self-directed rehabilitation as the first-line therapy.

Supervised rehabilitation was only recommended as an option for patients who cannot benefit from self-directed rehabilitation (for example those with dementia or learning difficulties) or where there are ongoing problems. Hence, where supervised rehabilitation has been recommended it has been for reasons of reducing inequalities as well as improving clinical effectiveness. This follows current practice where those who need more support are already offered out-patient rehabilitation based on normal, routine clinical reasoning. As these recommendations follow current practice, no resource impact is expected.

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1.7.3 Other factors the committee took into account

The committee mentioned there are self-directed rehabilitation services that will provide an information booklet on exercises after surgery and the person is expected to follow the booklet themselves without any further supervision or access to supervision. The committee did not consider this a sufficient approach to rehabilitation.

The committee also felt that rehabilitation is often seen as a surrogate term for exercise, but this underplays the diversity of rehabilitation that can and should be offered. There are functional aspects around living at home with a new joint replacement, for example, cooking, putting shoes and socks on, and getting in and out of the car. There are occupational adaptations that might be necessary for people attempting to return to work. Additionally, there are other interventions that could be offered such as motivational coaching to help with psychosocial behaviour change.

The committee agreed there are benefits to supervised rehabilitation that are not shown by the evidence. There are a number of personal situations that can lead to a lack of engagement with the exercise portion of the rehabilitation. This was highlighted by a lay member who finds this commonly happens among people she speaks to after joint replacement. Examples include; people whose care situation does not promote effective engagement with self-directed rehabilitation. These people are often elderly and return home after hospital discharge and are just managing to get out of the chair to cook but forgetting or not being encouraged to do the exercises in the program. This lack of rehabilitation can lead to functional problems and consequently falls and injury. The benefit of supervised rehabilitation to this group of people is that it would likely engage the person more fully in the exercise side of the rehabilitation. A lay member commented that it is the early stages of rehabilitation where a supervised approach would be most useful as it 'gets someone going' with rehabilitation, eventually becoming part of their daily life and naturally becomes more self-directed. This "getting involved" through supervised rehabilitation may have come through the evidence in the positive quality of life outcomes.

A committee member commented his orthopaedic centre utilises self-directed rehabilitation in the first instance but there is a 2 week review. During the review people who are having trouble engaging with the self-directed rehabilitation are identified and provisions are made to enable them to follow the program. This is a more intensive “system of checking” to find people who are not responding well to self-directed rehabilitation. Often centres have 6 week review appointments but the committee members considered that to be too lengthy a period of time before those having trouble are picked up. Also this form of usual care may not be ideal for people who could benefit from supervised rehabilitation immediately after hospital discharge. For example, younger people who are returning to work may require more complex, individual help, and a delay of 6 weeks or indeed 2 weeks for self-directed rehabilitation might adversely affect their outpatient experience.

The committee also noted the quality of life may have shown a benefit of supervised rehabilitation as it could also be reflecting patients’ satisfaction with care and the large non-specific effect of being treated by a physiotherapist. This personal treatment is gained in both forms of supervised rehabilitation though it could be more strongly seen in the individual rehabilitation where all attention is given to one person during the session. The benefits can be summarised as contact with a health professional who cares about you and shows attention to you as having a positive effect. Questions like; how’s your wound doing? Is your movement ok? How is life at the moment? Can I give you some tips on making the best of this? These are the benefits of paying personal attention to someone and engaging in understanding their postoperative situation while using expertise to help them out. This is not easily captured in clinical studies and a committee member commented that this is where qualitative data is of use.

References

1. Allegrante JP, Peterson MG, Cornell CN, MacKenzie CR, Robbins L, Horton R et al. Methodological challenges of multiple-component intervention: Lessons learned from a randomized controlled trial of functional recovery after hip fracture. HSS Journal. 2007; 3(1):63-70

2. Anonymous. Multimodal perioperative rehabilitation after total hip replacement (project) - Primary research (Project record). 2003. Available from: http://cochranelibrary-wiley.com/o/cochrane/clhta/articles/HTA-32003000214/frame.html

3. Artz N, Dixon S, Wylde V, Marques E, Beswick AD, Lenguerrand E et al. Comparison of group-based outpatient physiotherapy with usual care after total knee replacement: A feasibility study for a randomized controlled trial. Clinical Rehabilitation. 2017; 31(4):487-499

4. Artz N, Elvers KT, Lowe CM, Sackley C, Jepson P, Beswick AD. Effectiveness of physiotherapy exercise following total knee replacement: systematic review and meta-analysis. BMC Musculoskeletal Disorders. 2015; 16:15

5. Austin MS, Urbani BT, Fleischman AN, Fernando ND, Purtill JJ, Hozack WJ et al. Formal physical therapy after total hip arthroplasty is not required: A randomized controlled trial. Journal of Bone and Joint Surgery (American Volume). 2017; 99(8):648-655

6. Barker KL, Beard D, Price A, Toye F, Underwood M, Drummond A et al. COmmunity-based Rehabilitation after Knee Arthroplasty (CORKA): Study protocol for a randomised controlled trial. Trials [Electronic Resource]. 2016; 17:501

7. Barker KL, Newman MA, Hughes T, Sackley C, Pandit H, Kiran A et al. Recovery of function following hip resurfacing arthroplasty: A randomized controlled trial comparing an accelerated versus standard physiotherapy rehabilitation programme. Clinical Rehabilitation. 2013; 27(9):771-84

8. Beaupre LA, Masson EC, Luckhurst BJ, Arafah O, O'Connor GJ. A randomized pilot study of a comprehensive postoperative exercise program compared with usual care following primary total hip arthroplasty in subjects less than 65 years of age: feasibility, selection of outcome measures and timing of assessment. BMC Musculoskeletal Disorders. 2014; 15:192

9. Bini SA, Mahajan J. Clinical outcomes of remote asynchronous telerehabilitation are equivalent to traditional therapy following total knee arthroplasty: A randomized control study. Journal of Telemedicine and Telecare. 2017; 23(2):239-247

10. Bruun-Olsen V, Heiberg KE, Wahl AK, Mengshoel AM. The immediate and long-term effects of a walking-skill program compared to usual physiotherapy care in patients who have undergone total knee arthroplasty (TKA): A randomized controlled trial. Disability and Rehabilitation. 2013; 35(23):2008-15

11. Buhagiar MA, Naylor JM, Harris IA, Xuan W, Kohler F, Wright RJ et al. Hospital Inpatient versus HOme-based rehabilitation after knee arthroplasty (The HIHO study): Study protocol for a randomized controlled trial. Trials [Electronic Resource]. 2013; 14:432

ISBN

12. Bulthuis Y, Drossaers-Bakker KW, Taal E, Rasker J, Oostveen J, van't Pad Bosch P et al. Arthritis patients show long-term benefits from 3 weeks intensive exercise training directly following hospital discharge. Rheumatology. 2007; 46(11):1712-7

13. Carmeli E, Sheklow SL, Coleman R. A comparative study of organized class-based exercise programs versus individual home-based exercise programs for elderly patients following hip surgery. Disability and Rehabilitation. 2006; 28(16):997-1005

14. Christiansen MB, Thoma LM, Master H, Schmitt LA, Pohlig R, White DK. A physical therapist-administered physical activity intervention after total knee replacement: Protocol for a randomized controlled trial. Physical Therapy. 2018; 98(7):578-584

15. Christiansen MB, Thoma LM, Master H, Voinier D, Schmitt LA, Ziegler ML et al. The feasibility and preliminary outcomes of a physical therapist-administered physical activity intervention after total knee replacement. Arthritis Care and Research. 2019; Epublication

16. Coulter C, Perriman DM, Neeman TM, Smith PN, Scarvell JM. Supervised or unsupervised rehabilitation after total hip replacement provides similar improvements for patients: A randomized controlled trial. Archives of Physical Medicine and Rehabilitation. 2017; 98(11):2253-2264

17. Curtis LA, Burns A. Unit costs of health and social care 2018. Project report. Kent. University of Kent, 2018. Available from: https://kar.kent.ac.uk/70995/1/Unit%20Costs%202018%20-%20FINAL%20with%20bookmarks%20and%20covers%20%282%29.pdf

18. Diong J, Allen N, Sherrington C. Structured exercise improves mobility after hip fracture: A meta-analysis with meta-regression. British Journal of Sports Medicine. 2016; 50(6):346-55

19. Dowsey MM, Kilgour ML, Santamaria NM, Choong PF. Clinical pathways in hip and knee arthroplasty: A prospective randomised controlled study. Medical Journal of Australia. 1999; 170(2):59-62

20. Eichler S, Rabe S, Salzwedel A, Muller S, Stoll J, Tilgner N et al. Effectiveness of an interactive telerehabilitation system with home-based exercise training in patients after total hip or knee replacement: Study protocol for a multicenter, superiority, no-blinded randomized controlled trial. Trials [Electronic Resource]. 2017; 18:438

21. Fillingham YA, Darrith B, Lonner JH, Culvern C, Crizer M, Della Valle CJ. Formal physical therapy may not be necessary after unicompartmental knee arthroplasty: A randomized clinical trial. Journal of Arthroplasty. 2018; 33(42):S93-S99 e3

22. Florez-Garcia M, Garcia-Perez F, Curbelo R, Perez-Porta I, Nishishinya B, Rosario Lozano MP et al. Efficacy and safety of home-based exercises versus individualized supervised outpatient physical therapy programs after total knee arthroplasty: A systematic review and meta-analysis. Knee Surgery, Sports Traumatology, Arthroscopy. 2017; 25(11):3340-3353

23. Fransen M, Nairn L, Bridgett L, Crosbie J, March L, Parker D et al. Post-acute rehabilitation after total knee replacement: A multicenter randomized clinical trial comparing long-term outcomes. Arthritis Care and Research. 2017; 69(2):192-200

24. Frost H, Lamb SE, Robertson S. A randomized controlled trial of exercise to improve mobility and function after elective knee arthroplasty. Feasibility, results and methodological difficulties. Clinical Rehabilitation. 2002; 16(2):200-9

ISBN

25. Fusco F, Turchetti G. Telerehabilitation after total knee replacement in Italy: Cost-effectiveness and cost-utility analysis of a mixed telerehabilitation-standard rehabilitation programme compared with usual care. BMJ Open. 2016; 6(5):e009964

26. Galea MP, Levinger P, Lythgo N, Cimoli C, Weller R, Tully E et al. A targeted home- and center-based exercise program for people after total hip replacement: A randomized clinical trial. Archives of Physical Medicine and Rehabilitation. 2008; 89(8):1442-7

27. Gao Zy, Wu Jx, Lin Wl, Tuo M, Zhu Qx, Wei L et al. Comprehensive rehabilitation following total knee arthroplasty: A randomized controlled trial. Journal of Clinical Rehabilitative Tissue Engineering Research. 2011; 15(39):7275-7278

28. Hagsten B, Svensson O, Gardulf A. Health-related quality of life and self-reported ability concerning ADL and IADL after hip fracture: A randomized trial. Acta Orthopaedica. 2006; 77(1):114-9

29. Han AS, Nairn L, Harmer AR, Crosbie J, March L, Parker D et al. Early rehabilitation after total knee replacement surgery: A multicenter, noninferiority, randomized clinical trial comparing a home exercise program with usual outpatient care. Arthritis Care and Research. 2015; 67(2):196-202

30. Heiberg KE, Bruun-Olsen V, Ekeland A, Mengshoel AM. Effect of a walking skill training program in patients who have undergone total hip arthroplasty: Followup one year after surgery. Arthritis Care and Research. 2012; 64(3):415-23

31. Heikkila A, Sevander-Kreus N, Hakkinen A, Vuorenmaa M, Salo P, Konsta P et al. Effect of total knee replacement surgery and postoperative 12 month home exercise program on gait parameters. Gait and Posture. 2017; 53:92-7

32. Henderson KG, Wallis JA, Snowdon DA. Active physiotherapy interventions following total knee arthroplasty in the hospital and inpatient rehabilitation settings: A systematic review and meta-analysis. Physiotherapy. 2018; 104(1):25-35

33. Hensman-Crook A. The effectiveness of physiotherapy intervention with home exercise programme versus patient directed home exercise programme following total knee replacement. Internal Medicine Journal. 2011; 41(S1):39

34. Holmgren T, Oberg B, Sjoberg I, Johansson K. Supervised strengthening exercises versus home-based movement exercises after arthroscopic acromioplasty: A randomized clinical trial. Journal of Rehabilitation Medicine. 2012; 44(1):12-8

35. Hsu WH, Hsu WB, Shen WJ, Lin ZR, Chang SH, Hsu RWW. Twenty-four-week hospital-based progressive resistance training on functional recovery in female patients post total knee arthroplasty. Knee. 2019; 26(3):729-736

36. Iyengar KP, Nadkarni JB, Ivanovic N, Mahale A. Targeted early rehabilitation at home after total hip and knee joint replacement: Does it work? Disability and Rehabilitation. 2007; 29(6):495-502

37. Jin C, Feng Y, Ni Y, Shan Z. Virtual reality intervention in postoperative rehabilitation after total knee arthroplasty: A prospective and randomized controlled clinical trial. International Journal of Clinical and Experimental Medicine. 2018; 11(6):6119-6124

38. Johnsson R, Melander A, Onnerfalt R. Physiotherapy after total hip replacement for primary arthrosis. Scandinavian Journal of Rehabilitation Medicine. 1988; 20(1):43-5

39. Joice MG, Bhowmick S, Amanatullah DF. Perioperative physiotherapy in total knee arthroplasty. Orthopedics. 2017; 40(5):e765-e773

40. Jokl P, Stull PA, Lynch JK, Vaughan V. Independent home versus supervised rehabilitation following arthroscopic knee surgery--a prospective randomized trial. Arthroscopy. 1989; 5(4):298-305

41. Juhakoski R, Tenhonen S, Malmivaara A, Kiviniemi V, Anttonen T, Arokoski JP. A pragmatic randomized controlled study of the effectiveness and cost consequences of exercise therapy in hip osteoarthritis. Clinical Rehabilitation. 2011; 25(4):370-83

42. Kauppila AM, Kyllonen E, Ohtonen P, Hamalainen M, Mikkonen P, Laine V et al. Multidisciplinary rehabilitation after primary total knee arthroplasty: A randomized controlled study of its effects on functional capacity and quality of life. Clinical Rehabilitation. 2010; 24(5):398-411

43. Kelly MH, Ackerman RM. Total joint arthroplasty: A comparison of postacute settings on patient functional outcomes. Orthopaedic Nursing. 1999; 18(5):75-84

44. Ko V, Naylor J, Harris I, Crosbie J, Yeo A, Mittal R. One-to-one therapy is not superior to group or home-based therapy after total knee arthroplasty: A randomized, superiority trial. Journal of Bone and Joint Surgery (American Volume). 2013; 95(21):1942-9

45. Kramer JF, Speechley M, Bourne R, Rorabeck C, Vaz M. Comparison of clinic- and home-based rehabilitation programs after total knee arthroplasty. Clinical Orthopaedics and Related Research. 2003; (410):225-34

46. Larsen K, Hvass KE, Hansen TB, Thomsen PB, Soballe K. Effectiveness of accelerated perioperative care and rehabilitation intervention compared to current intervention after hip and knee arthroplasty. A before-after trial of 247 patients with a 3-month follow-up. BMC Musculoskeletal Disorders. 2008; 9:59

47. Lenguerrand E, Artz N, Marques E, Sanderson E, Lewis K, Murray J et al. Effect of group-based outpatient physiotherapy on function after total knee replacement: The ARENA randomised controlled trial. Arthritis Care and Research. 2019; Epublication

48. Levine M, McElroy K, Stakich V, Cicco J. Comparing conventional physical therapy rehabilitation with neuromuscular electrical stimulation after TKA. Orthopedics. 2013; 36(3):e319-24

49. Li D, Yang Z, Kang P, Xie X. Home-based compared with hospital-based rehabilitation program for patients undergoing total knee arthroplasty for osteoarthritis: A systematic review and meta-analysis of randomized controlled trials. American Journal of Physical Medicine and Rehabilitation. 2017; 96(6):440-447

50. Lin CW, March L, Crosbie J, Crawford R, Graves S, Naylor J et al. Maximum recovery after knee replacement--the MARKER study rationale and protocol. BMC Musculoskeletal Disorders. 2009; 10:69

51. Liu M, Jia Y, Shi N. Application value of an integrated treatment model of orthopedic rehabilitation in patients undergoing total knee arthroplasty. International Journal of Clinical and Experimental Medicine. 2018; 11(9):9455-9461

52. Liu YJ, Xu HP, Zhao H. Self-management approaches following total knee arthroplasty. Journal of Clinical Rehabilitative Tissue Engineering Research. 2011; 15(17):3057-3061

53. Losina E, Collins JE, Daigle ME, Donnell-Fink LA, Prokopetz JJ, Strnad D et al. The AViKA (Adding Value in Knee Arthroplasty) postoperative care navigation trial: Rationale and design features. BMC Musculoskeletal Disorders. 2013; 14:290

ISBN

54. Lowe CJ, Davies L, Sackley CM, Barker KL. Effectiveness of land-based physiotherapy exercise following hospital discharge following hip arthroplasty for osteoarthritis: An updated systematic review. Physiotherapy. 2015; 101(3):252-65

55. Medical Advisory Secretariat. Physiotherapy rehabilitation after total knee or hip replacement: An evidence-based analysis. 2005. Available from: http://cochranelibrary-wiley.com/o/cochrane/clhta/articles/HTA-32005001179/frame.html

56. Mikkelsen LR, Mechlenburg I, Soballe K, Jorgensen LB, Mikkelsen S, Bandholm T et al. Effect of early supervised progressive resistance training compared to unsupervised home-based exercise after fast-track total hip replacement applied to patients with preoperative functional limitations. A single-blinded randomised controlled trial. Osteoarthritis and Cartilage. 2014; 22(12):2051-8

57. Minns Lowe CJ, Barker KL, Holder R, Sackley CM. Comparison of postdischarge physiotherapy versus usual care following primary total knee arthroplasty for osteoarthritis: An exploratory pilot randomized clinical trial. Clinical Rehabilitation. 2012; 26(7):629-41

58. Mockford BJ, Thompson NW, Humphreys P, Beverland DE. Does a standard outpatient physiotherapy regime improve the range of knee motion after primary total knee arthroplasty? Journal of Arthroplasty. 2008; 23(8):1110-4

59. Moffet H, Collet JP, Shapiro SH, Paradis G, Marquis F, Roy L. Effectiveness of intensive rehabilitation on functional ability and quality of life after first total knee arthroplasty: A single-blind randomized controlled trial. Archives of Physical Medicine and Rehabilitation. 2004; 85(4):546-56

60. Moffet H, Tousignant M, Nadeau S, Merette C, Boissy P, Corriveau H et al. Patient satisfaction with in-home telerehabilitation after total knee arthroplasty: Results from a randomized controlled trial. Telemedicine Journal and e-Health. 2017; 23(2):80-7

61. Moffet H, Tousignant M, Nadeau S, Merette C, Boissy P, Corriveau H et al. In-home telerehabilitation compared with face-to-face rehabilitation after total knee arthroplasty: A noninferiority randomized controlled trial. Journal of Bone and Joint Surgery (American Volume). 2015; 97(14):1129-41

62. Monaghan B, Cunningham P, Harrington P, Hing W, Blake C, D OD et al. Randomised controlled trial to evaluate a physiotherapy-led functional exercise programme after total hip replacement. Physiotherapy. 2017; 103(3):283-288

63. Monaghan B, Grant T, Hing W, Cusack T. Functional exercise after total hip replacement (FEATHER): A randomised control trial. BMC Musculoskeletal Disorders. 2012; 13:237

64. Naglie G, Tansey C, Kirkland JL, Ogilvie-Harris DJ, Detsky AS, Etchells E et al. Interdisciplinary inpatient care for elderly people with hip fracture: A randomized controlled trial. CMAJ : Canadian Medical Association journal. 2002; 167(1):25-32

65. National Institute for Health and Care Excellence. Developing NICE guidelines: the manual [updated 2018]. London. National Institute for Health and Care Excellence, 2014. Available from: http://www.nice.org.uk/article/PMG20/chapter/1%20Introduction%20and%20overview

66. Okoro T, Morrison V, Maddison P, Lemmey AB, Andrew JG. An assessment of the impact of behavioural cognitions on function in patients partaking in a trial of early home-based progressive resistance training after total hip replacement surgery. Disability and Rehabilitation. 2013; 35(23):2000-7

ISBN

67. Okoro T, Whitaker R, Gardner A, Maddison P, Andrew JG, Lemmey A. Does an early home-based progressive resistance training program improve function following total hip replacement? Results of a randomized controlled study. BMC Musculoskeletal Disorders. 2016; 17:173

68. Ozdemir O, Tosun BU. Effects of home exercise programmes during home visits after hip replacement: A systematic review. Journal of the College of Physicians and Surgeons--Pakistan. 2017; 27(1):34-7

69. Piqueras M, Marco E, Coll M, Escalada F, Ballester A, Cinca C et al. Effectiveness of an interactive virtual telerehabilitation system in patients after total knee arthoplasty: A randomized controlled trial. Journal of Rehabilitation Medicine. 2013; 45(4):392-6

70. Piva SR, Schneider MJ, Moore CG, Catelani MB, Gil AB, Klatt BA et al. Effectiveness of later-stage exercise programs vs usual medical care on physical function and activity after total knee replacement: A randomized clinical trial. JAMA Network Open. 2019; 2(2):e190018

71. Poulsen E, Hartvigsen J, Christensen HW, Roos EM, Vach W, Overgaard S. Patient education with or without manual therapy compared to a control group in patients with osteoarthritis of the hip. A proof-of-principle three-arm parallel group randomized clinical trial. Osteoarthritis and Cartilage. 2013; 21(10):1494-503

72. Rajan RA, Pack Y, Jackson H, Gillies C, Asirvatham R. No need for outpatient physiotherapy following total knee arthroplasty: A randomized trial of 120 patients. Acta Orthopaedica Scandinavica. 2004; 75(1):71-3

73. Riddle DL, Keefe FJ, Ang D, J K, Dumenci L, Jensen MP et al. A phase III randomized three-arm trial of physical therapist delivered pain coping skills training for patients with total knee arthroplasty: The KASTPain protocol. BMC Musculoskeletal Disorders. 2012; 13:149

74. Russell TG, Buttrum P, Wootton R, Jull GA. Low-bandwidth telerehabilitation for patients who have undergone total knee replacement: Preliminary results. Journal of Telemedicine and Telecare. 2003; 9(Suppl 2):S44-7

75. Russell TG, Buttrum P, Wootton R, Jull GA. Internet-based outpatient telerehabilitation for patients following total knee arthroplasty: A randomized controlled trial. Journal of Bone and Joint Surgery (American Volume). 2011; 93(2):113-20

76. Shukla H, Nair SR, Thakker D. Role of telerehabilitation in patients following total knee arthroplasty: Evidence from a systematic literature review and meta-analysis. Journal of Telemedicine and Telecare. 2017; 23(2):339-346

77. Simpson AH, Hamilton DF, Beard DJ, Barker KL, Wilton T, Hutchison JD et al. Targeted rehabilitation to improve outcome after total knee replacement (TRIO): Study protocol for a randomised controlled trial. Trials [Electronic Resource]. 2014; 15:44

78. Strom H, Huss K, Larsson S. Unrestricted weight bearing and intensive physiotherapy after uncemented total hip arthroplasty. Scandinavian Journal of Surgery. 2006; 95(1):55-60

79. Tal-Akabi A, Steiger U, Villiger PM. Neuromuscular adaptation to early post-operative, high-intensity, short resistance training of non-operated lower extremity in elderly patients: A randomized controlled trial. Journal of Rehabilitation Medicine. 2007; 39(9):724-9

ISBN

80. Taraldsen K, Sletvold O, Thingstad P, Saltvedt I, Granat MH, Lydersen S et al. Physical behavior and function early after hip fracture surgery in patients receiving comprehensive geriatric care or orthopedic care--a randomized controlled trial. Journals of Gerontology Series A: Biological Sciences and Medical Sciences. 2014; 69(3):338-45

81. Tousignant M, Moffet H, Boissy P, Corriveau H, Cabana F, Marquis F. A randomized controlled trial of home telerehabilitation for post-knee arthroplasty. Journal of Telemedicine and Telecare. 2011; 17(4):195-8

82. Tousignant M, Moffet H, Nadeau S, Merette C, Boissy P, Corriveau H et al. Cost analysis of in-home telerehabilitation for post-knee arthroplasty. Journal of Medical Internet Research. 2015; 17(3):e83

83. Tsauo JY, Leu WS, Chen YT, Yang RS. Effects on function and quality of life of postoperative home-based physical therapy for patients with hip fracture. Archives of Physical Medicine and Rehabilitation. 2005; 86(10):1953-7

84. Tseng MY, Liang J, Shyu YI, Wu CC, Cheng HS, Chen CY et al. Effects of interventions on trajectories of health-related quality of life among older patients with hip fracture: A prospective randomized controlled trial. BMC Musculoskeletal Disorders. 2016; 17:114

85. Umpierres CS, Ribeiro TA, Marchisio AE, Galvao L, Borges IN, Macedo CA et al. Rehabilitation following total hip arthroplasty evaluation over short follow-up time: Randomized clinical trial. Journal of Rehabilitation Research and Development. 2014; 51(10):1567-78

86. Unlu E, Eksioglu E, Aydog E, Aydog ST, Atay G. The effect of exercise on hip muscle strength, gait speed and cadence in patients with total hip arthroplasty: A randomized controlled study. Clinical Rehabilitation. 2007; 21(8):706-11

87. Vadher K, Knight R, Barker KL, Dutton SJ. COmmunity-based Rehabilitation after Knee Arthroplasty (CORKA): Statistical analysis plan for a randomised controlled trial. Trials [Electronic Resource]. 2018; 19(1):638

88. Vesterby MS, Pedersen PU, Laursen M, Mikkelsen S, Larsen J, Soballe K et al. Telemedicine support shortens length of stay after fast-track hip replacement. Acta Orthopaedica. 2017; 88(1):41-47

89. Vuorenmaa M, Ylinen J, Piitulainen K, Salo P, Kautiainen H, Pesola M et al. Efficacy of a 12-month, monitored home exercise programme compared with normal care commencing 2 months after total knee arthroplasty: A randomized controlled trial. Journal of Rehabilitation Medicine. 2014; 46(2):166-72

90. Walker RH, Morris BA, Angulo DL, Schneider J, Colwell CW. Postoperative use of continuous passive motion, transcutaneous electricle nerve stimulation, and continuous cooling pad following total knee arthroplasty. Journal of Arthroplasty. 1991; 6(2):151-156

91. Wang D, Wang HY, Cao C, Li LL, Meng WK, Pei FX et al. Tranexamic acid in primary total knee arthroplasty without tourniquet: A randomized, controlled trial of oral versus intravenous versus topical administration. Scientific Reports. 2018; 8(1):13579

92. Weaver FM, Hughes SL, Almagor O, Wixson R, Manheim L, Fulton B et al. Comparison of two home care protocols for total joint replacement. Journal of the American Geriatrics Society. 2003; 51(4):523-8

ISBN

93. Wei XP, Li XL, Xing XY, Zhang XY. Daily living activities and effect evaluation following total hip replacement: Community return visit. Journal of Clinical Rehabilitative Tissue Engineering Research. 2010; 14(22):4047-4049

94. Worland RL, Arredondo J, Angles F, Lopez-Jimenez F, Jessup DE. Home continuous passive motion machine versus professional physical therapy following total knee replacement. Journal of Arthroplasty. 1998; 13(7):784-7

95. Wylde V, Artz N, Marques E, Lenguerrand E, Dixon S, Beswick AD et al. Effectiveness and cost-effectiveness of outpatient physiotherapy after knee replacement for osteoarthritis: Study protocol for a randomised controlled trial. Trials [Electronic Resource]. 2016; 17:289

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Appendices

Appendix A: Review protocols

Table 6: Review protocol: Post-operative rehabilitation

ID	Field	Content
0.	PROSPERO registration number	Not registered
1.	Review title	Outpatient rehabilitation in those who have undergone hip/knee joint replacement
2.	Review question	In adults who have undergone primary elective hip or knee replacement, what is the clinical and cost effectiveness of self-directed outpatient rehabilitation versus supervised outpatient rehabilitation?
3.	Objective	Rehabilitation includes education, advice, functional exercises and muscle work to restore strength and joint mobility and to improve patients' functional capacity. This review seeks to find out whether it is more effective and cost-effective to have self-directed or supervised postoperative outpatient rehabilitation after surgery.
4.	Searches	The following databases will be searched: Cochrane Central Register of Controlled Trials (CENTRAL) Cochrane Database of Systematic Reviews (CDSR) Embase MEDLINE Searches will be restricted by: English language Human studies Letters and comments are excluded. Other searches: Inclusion lists of relevant systematic reviews will be checked by the reviewer. The searches may be re-run 6 weeks before final committee meeting and further studies retrieved for inclusion if relevant. The full search strategies will be published in the final review.
5.	Condition or domain	Outpatient rehabilitation in those undergoing hip/knee joint replacement

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ID	Field	Content
	being studied	
6.	Population	Inclusion: Adults who have undergone primary hip or knee joint replacement. Exclusion: Adults having joint replacement as immediate treatment following fracture. Adults having revision joint replacement. Adults having joint replacement as treatment for primary or secondary cancer affecting the bones.
7.	Intervention/Exposure/Test	Group based supervised post-operative rehabilitation commencing from first post-operative follow-up appointment Individually supervised post-operative rehabilitation commencing from first post-operative follow-up appointment
8.	Comparator/Reference standard/Confounding factors	Self-directed rehabilitation
9.	Types of study to be included	Randomised controlled trials If no well conducted RCTs are available, then observational studies with multivariate analysis will be investigated.
10.	Other exclusion criteria	Non-English language studies. Abstracts will be excluded as it is expected there will be sufficient full text published studies available.
11.	Context	N/A
12.	Primary outcomes (critical outcomes)	Quality of life at 6 to 24 months (continuous) for example EQ-5D, EQ-VAS. Patient Reported Outcome Measures (PROMs) within at 6 to 24 (continuous) Revision of joint replacement (time to event) Reoperation including dislocation within 24 months (dichotomous)
13.	Secondary outcomes (important outcomes)	Hospital readmissions: within 90 days (dichotomous) Thromboembolic complications within 90 days To be extracted when not included within a PROM:

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ID	Field	Content
		Function at 6 to 24 months (continuous) Pain (continuous) within at 6 to 24 months
14.	Data extraction (selection and coding)	EndNote will be used for reference management, sifting, citations and bibliographies. Titles and/or abstracts of studies retrieved using the search strategy and those from additional sources will be screened for inclusion. The full text of potentially eligible studies will be retrieved and will be assessed for eligibility in line with the criteria outlined above. 10% of the abstracts will be reviewed by two reviewers, with any disagreements resolved by discussion or, if necessary, a third independent reviewer. An in-house developed database; EviBase, will be used for data extraction. A standardised form is followed to extract data from studies (see Developing NICE guidelines: the manual section 6.4) and for undertaking assessment of study quality. Summary evidence tables will be produced including information on: study setting; study population and participant demographics and baseline characteristics; details of the intervention and control interventions; study methodology' recruitment and missing data rates; outcomes and times of measurement; critical appraisal ratings. A second reviewer will quality assure the extracted data. Discrepancies will be identified and resolved through discussion (with a third reviewer where necessary).
15.	Risk of bias (quality) assessment	Risk of bias will be assessed using the appropriate checklist as described in Developing NICE guidelines: the manual. For Intervention reviews the following checklist will be used according to study design being assessed: Systematic reviews: Risk of Bias in Systematic Reviews (ROBIS) Randomised Controlled Trial: Cochrane RoB (2.0) Disagreements between the review authors over the risk of bias in particular studies will be resolved by discussion, with involvement of a third review author where necessary.
16.	Strategy for data synthesis	Where possible, data will be meta-analysed. Pairwise meta-analyses will be performed using Cochrane Review Manager (RevMan5) to combine the data given in all studies for each of the outcomes stated above. A fixed effect meta-analysis, with weighted mean differences for continuous outcomes and risk ratios for binary outcomes will be used, and 95% confidence intervals will be calculated for each outcome. Heterogeneity between the studies in effect measures will be assessed using the I^2 statistic and visually inspected. We will consider an I^2 value greater than 50% indicative of substantial heterogeneity. Sensitivity analyses will be conducted based on pre-specified subgroups using stratified meta-analysis to explore the heterogeneity in effect estimates. If this does not explain the heterogeneity, the results will be presented using random-effects. GRADE pro will be used to assess the quality of each outcome, taking into account individual study quality and the meta-

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ID	Field	Content
		analysis results. The 4 main quality elements (risk of bias, indirectness, inconsistency and imprecision) will be appraised for each outcome. If the population included in an individual study includes children aged under 12, it will be included if the majority of the population is aged over 12, and downgraded for indirectness if the overlap into those aged less than 12 is greater than 20%. Publication bias is tested for when there are more than 5 studies for an outcome. Other bias will only be taken into consideration in the quality assessment if it is apparent. Where meta-analysis is not possible, data will be presented and quality assessed individually per outcome. If sufficient data is available to make a network of treatments, WinBUGS will be used for network meta-analysis.
17.	Analysis of sub-groups	Site/type of joint replacement: unicompartmental knee arthroplasty total knee arthroplasty hip replacement Number of supervised sessions: ≤3 sessions >3 sessions Age: working age non-working age Use of hydrotherapy: land-based physiotherapy additional hydrotherapy Cognitive status: people with cognitive impairment people without cognitive impairment Telerehab: Use of telephone calls for supervision appointments No use of telephone calls for supervision appointments

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ID	Field	Content			
18.	Type and method of review	☒	Intervention		
		☐	Diagnostic		
		☐	Prognostic		
		☐	Qualitative		
		☐	Epidemiologic		
		☐	Service Delivery		
		☐	Other (please specify)		
19.	Language	English			
20.	Country	England			
21.	Anticipated or actual start date	02/07/18			
22.	Anticipated completion date	20/03/20			
23.	Stage of review at time of this submission	Review stage		Started	Completed
		Preliminary searches		☐	☑
		Piloting of the study selection process		☐	☑
		Formal screening of search results against eligibility criteria		☐	☑
		Data extraction		☐	☑
		Risk of bias (quality) assessment		☐	☑
		Data analysis		☐	☑
24.	Named contact	5a. Named contact National Guideline Centre 5b Named contact e-mail 5e Organisational affiliation of the review			

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ID	Field	Content
		National Institute for Health and Care Excellence (NICE) and the National Guideline Centre
25.	Review team members	From the National Guideline Centre: Carlos Sharpin [Guideline lead] Alex Allen [Senior Systematic Reviewer] Rafina Yarde [Systematic reviewer] Robert King [Health economist] Agnès Cuyàs [Information specialist] Eleanor Priestnall [Project Manager]
26.	Funding sources/sponsor	This systematic review is being completed by the National Guideline Centre which receives funding from NICE.
27.	Conflicts of interest	All guideline committee members and anyone who has direct input into NICE guidelines (including the evidence review team and expert witnesses) must declare any potential conflicts of interest in line with NICE's code of practice for declaring and dealing with conflicts of interest. Any relevant interests, or changes to interests, will also be declared publicly at the start of each guideline committee meeting. Before each meeting, any potential conflicts of interest will be considered by the guideline committee Chair and a senior member of the development team. Any decisions to exclude a person from all or part of a meeting will be documented. Any changes to a member's declaration of interests will be recorded in the minutes of the meeting. Declarations of interests will be published with the final guideline.
28.	Collaborators	Development of this systematic review will be overseen by an advisory committee who will use the review to inform the development of evidence-based recommendations in line with section 3 of Developing NICE guidelines: the manual. Members of the guideline committee are available on the NICE website: [NICE guideline webpage].
29.	Other registration details	
30.	Reference/URL for published protocol	
31.	Dissemination plans	NICE may use a range of different methods to raise awareness of the guideline. These include standard approaches such as: notifying registered stakeholders of publication publicising the guideline through NICE's newsletter and alerts issuing a press release or briefing as appropriate, posting news articles on the NICE website, using social media channels, and publicising the guideline within NICE.
32.	Keywords	Rehabilitation, outpatient, joint replacement, hip or knee,
33.	Details of existing review of same topic by	N/A

ISBN

ID	Field	Content	
	same authors		
34.	Current review status	☐	Ongoing
		☒	Completed but not published
		☐	Completed and published
		☐	Completed, published and being updated
		☐	Discontinued
35..	Additional information	N/A	
36.	Details of final publication	www.nice.org.uk	

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1 **Table 7: Health economic review protocol**

Review question	All questions – health economic evidence
Objectives	To identify health economic studies relevant to any of the review questions.
Search criteria	• Populations, interventions and comparators must be as specified in the clinical review protocol above. • Studies must be of a relevant health economic study design (cost–utility analysis, cost-effectiveness analysis, cost–benefit analysis, cost–consequences analysis, comparative cost analysis). • Studies must not be a letter, editorial or commentary, or a review of health economic evaluations. (Recent reviews will be ordered although not reviewed. The bibliographies will be checked for relevant studies, which will then be ordered.) • Unpublished reports will not be considered unless submitted as part of a call for evidence. • Studies must be in English.
Search strategy	A health economic study search will be undertaken using population-specific terms and a health economic study filter – see appendix B below.
Review strategy	Studies not meeting any of the search criteria above will be excluded. Studies published before 2003, abstract-only studies and studies from low or middle-income countries (e.g. most non-OECD countries) or the USA will also be excluded. Each remaining study will be assessed for applicability and methodological limitations using the NICE economic evaluation checklist which can be found in appendix H of Developing NICE guidelines: the manual (2014).[65] **Inclusion and exclusion criteria** • If a study is rated as both 'Directly applicable' and with 'Minor limitations' then it will be included in the guideline. A health economic evidence table will be completed and it will be included in the health economic evidence profile. • If a study is rated as either 'Not applicable' or with 'Very serious limitations' then it will usually be excluded from the guideline. If it is excluded then a health economic evidence table will not be completed and it will not be included in the health economic evidence profile. • If a study is rated as 'Partially applicable', with 'Potentially serious limitations' or both then there is discretion over whether it should be included. **Where there is discretion** The health economist will make a decision based on the relative applicability and quality of the available evidence for that question, in discussion with the guideline committee if required. The ultimate aim is to include health economic studies that are helpful for decision-making in the context of the guideline and the current NHS setting. If several studies are considered of sufficiently high applicability and methodological quality that they could all be included, then the health economist, in discussion with the committee if required, may decide to include only the most applicable studies and to selectively exclude the remaining studies. All studies excluded on the basis of applicability or methodological limitations will be listed with explanation in the excluded health economic studies appendix below. The health economist will be guided by the following hierarchies. *Setting:* • UK NHS (most applicable). • OECD countries with predominantly public health insurance systems (for example, France, Germany, Sweden). • OECD countries with predominantly private health insurance systems (for example,

	Switzerland). • Studies set in non-OECD countries or in the USA will be excluded before being assessed for applicability and methodological limitations. *Health economic study type:* • Cost–utility analysis (most applicable). • Other type of full economic evaluation (cost–benefit analysis, cost-effectiveness analysis, cost–consequences analysis). • Comparative cost analysis. • Non-comparative cost analyses including cost-of-illness studies will be excluded before being assessed for applicability and methodological limitations. *Year of analysis:* • The more recent the study, the more applicable it will be. • Studies published in 2003 or later but that depend on unit costs and resource data entirely or predominantly from before 2003 will be rated as 'Not applicable'. • Studies published before 2003 will be excluded before being assessed for applicability and methodological limitations. *Quality and relevance of effectiveness data used in the health economic analysis:* • The more closely the clinical effectiveness data used in the health economic analysis match with the outcomes of the studies included in the clinical review the more useful the analysis will be for decision-making in the guideline.

ISBN

Appendix B: Literature search strategies

The literature searches for this review are detailed below and complied with the methodology outlined in Developing NICE guidelines: the manual.[65]

For more detailed information, please see the Methodology Review.

B.1 Clinical search literature search strategy

Searches were constructed using a PICO framework where population (P) terms were combined with Intervention (I) and in some cases Comparison (C) terms. Outcomes (O) are rarely used in search strategies for interventions as these concepts may not be well described in title, abstract or indexes and therefore difficult to retrieve. Search filters were applied to the searches where appropriate.

Table 8: Database date parameters and filters used

Database	Dates searched	Search filter used
Medline (OVID)	1946 – 01 May 2019	Exclusions Randomised controlled trials Systematic review studies Observational studies
Embase (OVID)	1974 – 01 May 2019	Exclusions Randomised controlled trials Systematic review studies Observational studies
The Cochrane Library (Wiley)	Cochrane Reviews to 2019 Issue 5 of 12 CENTRAL to 2019 Issue 5 of 12 DARE, and NHSEED to 2015 Issue 2 of 4 HTA to 2016 Issue 4 of 4	None

Medline (Ovid) search terms

1.	arthroplasty/ or arthroplasty, replacement/ or arthroplasty, replacement, hip/ or arthroplasty, replacement, knee/ or arthroplasty, replacement, shoulder/ or hemiarthroplasty/
2.	joint prosthesis/ or hip prosthesis/ or knee prosthesis/ or shoulder prosthesis/
3.	((joint* or knee* or shoulder* or hip*) adj5 (surger* or replace* or prosthe* or endoprosthe* or implant* or artificial or arthroplast* or hemiarthroplast*)).ti,ab.
4.	or/1-3
5.	letter/
6.	editorial/
7.	news/
8.	exp historical article/
9.	Anecdotes as Topic/
10.	comment/
11.	case report/
12.	(letter or comment*).ti.
13.	or/5-12
14.	randomized controlled trial/ or random*.ti,ab.

15.	13 not 14
16.	animals/ not humans/
17.	exp Animals, Laboratory/
18.	exp Animal Experimentation/
19.	exp Models, Animal/
20.	exp Rodentia/
21.	(rat or rats or mouse or mice).ti.
22.	or/15-21
23.	4 not 22
24.	limit 23 to English language
25.	exp Rehabilitation/
26.	Rehabilitation Nursing/
27.	rehab*.ti,ab.
28.	(prehabilitat* or pre habilitat*).ti,ab.
29.	Early Ambulation/
30.	(early adj3 (ambulation or mobili*)).ti,ab.
31.	Physical Therapy Modalities/
32.	exp Exercise Therapy/ or Physical Conditioning, Human/ or Occupational Therapy/ or Recreation Therapy/ or Rehabilitation, Vocational/
33.	Motion Therapy, Continuous Passive/ or Muscle Stretching Exercises/ or Manipulation, Orthopedic/ or Resistance Training/
34.	((physical* or exercise* or motion or movement or occupational or recreation* or vocational) adj3 (therap* or condition*)).ti,ab.
35.	(manipulation or MUA).ti,ab.
36.	((standardi?ed or SE or continuous passive motion or CPM or slider board or SB or range of motion or ROM or resistance or weight bearing or equilibrium or flexibility or stretch*) adj2 (therap* or exercise*)).ti,ab.
37.	physiotherap*.ti,ab.
38.	Hydrotherapy/
39.	(hydrotherap* or aquatic physiotherap*).ti,ab.
40.	Transcutaneous Electric Nerve Stimulation/
41.	(electric* nerve stimulation or TENS).ti,ab.
42.	Patient Education as Topic/
43.	(patient* adj3 (education or information or advice)).ti,ab.
44.	or/25-43
45.	24 and 44
46.	randomized controlled trial.pt.
47.	controlled clinical trial.pt.
48.	randomi#ed.ti,ab.
49.	placebo.ab.
50.	randomly.ti,ab.
51.	Clinical Trials as topic.sh.
52.	trial.ti.
53.	or/46-52
54.	Meta-Analysis/
55.	exp Meta-Analysis as Topic/

ISBN

56.	(meta analy* or metanaly* or metaanaly* or meta regression).ti,ab.
57.	((systematic* or evidence*) adj3 (review* or overview*)).ti,ab.
58.	(reference list* or bibliograph* or hand search* or manual search* or relevant journals).ab.
59.	(search strategy or search criteria or systematic search or study selection or data extraction).ab.
60.	(search* adj4 literature).ab.
61.	(medline or pubmed or cochrane or embase or psychlit or psyclit or psychinfo or psycinfo or cinahl or science citation index or bids or cancerlit).ab.
62.	cochrane.jw.
63.	((multiple treatment* or indirect or mixed) adj2 comparison*).ti,ab.
64.	or/54-63
65.	Epidemiologic studies/
66.	Observational study/
67.	exp Cohort studies/
68.	(cohort adj (study or studies or analys* or data)).ti,ab.
69.	((follow up or observational or uncontrolled or non randomi#ed or epidemiologic*) adj (study or studies or data)).ti,ab.
70.	((longitudinal or retrospective or prospective or cross sectional) and (study or studies or review or analys* or cohort* or data)).ti,ab.
71.	Controlled Before-After Studies/
72.	Historically Controlled Study/
73.	Interrupted Time Series Analysis/
74.	(before adj2 after adj2 (study or studies or data)).ti,ab.
75.	or/65-74
76.	exp case control study/
77.	case control*.ti,ab.
78.	or/76-77
79.	75 or 78
80.	Cross-sectional studies/
81.	(cross sectional and (study or studies or review or analys* or cohort* or data)).ti,ab.
82.	or/80-81
83.	75 or 82
84.	75 or 78 or 82
85.	45 and (53 or 64 or 84)

1 **Embase (Ovid) search terms**

1.	*arthroplasty/ or *replacement arthroplasty/ or *hip replacement/ or *knee replacement/ or *shoulder replacement/ or *hemiarthroplasty/
2.	*joint prosthesis/ or *hip prosthesis/ or *knee prosthesis/ or *shoulder prosthesis/
3.	((joint* or knee* or shoulder* or hip*) adj5 (surger* or replace* or prosthe* or endoprosthe* or implant* or artificial or arthroplast* or hemiarthroplast*)).ti,ab.
4.	or/1-3
5.	letter.pt. or letter/
6.	note.pt.
7.	editorial.pt.
8.	case report/ or case study/
9.	(letter or comment*).ti.

10.	or/5-9
11.	randomized controlled trial/ or random*.ti,ab.
12.	10 not 11
13.	animal/ not human/
14.	nonhuman/
15.	exp Animal Experiment/
16.	exp Experimental Animal/
17.	animal model/
18.	exp Rodent/
19.	(rat or rats or mouse or mice).ti.
20.	or/12-19
21.	4 not 20
22.	limit 21 to English language
23.	exp rehabilitation/
24.	rehabilitation nursing/
25.	rehab*.ti,ab.
26.	(prehabilitat* or pre habilitat*).ti,ab.
27.	*mobilization/
28.	(early adj3 (ambulation or mobili*)).ti,ab.
29.	*physiotherapy/ or *kinesiotherapy/ or *exercise/ or *occupational therapy/ or *recreational therapy/ or *vocational rehabilitation/
30.	*movement therapy/ or *stretching exercise/ or *orthopedic manipulation/ or *resistance training/
31.	((physical* or exercise* or motion or movement or occupational or recreation* or vocational) adj3 (therap* or condition*)).ti,ab.
32.	(manipulation or MUA).ti,ab.
33.	((standardi?ed or SE or continuous passive motion or CPM or slider board or SB or range of motion or ROM or resistance or weight bearing or equilibrium or flexibility or stretch*) adj2 (therap* or exercise*)).ti,ab.
34.	physiotherap*.ti,ab.
35.	hydrotherapy/
36.	(hydrotherap* or aquatic physiotherap*).ti,ab.
37.	transcutaneous electrical nerve stimulation/
38.	(electric* nerve stimulation or TENS).ti,ab.
39.	*patient education/
40.	(patient* adj3 (education or information or advice)).ti,ab.
41.	or/23-40
42.	22 and 41
43.	random*.ti,ab.
44.	factorial*.ti,ab.
45.	(crossover* or cross over*).ti,ab.
46.	((doubl* or singl*) adj blind*).ti,ab.
47.	(assign* or allocat* or volunteer* or placebo*).ti,ab.
48.	crossover procedure/
49.	single blind procedure/
50.	randomized controlled trial/

ISBN

51.	double blind procedure/
52.	or/43-51
53.	systematic review/
54.	meta-analysis/
55.	(meta analy* or metanaly* or metaanaly* or meta regression).ti,ab.
56.	((systematic* or evidence*) adj3 (review* or overview*)).ti,ab.
57.	(reference list* or bibliograph* or hand search* or manual search* or relevant journals).ab.
58.	(search strategy or search criteria or systematic search or study selection or data extraction).ab.
59.	(search* adj4 literature).ab.
60.	(medline or pubmed or cochrane or embase or psychlit or psyclit or psychinfo or psycinfo or cinahl or science citation index or bids or cancerlit).ab.
61.	cochrane.jw.
62.	((multiple treatment* or indirect or mixed) adj2 comparison*).ti,ab.
63.	or/53-62
64.	Clinical study/
65.	Observational study/
66.	family study/
67.	longitudinal study/
68.	retrospective study/
69.	prospective study/
70.	cohort analysis/
71.	follow-up/
72.	cohort*.ti,ab.
73.	71 and 72
74.	(cohort adj (study or studies or analys* or data)).ti,ab.
75.	((follow up or observational or uncontrolled or non randomi#ed or epidemiologic*) adj (study or studies or data)).ti,ab.
76.	((longitudinal or retrospective or prospective or cross sectional) and (study or studies or review or analys* or cohort* or data)).ti,ab.
77.	(before adj2 after adj2 (study or studies or data)).ti,ab.
78.	or/64-70,73-77
79.	exp case control study/
80.	case control*.ti,ab.
81.	or/79-80
82.	78 or 81
83.	cross-sectional study/
84.	(cross sectional and (study or studies or review or analys* or cohort* or data)).ti,ab.
85.	or/83-84
86.	78 or 85
87.	78 or 81 or 85
88.	42 and (52 or 63 or 87)

1 **Cochrane Library (Wiley) search terms**

#1.	MeSH descriptor: [Arthroplasty] this term only
#2.	MeSH descriptor: [Arthroplasty, Replacement] this term only

#3.	MeSH descriptor: [Arthroplasty, Replacement, Hip] this term only
#4.	MeSH descriptor: [Arthroplasty, Replacement, Knee] this term only
#5.	MeSH descriptor: [Arthroplasty, Replacement, Shoulder] this term only
#6.	MeSH descriptor: [Hemiarthroplasty] this term only
#7.	(or #1-#6)
#8.	MeSH descriptor: [Joint Prosthesis] this term only
#9.	MeSH descriptor: [Hip Prosthesis] this term only
#10.	MeSH descriptor: [Knee Prosthesis] this term only
#11.	MeSH descriptor: [Shoulder Prosthesis] this term only
#12.	(or #8-#11)
#13.	((joint* or knee* or shoulder* or hip*) near/5 (surger* or replace* or prosthe* or endoprosthe* or implant* or artificial or arthroplast* or hemiarthroplast*)):ti,ab
#14.	(or #7, #12-#13)
#15.	MeSH descriptor: [Rehabilitation] explode all trees
#16.	MeSH descriptor: [Rehabilitation Nursing] explode all trees
#17.	rehab*:ti,ab
#18.	(prehabilitat* or pre habilitat*):ti,ab
#19.	MeSH descriptor: [Early Ambulation] this term only
#20.	(early near/3 (ambulation or mobili*)):ti,ab
#21.	MeSH descriptor: [Physical Therapy Modalities] this term only
#22.	MeSH descriptor: [Exercise Therapy] explode all trees
#23.	MeSH descriptor: [Physical Conditioning, Human] this term only
#24.	MeSH descriptor: [Occupational Therapy] this term only
#25.	MeSH descriptor: [Recreation Therapy] this term only
#26.	MeSH descriptor: [Rehabilitation, Vocational] this term only
#27.	MeSH descriptor: [Motion Therapy, Continuous Passive] this term only
#28.	MeSH descriptor: [Muscle Stretching Exercises] this term only
#29.	MeSH descriptor: [Manipulation, Orthopedic] this term only
#30.	MeSH descriptor: [Resistance Training] this term only
#31.	((physical* or exercise* or motion or movement or occupational or recreation* or vocational) near/3 (therap* or condition*)):ti,ab
#32.	(manipulation or MUA):ti,ab
#33.	((standardised or standardized or SE or continuous passive motion or CPM or slider board or SB or range of motion or ROM or resistence or weight bearing or equilibrium or flexibility or stretch*) near/2 (therap* or exercise*)):ti,ab
#34.	physiotherap*:ti,ab
#35.	MeSH descriptor: [Hydrotherapy] this term only
#36.	(hydrotherap* or aquatic physiotherap*):ti,ab
#37.	MeSH descriptor: [Transcutaneous Electric Nerve Stimulation] this term only
#38.	(electric* nerve stimulation or TENS):ti,ab
#39.	MeSH descriptor: [Patient Education as Topic] this term only
#40.	(patient* near/3 (education or information or advice)):ti,ab
#41.	(or #15-#40)
#42.	#14 and #41

ISBN

B.2 Health Economics literature search strategy

Health economic evidence was identified by conducting a broad search relating to the joint replacement population in NHS Economic Evaluation Database (NHS EED – this ceased to be updated after March 2015) and the Health Technology Assessment database (HTA) with no date restrictions. NHS EED and HTA databases are hosted by the Centre for Research and Dissemination (CRD). Additional health economic searches were run in Medline and Embase..

Table 9: Database date parameters and filters used

Database	Dates searched	Search filter used
Medline	2014 – 01 May 2019	Exclusions Health economics studies
Embase	2014 – 01 May 2019	Exclusions Health economics studies
Centre for Research and Dissemination (CRD)	HTA - Inception – 01 May 2019 NHSEED - Inception to March 2015	None

Medline (Ovid) search terms

1.	arthroplasty/ or arthroplasty, replacement/ or arthroplasty, replacement, hip/ or arthroplasty, replacement, knee/ or arthroplasty, replacement, shoulder/ or hemiarthroplasty/
2.	joint prosthesis/ or hip prosthesis/ or knee prosthesis/ or shoulder prosthesis/
3.	((joint* or knee* or shoulder* or hip*) adj5 (surger* or replace* or prosthe* or endoprosthe* or implant* or artificial or arthroplast* or hemiarthroplast*)).ti,ab.
4.	or/1-3
5.	letter/
6.	editorial/
7.	news/
8.	exp historical article/
9.	Anecdotes as Topic/
10.	comment/
11.	case report/
12.	(letter or comment*).ti.
13.	or/5-12
14.	randomized controlled trial/ or random*.ti,ab.
15.	13 not 14
16.	animals/ not humans/
17.	exp Animals, Laboratory/
18.	exp Animal Experimentation/
19.	exp Models, Animal/
20.	exp Rodentia/
21.	(rat or rats or mouse or mice).ti.
22.	or/15-21
23.	4 not 22
24.	limit 23 to English language

25.	Economics/
26.	Value of life/
27.	exp "Costs and Cost Analysis"/
28.	exp Economics, Hospital/
29.	exp Economics, Medical/
30.	Economics, Nursing/
31.	Economics, Pharmaceutical/
32.	exp "Fees and Charges"/
33.	exp Budgets/
34.	budget*.ti,ab.
35.	cost*.ti.
36.	(economic* or pharmaco?economic*).ti.
37.	(price* or pricing*).ti,ab.
38.	(cost* adj2 (effective* or utilit* or benefit* or minimi* or unit* or estimat* or variable*)).ab.
39.	(financ* or fee or fees).ti,ab.
40.	(value adj2 (money or monetary)).ti,ab.
41.	or/25-40
42.	24 and 41

1 Embase (Ovid) search terms

1.	*arthroplasty/ or *replacement arthroplasty/ or *hip replacement/ or *knee replacement/ or *shoulder replacement/ or *hemiarthroplasty/
2.	*joint prosthesis/ or *hip prosthesis/ or *knee prosthesis/ or *shoulder prosthesis/
3.	((joint* or knee* or shoulder* or hip*) adj5 (surger* or replace* or prosthe* or endoprosthe* or implant* or artificial or arthroplast* or hemiarthroplast*)).ti,ab.
4.	or/1-3
5.	letter.pt. or letter/
6.	note.pt.
7.	editorial.pt.
8.	case report/ or case study/
9.	(letter or comment*).ti.
10.	or/5-9
11.	randomized controlled trial/ or random*.ti,ab.
12.	10 not 11
13.	animal/ not human/
14.	nonhuman/
15.	exp Animal Experiment/
16.	exp Experimental Animal/
17.	animal model/
18.	exp Rodent/
19.	(rat or rats or mouse or mice).ti.
20.	or/12-19
21.	4 not 20

ISBN

22.	limit 21 to English language
23.	health economics/
24.	exp economic evaluation/
25.	exp health care cost/
26.	exp fee/
27.	budget/
28.	funding/
29.	budget*.ti,ab.
30.	cost*.ti.
31.	(economic* or pharmaco?economic*).ti.
32.	(price* or pricing*).ti,ab.
33.	(cost* adj2 (effective* or utilit* or benefit* or minimi* or unit* or estimat* or variable*)).ab.
34.	(financ* or fee or fees).ti,ab.
35.	(value adj2 (money or monetary)).ti,ab.
36.	or/23-35
37.	22 and 36

1 **NHS EED and HTA (CRD) search terms**

#1.	MeSH DESCRIPTOR arthroplasty
#2.	MeSH DESCRIPTOR arthroplasty, replacement
#3.	MeSH DESCRIPTOR arthroplasty, replacement, hip
#4.	MeSH DESCRIPTOR arthroplasty, replacement, knee
#5.	MeSH DESCRIPTOR arthroplasty, replacement, shoulder
#6.	MeSH DESCRIPTOR hemiarthroplasty
#7.	MeSH DESCRIPTOR joint prosthesis
#8.	MeSH DESCRIPTOR hip prosthesis
#9.	MeSH DESCRIPTOR knee prosthesis
#10.	MeSH DESCRIPTOR shoulder prosthesis
#11.	(((joint* or knee* or shoulder* or hip*) adj5 (surger* or replace* or prosthe* or endoprosthe* or implant* or artificial or arthroplast* or hemiarthroplast*)))
#12.	(#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11) IN NHSEED
#13.	(#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11) IN HTA

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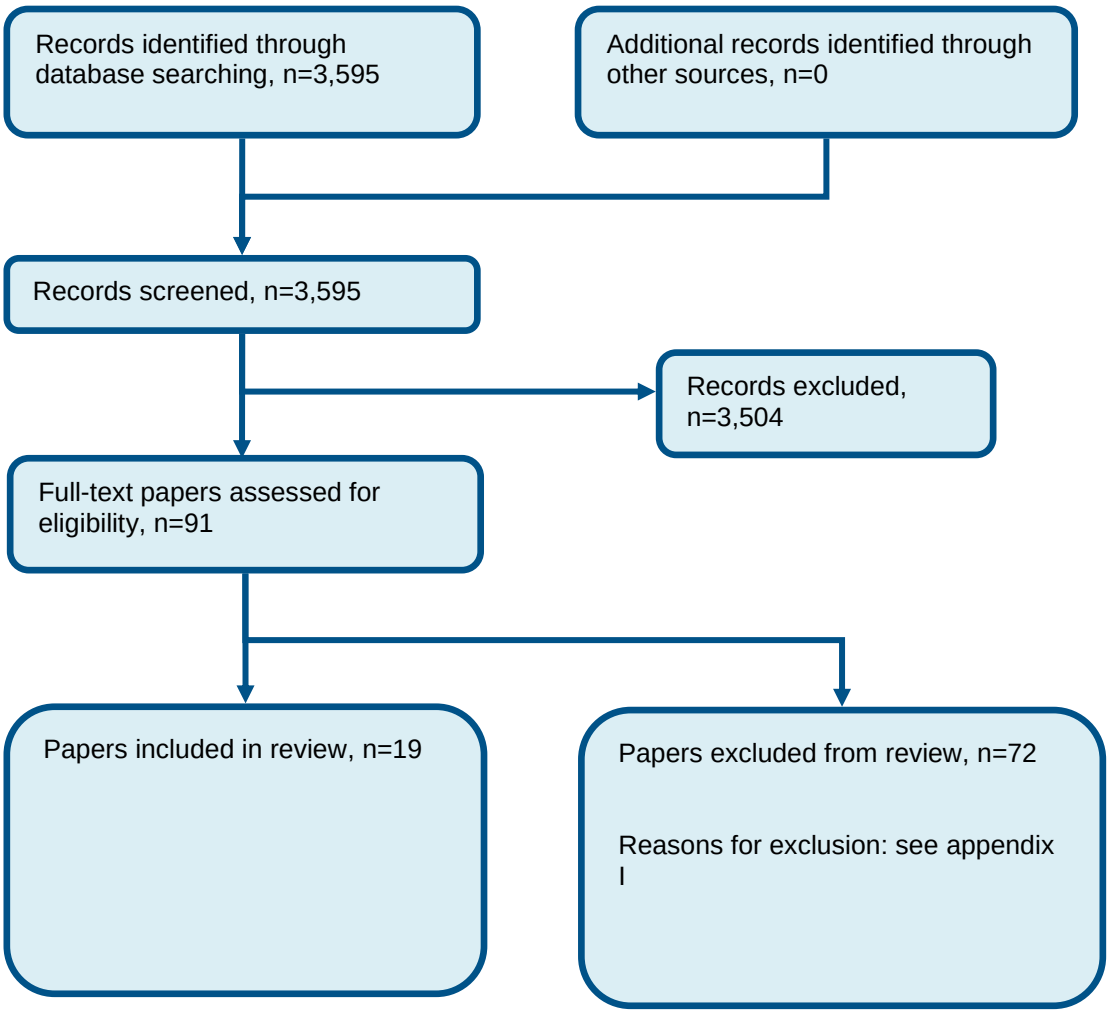
3

ISBN

Appendix C: Clinical evidence selection

Figure 1: Flow chart of clinical study selection for the review of post-operative rehabilitation



ISBN

Appendix D: Clinical evidence tables

Study	Artz 2017[3]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=46)
Countries and setting	Conducted in United Kingdom; Setting: Secondary care hospital
Line of therapy	First line
Duration of study	Intervention + follow up: 6 months
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients undergoing a primary total knee replacement for osteoarthritis were eligible for participation in the study.
Exclusion criteria	Exclusion criteria included: knee replacement for conditions other than osteoarthritis, revision knee surgery, inability to participate in exercise for any medical reason such as unstable cardiovascular or cardiorespiratory disease, diagnosis of severe neurological disorders, inability to provide informed consent, and inability to complete study questionnaires in English as the study was using measures that had not all been validated in other languages.
Age, sex and family origin	Age - Mean (range): 68.6 (51 - 82). Sex (M:F): 22 male, 24 female. Family origin: N/A
Further population details	1. Age: 2. Cognitive status: 3. Site/type of joint replacement: Total knee arthroplasty
Indirectness of population	No indirectness
Interventions	(n=23) Intervention 1: Supervised postoperative rehabilitation from first postoperative appointment - Group-based supervised rehabilitation. Participants randomized into the intervention arm were invited to attend an exercise group starting at the sixth week after surgery and running for a period of six weeks. The weekly one-hour exercise classes were run by two experienced research physiotherapists starting at six weeks after surgery and lasting a total of six weeks. The exercise class took place weekly in a physiotherapy gym at our centre and consisted of 12 separate stations with exercises designed to increase general fitness, lower-limb strength and function, balance, gait, and confidence. On completion of the exercise class, participants were provided with a list of exercises, including their individual exercises, to continue with at home on a regular basis. Duration 6 weeks. Concurrent medication/care: All participants were asked to complete study questionnaires before surgery and at two weeks, three months, and six months after surgery.

	Indirectness: No indirectness Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy: (n=23) Intervention 2: Self-directed rehabilitation. Participants in the usual care arm of the study were instructed to continue with the routine care provided by the health service. All patients received standard inpatient care provided by our centre and upon discharge from hospital were provided with a knee replacement booklet. In addition to this booklet, some patients were referred to physiotherapy services on an individual basis at the discretion of the hospital's physiotherapy or orthopaedic team or by their GP. Services included referral to local outpatient physiotherapy or community physiotherapy at home. In such cases, patients may have received a variety of physiotherapy interventions, including specific knee strengthening and stretching exercises, functional exercise, manual therapy, or hydrotherapy. Duration 6 weeks. Concurrent medication/care: All participants were asked to complete study questionnaires before surgery and at two weeks, three months, and six months after surgery. Indirectness: No indirectness Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy:
Funding	Study funded by industry (This article presents independent research funded by the National Institute for Health Research (NIHR) under its Programme Grants for Applied Research programme)

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: GROUP-BASED SUPERVISED REHABILITATION versus SELF-DIRECTED REHABILITATION

Protocol outcome 1: Patient Reported Outcome Measures (PROMs) at 6 to 24 months
- Actual outcome: KOOS pain at 6 months at 6 months; Group 1: mean 78.6 (SD 25.9); n=21, Group 2: mean 70.9 (SD 27.1); n=15
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Intervention - 40.5, UC - 44.5; Group 1 Number missing: 2, Reason: Withdrawal; Group 2 Number missing: 8, Reason: Withdrawal, didn't attend classes, didn't undergo surgery
- Actual outcome: KOOS symptoms at 6 months at 6 months; Group 1: mean 58.4 (SD 18.9); n=21,
Risk of bias: All domain - Very high, Selection - Low, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Intervention - 40.7, UC - 43.9; Group 1 Number missing: 2, Reason: Withdrawal; Group 2 Number missing: 8, Reason: Withdrawal, didn't attend classes, didn't undergo surgery
- Actual outcome: KOOS activities of daily living at 6 months at 6 months; Group 1: mean 79.6 (SD 23.4); n=21, Group 2: mean 73.5 (SD 26.4); n=15
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Intervention - 41.8, UC - 51.2; Group 1 Number missing: 2, Reason: Withdrawal; Group 2 Number missing: 8, Reason: Withdrawal, didn't attend classes, didn't undergo surgery
- Actual outcome: KOOS quality of life at 6 months at 6 months; Group 1: mean 61.5 (SD 32.3); n=21, Group 2: mean 45.1 (SD 29.2); n=15
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - High, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Baseline details: Intervention - 12.5, UC - 18.4; Group 1 Number missing: 2, Reason: Withdrawal; Group 2 Number missing: 8, Reason: Withdrawal, didn't attend classes, didn't undergo surgery

ISBN

Protocol outcomes not reported by the study	Quality of life at 6 to 24 months; Revision of joint replacement at time to event; Reoperation including dislocation at within 24 months; Hospital readmissions at within 90 days; Thromboembolic complications at within 90 days; Pain at 6 to 24 months; Function at 6 to 24 months

ISBN

Study	Austin 2017[5]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=120)
Countries and setting	Conducted in USA
Line of therapy	first line
Duration of study	Intervention + follow up: 1 year
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall:
Subgroup analysis within study	Not applicable
Inclusion criteria	Eligible participants were between 18 and 80 years of age undergoing primary, unilateral total hip arthroplasty for osteoarthritis.
Exclusion criteria	The following patients were excluded: those with inflammatory or posttraumatic arthritis, those with a history of septic arthritis of the involved hip, and those undergoing revision total hip arthroplasty or conversion total hip arthroplasty with removal of previously implanted components. Additionally, patients requiring discharge to an acute rehabilitation centre, skilled nursing facility, convalescent home, or long-term care facility were excluded.
Age, sex and family origin	Age - Mean (SD): 61.75 (10.55). Sex (M:F): 61 male, 47 female. Family origin: N/A
Further population details	1. Age: 2. Cognitive status: 3. Site/type of joint replacement: Hip replacement
Indirectness of population	Serious indirectness: 30 patients (28%) crossed over between groups. 20 (37%) from the formal out-patient physical therapy group and 10 (19%) from the unsupervised home exercise group.
Interventions	(n=60) Intervention 1: Supervised postoperative rehabilitation from first postoperative appointment - Individually supervised rehabilitation. The formal outpatient physical therapy group received 2 weeks of in-home physical therapy followed by formal outpatient therapy, with 2 to 3 weekly sessions for an additional 8 weeks after the surgical procedure. Additionally, patients were provided with a list of suggested physical therapy exercises to be performed at home. Duration 10 weeks. Concurrent medication/care: All patients received daily inpatient physical therapy and occupational therapy until the time of hospital discharge. All participants from both groups were provided a diary to keep a record of their daily therapy regimen and to promote compliance. Indirectness: No indirectness Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy: (n=60) Intervention 2: Self-directed rehabilitation. The unsupervised home exercise group followed a 10-week unsupervised home exercise program based on a detailed physical therapy manual that was provided to patients prior to discharge. This manual provided images and written explanations for suggested

ISBN

	exercises, which were performed 3 times daily and were graduated from week to week. Exercises were demonstrated to patients prior to hospital discharge. Patients in the unsupervised home exercise group were evaluated 2 weeks postoperatively, and those who were deemed to be behind in their recovery or who wished to attend formal outpatient therapy were allowed to do so. Duration 10 weeks. Concurrent medication/care: All patients received daily inpatient physical therapy and occupational therapy until the time of hospital discharge. All participants from both groups were provided a diary to keep a record of their daily therapy regimen and to promote compliance. . Indirectness: No indirectness Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy:
Funding	Other (This project did not receive any financial funding from external sources. On the Disclosure of Potential Conflicts of Interest forms, which are provided with the online version of the article, one or more of the authors checked “yes” to indicate that the author had a relevant financial relationship in the biomedical arena outside the submitted work.)
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: INDIVIDUALLY SUPERVISED REHABILITATION versus SELF-DIRECTED REHABILITATION Protocol outcome 1: Quality of life at 6 to 24 months - Actual outcome: SF-36 physical health scores - baseline to 6 to 12 months at Baseline to 6 to 12 months; Mean; , Comments: intervention - 20.4 points (95% CI - 17.2, 23.7) control group - 19.9 points (95% CI - 16.8 to 23.0); Risk of bias: All domain - Very high, Selection - Low, Blinding - High, Incomplete outcome data - High, Outcome reporting - High, Measurement - Low, Crossover - High; Indirectness of outcome: No indirectness ; Group 1 Number missing: , Reason: 20 crossed over to control group, 6 excluded, 2 missed 6-12 month time point; Group 2 Number missing: , Reason: 10 crossed over to intervention group, 6 excluded, 2 missed 6-12 month time point	
Protocol outcomes not reported by the study	Patient Reported Outcome Measures (PROMs) at 6 to 24 months; Revision of joint replacement at time to event; Reoperation including dislocation at within 24 months; Hospital readmissions at within 90 days; Thromboembolic complications at within 90 days; Pain at 6 to 24 months; Function at 6 to 24 months

Study	Beaupre 2014[8]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=21)
Countries and setting	Conducted in USA; Setting:
Line of therapy	first line
Duration of study	Intervention + follow up: 3 months and 1 year FU
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Subjects were less than 65 years old, had recently undergone primary unilateral THA using a direct lateral (Hardinge) approach, which involves splitting the gluteus medius muscle during surgery. Subjects lived in the metropolitan area so that they could attend the program.
Exclusion criteria	Those subjects for whom the surgeon recorded a primary diagnosis of developmental dysplasia of the hip were excluded.
Recruitment/selection of patients	Subjects were recruited at the Pre-Admission Clinic by a research associate who explained the study and obtained informed consent.
Age, sex and family origin	Age - Mean (SD): 53.8 (9.1). Sex (M:F): 10 female, 11 male . Family origin:
Further population details	1. Age: 2. Cognitive status: 3. Site/type of joint replacement: Hip replacement
Indirectness of population	Serious indirectness: Some of the usual care group received community based rehabilitation.
Interventions	(n=11) Intervention 1: Supervised postoperative rehabilitation from first postoperative appointment - Group-based supervised rehabilitation. Following the six week postoperative surgeon evaluation, Intervention subjects commenced the outpatient rehabilitation program. Sessions were approximately two and one-half hours in duration and included both aquatic and land-based components with a focus on strength and gait re-training. Participants attended sessions two times/week for approximately three months and were encouraged to perform home exercises daily. Duration 3 months. Concurrent medication/care: All subjects received usual post-surgical care in the hospital and were discharged home with home exercises following a three to four day hospital stay. Indirectness: No indirectness Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy: (n=10) Intervention 2: Self-directed rehabilitation. Control subjects continued with usual care after their six-week appointment, which varied from the home exercises provided in hospital to community based rehabilitation programs for a total of four to six sessions at patients' discretion.. Duration 3 months.

	Concurrent medication/care: All subjects received usual post-surgical care in the hospital and were discharged home with home exercises following a three to four day hospital stay. Indirectness: Serious indirectness; Indirectness comment: Some received community based rehabilitation. Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy:
Funding	Academic or government funding (This work was supported by a research grant from the Royal Alexandra Hospital Foundation.)
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: GROUP-BASED SUPERVISED REHABILITATION versus SELF-DIRECTED REHABILITATION Protocol outcome 1: Pain at 6 to 24 months - Actual outcome: WOMAC - pain, 12 months at 12 months; Group 1: mean 91.7 (SD 13.2); n=11, Group 2: mean 87 (SD 18.9); n=10 Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness ; Baseline details: Intervention - 46.0 (12.4) UC - 55.6 (13.2); Group 1 Number missing: 0; Group 2 Number missing: 0 Protocol outcome 2: Function at 6 to 24 months - Actual outcome: WOMAC - function, 12 months at 12 months; Group 1: mean 90.8 (SD 12.7); n=11, Group 2: mean 85.6 (SD 15.6); n=10 Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness ; Baseline details: Intervention - 51 (14.8) UC - 55.1 (14.0); Group 1 Number missing: 0; Group 2 Number missing: 0	
Protocol outcomes not reported by the study	Quality of life at 6 to 24 months; Patient Reported Outcome Measures (PROMs) at 6 to 24 months; Revision of joint replacement at time to event; Reoperation including dislocation at within 24 months; Hospital readmissions at within 90 days; Thromboembolic complications at within 90 days

Study	Coulter 2017[16]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=98)
Countries and setting	Conducted in Australia; Setting: 1 public teaching hospital and 1 private hospital.
Line of therapy	first line
Duration of study	Intervention + follow up: 4 weeks and
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Older than 18 years, having a primary elective THR, residing within the local area.
Exclusion criteria	Metastatic disease, pathological fractures, infection, or acute trauma, revision THR, inability to provide informed consent because of poor understanding, University of California Los Angeles (UCLA) activity scale level <2 preoperatively, being able to bear weight postoperatively, requiring inpatient rehabilitation postoperatively. Patients who were enrolled preoperatively but
Age, sex and family origin	Age - Median (IQR): 64 (54-88). Sex (M:F): 41 male, 57 female. Family origin:
Further population details	1. Age: 2. Cognitive status: 3. Site/type of joint replacement: Hip replacement
Indirectness of population	No indirectness
Interventions	(n=56) Intervention 1: Supervised postoperative rehabilitation from first postoperative appointment - Group-based supervised rehabilitation. Attended a program once weekly for 4 weeks. It included a circuit class with 9 stations including quadriceps strengthening, supine hip abductor and gluteal strengthening, standing hip abductor and gluteal strengthening, stair training, standing arm ergometer, step ups, sit-to-stand training, exercise bike for range of motion, and gait retraining with progression of gait aid. The level of difficulty was incremented on an individual basis by the therapist supervising the class and included use of TherBand and/or leg weights. . Duration 4 weeks. Concurrent medication/care: Patients received twice daily physiotherapy sessions from day 2. Patients were usually discharged on day 5 with a suitable gait aid, which was most commonly crutches. All patients were discharged directly home from the hospital. Before discharge home, both groups were taught standard home-based exercises to be performed thrice daily. These exercises were also provided in a written and pictorial format. . Indirectness: No indirectness Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy: (n=42) Intervention 2: Self-directed rehabilitation. They were instructed at inpatient discharge to continue the exercises that they were taught in the hospital, gradually increasing the number of repetitions of each exercise so that they remained challenging. These exercises were performed in supine and standing

	positions but without resistance. Additional guidelines instructing patients to commence a daily walking programme upon discharge home and informing them how to progress their gait aid from crutches/frame to 2 walking sticks and toward nil aid were provided. The home based group continued their exercise programme at home without further supervision, but were encouraged to contact the physiotherapist, if required, by telephone for the duration of the study. In addition, patients were contacted by the physiotherapist for their follow-up reassessments. During these telephone calls, they were able to ask questions about recovery, troubling symptoms and commencement of activities or hobbies. . Duration 4 weeks. Concurrent medication/care: Patients received twice daily physiotherapy sessions from day 2. Patients were usually discharged on day 5 with a suitable gait aid, which was most commonly crutches. All patients were discharged directly home from the hospital. Before discharge home, both groups were taught standard home-based exercises to be performed thrice daily. These exercises were also provided in a written and pictorial format. . Indirectness: No indirectness Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy:
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: GROUP-BASED SUPERVISED REHABILITATION versus SELF-DIRECTED REHABILITATION

Protocol outcome 1: Quality of life at 6 to 24 months
- Actual outcome: SF-36 PCS, 6.5 months at 6.5 months; Mean; , Comments: Mean (95% CI)

Intervention - 71.40 (63.76 - 79.03)
UC - 68.50 (60.05 - 77.02)

Mean scores are marginal means based on linear mixed models adjusted for baseline score, age and sex. ;
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 4/56=7.14, Reason: 3 unable to contact, 1 personal reasons; Group 2 Number missing: 4/42=9.52, Reason: 3 unable to contact, 1 death
- Actual outcome: SF-36 MCS, 6.5 months at 6.5 months; Mean; , Comments: Mean (95% CI)
Intervention - 81.10 (74.94-87.25)
UC - 78.60 (71.75 - 85.47)
Mean scores are marginal means based on linear mixed models adjusted for baseline score, age and sex. ;
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 4/56=7.14, Reason: 3 unable to contact, 1 personal reasons; Group 2 Number missing: 4/42=9.52, Reason: 3 unable to contact, 1 death

Protocol outcome 2: Patient Reported Outcome Measures (PROMs) at 6 to 24 months
- Actual outcome: WOMAC - total score, 6.5 months at 6.5 months; Mean; , Comments: Mean (95% CI)

ISBN

Intervention - 18.40 (11.88 to 24.88) UC - 19.70 (12.46 to 26.98) Mean scores are marginal means based on linear mixed models adjusted for baseline score, age and sex. ; Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 4/56=7.14, Reason: 3 unable to contact, 1 personal reasons; Group 2 Number missing: 4/42=9.52, Reason: 3 unable to contact, 1 death	
Protocol outcomes not reported by the study	Revision of joint replacement at time to event; Reoperation including dislocation at within 24 months; Hospital readmissions at within 90 days; Thromboembolic complications at within 90 days; Pain at 6 to 24 months; Function at 6 to 24 months

ISBN

Study	Fillingham 2018[21]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=52)
Countries and setting	Conducted in USA
Line of therapy	first line
Duration of study	Intervention + follow up: 6 weeks
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	All patients over the age of 18 years scheduled to undergo unilateral UKA were eligible for inclusion.
Exclusion criteria	Patients excluded if they were discharged to an acute rehabilitation facility, skilled nursing facility, long-term care facility, or home with in home one on one PT. Patients no longer deemed to be a candidate for UKA based on intraoperative findings who got a TKA were likewise excluded. Any patient who declined to participate or was scheduled for a UKA within 6 weeks of the initial procedure was excluded.
Age, sex and family origin	Age - Mean (SD): 60 (7.6). Sex (M:F): N/A. Family origin: N/A
Further population details	1. Age: 2. Cognitive status: 3. Site/type of joint replacement: Unicompartmental knee arthroplasty
Indirectness of population	No indirectness

Interventions	(n=25) Intervention 1: Supervised postoperative rehabilitation from first postoperative appointment - Individually supervised rehabilitation. Patients were provided the same prescription and allowed to choose their preferred facility. Was carried out as 3 sessions per week for 6 weeks with a focus on flexibility, strength and gait training.. Duration 6 weeks. Concurrent medication/care: All patients were mobilised on day 0 and discharged home following clearance by the hospital or ambulatory surgery centre clinical staff. . Indirectness: No indirectness Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy: (n=22) Intervention 2: Self-directed rehabilitation. Patients assigned to the self-directed home exercise group were provided access to a web-based platform that contained written and video instructions for the exercises. For the purpose of the study, the only features enabled were the written and video demonstrations of the exercises. All other features including the 2-way communication were disabled to ensure patients were unsupervised. . Duration 6 weeks. Concurrent medication/care: All patients were mobilised on day 0 and discharged home following clearance by the hospital or ambulatory surgery centre clinical staff. . Indirectness: No indirectness Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy:
Funding	Funding not stated
Protocol outcomes not reported by the study	Quality of life at 6 to 24 months; Patient Reported Outcome Measures (PROMs) at 6 to 24 months; Revision of joint replacement at time to event; Reoperation including dislocation at within 24 months; Hospital readmissions at within 90 days; Thromboembolic complications at within 90 days; Pain at 6 to 24 months; Function at 6 to 24 months

ISBN

Study	Galea 2008[26]
Study type	RCT (randomised; Parallel)
Number of studies (number of participants)	(n=23)
Countries and setting	Conducted in Australia; Setting: Rehabilitation research centre in Australia.
Line of therapy	first line
Duration of study	Intervention + follow up: 8 weeks
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	All had undergone uncomplicated, unilateral THR surgery for the primary diagnosis of OA of the hip. Inclusion criteria for the study included the ability to walk at least 45m independently with a mobility aid, independence in sit-to-stand transfer, and the ability to adequately comprehend written and verbal instructions. Patients had been instructed by their surgeon that they were permitted to weight bear as tolerated on the operated hip. All participants gave informed consent.
Exclusion criteria	Exclusion criteria were uncontrolled systemic disease, a pre-existing neurologic or other orthopaedic condition affecting walking, more than 4 weeks physiotherapy post surgery, and revision surgery or significant postoperative complications, such as significant residual pain or wound infection.
Age, sex and family origin	Age - Mean (SD): 67.6 (8.8). Sex (M:F): 7 male, 16 female . Family origin: N/A
Further population details	1. Age: 2. Cognitive status: 3. Site/type of joint replacement: Hip replacement
Indirectness of population	No indirectness
Interventions	(n=11) Intervention 1: Supervised postoperative rehabilitation from first postoperative appointment - Group-based supervised rehabilitation. During the centre-based exercise program, a physiotherapist modified the exercises according to the participants' physical performance and kept a record of their progress. Duration 8 weeks. Concurrent medication/care: Each of the participants had completed an initial standard inpatient rehabilitation program provided by Austin Health. This involved a 5- to 6-day program of functional tasks such as gait, stairs, and transfers that address specific physical issues related to THR such as circulation, range of movement, and muscular strength. Participants in both groups were given a diary and instructed to keep a daily record of the exercises they performed including the time or number of sets and repetitions as well as other therapeutic interventions or physical activities undertaken. . Indirectness: No indirectness Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy: (n=12) Intervention 2: Self-directed rehabilitation. The home-based group received an illustrated guide of the

	same prescribed exercises that included basic instructions for the exercise with illustrations. . Duration 8 weeks. Concurrent medication/care: Each of the participants had completed an initial standard inpatient rehabilitation program provided by Austin Health. This involved a 5- to 6-day program of functional tasks such as gait, stairs, and transfers that address specific physical issues related to THR such as circulation, range of movement, and muscular strength. Participants in both groups were given a diary and instructed to keep a daily record of the exercises they performed including the time or number of sets and repetitions as well as other therapeutic interventions or physical activities undertaken. . Indirectness: No indirectness Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy:
Funding	-- (Supported by Arthritis Australia and the National Arthritis and Musculoskeletal Health Initiative.)
Protocol outcomes not reported by the study	Quality of life at 6 to 24 months; Patient Reported Outcome Measures (PROMs) at 6 to 24 months; Revision of joint replacement at time to event; Reoperation including dislocation at within 24 months; Hospital readmissions at within 90 days; Thromboembolic complications at within 90 days; Pain at 6 to 24 months; Function at 6 to 24 months

ISBN

Study	Heiberg 2012[30]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=68)
Countries and setting	Conducted in Norway
Line of therapy	first line
Duration of study	Intervention + follow up: 6 weeks, 1 year FU
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	They were asked to participate in a longitudinal study the day before surgery if they met the following criteria: diagnosis of OA of the hip joint (30) and residence close to the hospital so as to be able to attend training sessions, i.e., within a radius of approximately 30 km.
Exclusion criteria	They were excluded if they had OA in a knee or the contralateral hip that restricted their walking, a neurologic disease, dementia, heart disease, drug abuse, and inadequate ability to read and understand Norwegian.
Recruitment/selection of patients	Patients who were scheduled for primary unilateral THA at 2 hospitals were sent information about the ongoing study before hospitalization.
Age, sex and family origin	Age - Mean (SD): 65.5 (8.17). Sex (M:F): 33 male, 35 female . Family origin: N/A
Further population details	1. Age: 2. Cognitive status: 3. Site/type of joint replacement: Hip replacement
Indirectness of population	No indirectness
Interventions	(n=35) Intervention 1: Supervised postoperative rehabilitation from first postoperative appointment - Group-based supervised rehabilitation. The program was performed in groups of 2 to 8 patients, and the group was led by a physiotherapist. Each patient participated in 12 sessions, which were held twice a week. Each session lasted for 70 minutes. Before the training started the patients were asked to identify some activities they wished to become better at, and 79% reported that they wished to improve their walking ability and 21% to improve their balance. This was taken into consideration when adjusting the training program to the individual patient. During the sessions the difficulty and number of repetitions of the exercises were continuously adjusted by the physiotherapist to each individual's level of physical functioning, personal goals of improvement, and progress over time. When the patient managed to do one activity, they had to practice the activity in a more demanding way, for example, by increasing the speed of the movements and height of the walking obstacles, as well as making the ground more uneven. To avoid cardiovascular risks, the patients should be able to talk while exercising.

ISBN

	The program was based on 2 main principles: to train neuromuscular functioning by doing several repetitions of different ambulatory tasks and activities, and to relearn more adequate movement patterns from guidance and feedback of the physiotherapist. Duration 6 weeks. Concurrent medication/care: The patients got requisition for physiotherapy when they were discharged from the hospital. From training logs we know that 73% of the patients exercised under supervision of a physiotherapist, mainly comprising flexibility and strengthening exercises on a bench or in an apparatus. All but 1 patient reported additionally that they had done home exercises and walks for more than twice a week.. Indirectness: No indirectness Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy: (n=33) Intervention 2: Self-directed rehabilitation. The control group did not attend any supervised physiotherapy programs during the same time period, but were encouraged to continue with the exercises they had learned in the hospital or during their rehabilitation stay, and to keep generally active.. Duration 6 weeks. Concurrent medication/care: The patients got requisition for physiotherapy when they were discharged from the hospital. From training logs we know that 73% of the patients exercised under supervision of a physiotherapist, mainly comprising flexibility and strengthening exercises on a bench or in an apparatus. All but 1 patient reported additionally that they had done home exercises and walks for more than twice a week.. Indirectness: No indirectness Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy:
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: GROUP-BASED SUPERVISED REHABILITATION versus SELF-DIRECTED REHABILITATION

Protocol outcome 1: Quality of life at 6 to 24 months
- Actual outcome: HOOS QoL at 5 months at 5 months; Mean; HOOS 0-100 Top=High is poor outcome, Comments: adjusted mean (95% CI)
Intervention - 77 (73, 82)
UC - 76 (71, 80)
;
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness ; Baseline details: Uc - 71 (65, 76)
intervention - 66 (59, 73); Group 1 Number missing: 3/35, Reason: Dropped out after randomisation, Dropped out after 5 sessions due to work, lost to follow up because of cancer treatment; Group 2 Number missing: 1/33, Reason: Dropped out after randomisation
- Actual outcome: HOOS QoL at 1 year at 1 year; Mean; HOOS 0-100 Top=High is poor outcome, Comments: Adjusted mean (95% CI)
Intervention -81 (76, 86))
UC - 83 (78, 88);
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness ; Baseline details: Uc - 71 (65, 76)

intervention - 66 (59, 73); Group 1 Number missing: 3/35, Reason: Dropped out after randomisation, Dropped out after 5 sessions due to work, lost to follow up because of cancer treatment; Group 2 Number missing: 1/33, Reason: Dropped out after randomisation

Protocol outcome 2: Patient Reported Outcome Measures (PROMs) at 6 to 24 months
- Actual outcome: HOOS symptoms at 5months at 5 months; Mean; , Comments: Adjusted mean (95% CI)

intervention - 81 (77, 84)
usual care - 81 (78, 84)
;
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness ; Baseline details: Uc - 79 (76, 82)
intervention - 77 (73, 81); Group 1 Number missing: 3/35, Reason: Dropped out after randomisation, Dropped out after 5 sessions due to work, lost to follow up because of cancer treatment; Group 2 Number missing: 1/33, Reason: Dropped out after randomisation
- Actual outcome: HOOS symptoms at 1 year at 1 year; Mean; , Comments: adjusted Mean (95% CI)

intervention - 86 (82, 89)
UC - 87 (84, 91));
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness ; Baseline details: Uc - 79 (76, 82)
intervention - 77 (73, 81); Group 1 Number missing: 3/35, Reason: Dropped out after randomisation, Dropped out after 5 sessions due to work, lost to follow up because of cancer treatment; Group 2 Number missing: 1/33, Reason: Dropped out after randomisation
- Actual outcome: HOOS pain at 5 months at 5 months; Mean; , Comments: Adjusted mean (95% CI)
Intervention - 92 (89, 95)
UC -90 (87, 93);
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness ; Baseline details: Uc - 89 (86, 93)
intervention - 85 (80, 90); Group 1 Number missing: 3/35, Reason: Dropped out after randomisation, Dropped out after 5 sessions due to work, lost to follow up because of cancer treatment; Group 2 Number missing: 1/33, Reason: Dropped out after randomisation
- Actual outcome: HOOS pain at 1 year at 1 year; Mean; , Comments: Adjusted mean (95% CI)
Intervention - 94 (91, 96)
UC - 94 (92, 97);
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness ; Baseline details: Uc - 89 (86, 93)
intervention - 85 (80, 90); Group 1 Number missing: 3/35, Reason: Dropped out after randomisation, Dropped out after 5 sessions due to work, lost to follow up because of cancer treatment; Group 2 Number missing: 1/33, Reason: Dropped out after randomisation

Protocol outcome 3: Function at 6 to 24 months
- Actual outcome: HOOS activities of daily living at 5 months at 5 months; Mean; HOOS 0-100 Top=High is poor outcome, Comments: Adjusted mean

	(95% CI) Intervention - 90 (88, 92) UC - 89 (86, 91); Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness ; Baseline details: Uc - 87 (84, 90) intervention - 81 (77, 86); Group 1 Number missing: 3/35, Reason: Dropped out after randomisation, Dropped out after 5 sessions due to work, lost to follow up because of cancer treatment; Group 2 Number missing: 1/33, Reason: Dropped out after randomisation - Actual outcome: HOOS activities of daily living at 1 year at 1 year; Mean; HOOS 0-100 Top=High is poor outcome, Comments: Adjusted Mean (95% CI) Intervention - 92 (90, 95) UC - 91 (88, 94); Risk of bias: All domain - High, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness ; Baseline details: Uc - 87 (84, 90) intervention - 81 (77, 86); Group 1 Number missing: 3/35, Reason: Dropped out after randomisation, Dropped out after 5 sessions due to work, lost to follow up because of cancer treatment; Group 2 Number missing: 1/33, Reason: Dropped out after randomisation
Protocol outcomes not reported by the study	Revision of joint replacement at time to event; Reoperation including dislocation at within 24 months; Hospital readmissions at within 90 days; Thromboembolic complications at within 90 days; Pain at 6 to 24 months

ISBN

Study (subsidiary papers)	Heikkila 2017[31] (Li 2017[49]) (Vuorenmaa 2014[89])
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=108)
Countries and setting	Conducted in Finland; Setting: Carried out in the Central Finland Central Hospital.
Line of therapy	first line
Duration of study	Intervention + follow up: 12 months
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	The inclusion criteria were diagnosed knee OA, primary arthroplasty of the knee in question and age over 18 years.
Exclusion criteria	The exclusion criteria were other surgery for lower limbs planned to be carried out within 12 months, dementia, other serious co-morbidities preventing active training and difficulty in visiting a physiotherapist due to long travelling distance.
Recruitment/selection of patients	The subjects were recruited from patients selected for TKA during a preoperative orientation visit to the clinic.
Age, sex and family origin	Age - Mean (SD): 69 (9). Sex (M:F): 84 female, 24 male. Family origin: N/A
Further population details	1. Age: 2. Cognitive status: 3. Site/type of joint replacement: Total knee arthroplasty
Indirectness of population	No indirectness
Interventions	(n=53) Intervention 1: Supervised postoperative rehabilitation from first postoperative appointment - Individually supervised rehabilitation. Exercise group - patients had individual guidance at 2 months after TKA, and at 1 and 4 months by the same physiotherapist. At each visit they received written information about the exercises. From baseline up to 6 weeks, programme consisted of strengthening exercises for the quadriceps and hamstring muscles at multiple knee joint angles performed in a sitting position. At one month check-up patients were given new home exercises. PAtients were advised to buy dumbbells or use other weights at home. At the check up visit after 4 months of training the progression of the previously used exercises increased. They were given postage paid envelopes for the monthly return of the exercise diaries. They also had the possibility to call or visit the physiotherapist if they needed more advice. . Duration 1 year. Concurrent medication/care: On discharge from hospital all received advice concerning the application of cold packs and a written exercise programme which included active and passive knee range of motion exercises, knee flexor and extensor exercises and hip abductor and extensor exercises in the standing position using the weight of the extremity as a resistance. These exercises were instructed to be performed

	with 10-15 repetitions, 1-2 times a day. The patients were also recommended to be active and gradually increase their walking distance over time. . Indirectness: No indirectness Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy: (n=55) Intervention 2: Self-directed rehabilitation. In accordance with usual care, the control group did not receive any additional guidance after discharge from hospital.. Duration 1 year. Concurrent medication/care: On discharge from hospital all received advice concerning the application of cold packs and a written exercise programme which included active and passive knee range of motion exercises, knee flexor and extensor exercises and hip abductor and extensor exercises in the standing position using the weight of the extremity as a resistance. These exercises were instructed to be performed with 10-15 repetitions, 1-2 times a day. The patients were also recommended to be active and gradually increase their walking distance over time.. Indirectness: No indirectness Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy:
Funding	Funding not stated
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: INDIVIDUALLY SUPERVISED REHABILITATION versus SELF-DIRECTED REHABILITATION Protocol outcome 1: Pain at 6 to 24 months - Actual outcome: Knee pain during loading (0-100mm) on operated leg measured using visual analogue pain scale at 14 months; Group 1: mean 12 (SD 21); n=50, Group 2: mean 15 (SD 20); n=52 Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness ; Baseline details: intervention - 55 (21) control 52 (23); Group 1 Number missing: 1, Reason: Lost to follow up; Group 2 Number missing: 2, Reason: Lost to follow up Protocol outcome 2: Reoperation including dislocation within 24 months - Actual outcome: Reoperation at 14 months; Group 1:1/53, Group 2:0/55,Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness ; Baseline details: intervention - 55 (21) control 52 (23); Group 1 Number missing: 1, Reason: Lost to follow up; Group 2 Number missing: 2, Reason: Lost to follow up	
Protocol outcomes not reported by the study	Quality of life at 6 to 24 months; Patient Reported Outcome Measures (PROMs) at 6 to 24 months; Revision of joint replacement at time to event; Hospital readmissions at within 90 days; Thromboembolic complications at within 90 days; Function at 6 to 24 months

ISBN

Study	Johnsson 1988[38]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=30)
Countries and setting	Conducted in Sweden
Line of therapy	first line
Duration of study	Intervention + follow up: 6 months
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients with primary arthrosis had unilateral THR through a posterolateral approach without osteotomy of the greater trochanter, using a cemented unconstrained prosthesis with 32mm head and polyethylene cup. All prosthetic components were adequately positioned and there were no complications. The patients were allowed full weight-bearing the first postoperative day. No previous surgery had been performed in the investigated hips.
Exclusion criteria	None stated.
Age, sex and family origin	Age - Mean (range): 68 (50-76). Sex (M:F): 17 male, 13 female. Family origin: N/A
Further population details	1. Age: 2. Cognitive status: 3. Site/type of joint replacement: Hip replacement
Indirectness of population	No indirectness
Interventions	(n=14) Intervention 1: Supervised postoperative rehabilitation from first postoperative appointment - Group-based supervised rehabilitation. Organised physiotherapy - Started 2 months postoperatively. They took place in the primary health care twice a week during one month, followed by either once a week during one month or once every two weeks during two months. The average duration of each session was 45 mins. With the patient in the supine position the abdominal, gluteal, hamstring and quadriceps muscles were activated first by lifting the pelvis with the lower part of the legs resting on a cushion, and secondly by lifting the pelvis holding a ball between the flexed knees and keeping the feet on the floor. These exercises were then performed with weight bearing on one leg at a time. With the patient standing up the gluteal, hamstring, hip adductor, tensor fascia lata, iliopsoas, quadriceps and gastrocnemius muscles were activated, by shifting the weight from one leg to the other in different directions with the feet fairly wide apart, by standing on the toes while flexing and extending the hips and knees, by standing on one leg while swinging the other slowly backwards and forwards, and finally by repeatedly mounting a step up and down using alternate legs. Walking exercises were performed. All the patients also performed these exercises on their own at home approximately daily until the follow up half a year after surgery. . Duration 6 months. Concurrent medication/care: During the 7-12 days of hospital stay a physiotherapist gave all the patients standardised

	instructions and training with start preoperatively for 20 mins daily. The quadriceps muscle was activated by lifting the stretched legs alternately and the gluteal muscles by extending the flexed hip against resistance. During these exercises the hip mobility was actively trained in the supine position. The patients were instructed how to walk with one or two canes, climb up and down a staircase with the operated leg extended, prevent hip flexion beyond 90 degrees, adduction and inward rotation when lying down, sitting or bending forwards, sue aids for dressing and picking things up, use a raised toilet seat and chair cushion. They were recommended to continue training on their own at home. They were also encouraged to gradually take up activities like car driving, cycling and swimming again starting 6-8 weeks after surgery in order to achieve a normal way of living. . Indirectness: No indirectness Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy: (n=16) Intervention 2: Self-directed rehabilitation. No physiotherapy. . Duration 6 months. Concurrent medication/care: During the 7-12 days of hospital stay a physiotherapist gave all the patients standardised instructions and training with start preoperatively for 20 mins daily. The quadriceps muscle was activated by lifting the stretched legs alternately and the gluteal muscles by extending the flexed hip against resistance. During these exercises the hip mobility was actively trained in the supine position. The patients were instructed how to walk with one or two canes, climb up and down a staircase with the operated leg extended, prevent hip flexion beyond 90 degrees, adduction and inward rotation when lying down, sitting or bending forwards, sue aids for dressing and picking things up, use a raised toilet seat and chair cushion. They were recommended to continue training on their own at home. They were also encouraged to gradually take up activities like car driving, cycling and swimming again starting 6-8 weeks after surgery in order to achieve a normal way of living. . Indirectness: No indirectness Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy:
Funding	Academic or government funding (This study was supported by grants from Doktor Gunnar Svantessons minnesfond, Sven och Dagmar Salens Stiftelse, Johan och Greta Kocks Stiftelse and Alfred Osterlunds Stiftelse.)
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: GROUP-BASED SUPERVISED REHABILITATION versus SELF-DIRECTED REHABILITATION Protocol outcome 1: Function at 6 to 24 months - Actual outcome: Range of hip motion (degrees) - flexion at 6 months; Group 1: mean 92 (SD 15); n=14, Group 2: mean 88 (SD 9); n=16 Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness ; Baseline details: Intervention - 84 (14) control - 83 (11); Group 1 Number missing: 0; Group 2 Number missing: 0	
Protocol outcomes not reported by the study	Quality of life at 6 to 24 months; Patient Reported Outcome Measures (PROMs) at 6 to 24 months; Revision of joint replacement at time to event; Reoperation including dislocation at within 24 months; Hospital readmissions at within 90 days; Thromboembolic complications at within 90 days; Pain at 6 to 24 months

Study	Jokl 1989[40]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=30)
Countries and setting	Conducted in USA; Setting:
Line of therapy	first line
Duration of study	Intervention + follow up: 8 weeks
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	No history of previous knee surgery on either extremity, the willingness to be randomised into either study group postoperatively, absence of significant other knee joint pathology or absence of severe medical conditions which would preclude full participation in the selected rehabilitation programme.
Exclusion criteria	Not stated.
Age, sex and family origin	Age - Mean (SD): 32.1 (10.35). Sex (M:F): 23 male, 7 female. Family origin: N/A
Further population details	1. Age: 2. Cognitive status: 3. Site/type of joint replacement: Total knee arthroplasty
Indirectness of population	No indirectness
Interventions	(n=15) Intervention 1: Supervised postoperative rehabilitation from first postoperative appointment - Group-based supervised rehabilitation. Supervised physical therapy regimen - one therapist from a private outpatient rehabilitation facility supervised the rehabilitation of all patients in this group to ensure consistency in the application of the following regimen. Initial evaluation and first treatment session generally began on postoperative day 5. Therapy included whirlpool, instruction on ROM exercises, electric stimulation to quadriceps, combined with quadriceps setting and straight leg raises without weights and hip extension exercises. Patients were seen 3 times a week with about 45 mins spent at each rehabilitation session. . Duration 8 weeks. Concurrent medication/care: N/A. Indirectness: No indirectness Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy: (n=15) Intervention 2: Self-directed rehabilitation. Patients were carefully instructed to adhere to the following home exercise routine. Quadriceps setting and straight leg raising without weights were to be initiated on the first postoperative day. 3 sets of 10 repetitions for each exercise were to be done each day. Patients were encouraged to participate in low-impact sports once 25lb was realised on quadriceps extensions. . Duration 8 weeks. Concurrent medication/care: N/A. Indirectness: No indirectness Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy:

Funding	Funding not stated
Protocol outcomes not reported by the study	Quality of life at 6 to 24 months; Patient Reported Outcome Measures (PROMs) at 6 to 24 months; Revision of joint replacement at time to event; Reoperation including dislocation at within 24 months; Hospital readmissions at within 90 days; Thromboembolic complications at within 90 days; Pain at 6 to 24 months; Function at 6 to 24 months

ISBN

Study	Kramer 2003[45]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=160)
Countries and setting	Conducted in Canada; Setting:
Line of therapy	first line
Duration of study	Intervention + follow up: 12 weeks and 1 year
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients selected using the following criteria; patients having primary unilateral total knee arthroplasty as a result of osteoarthritis, having at least 90 degrees active knee flexion range of motion (ROM) before surgery, having a functional hip on the operative side, able to follow the home exercise protocol independently, and able to give independent informed consent.
Exclusion criteria	Patients with rheumatoid arthritis or major neurologic conditions were excluded.
Age, sex and family origin	Age - Mean (SD): 68.4 (7.35). Sex (M:F): 91 female, 69 male. Family origin: N/A
Further population details	1. Age: 2. Cognitive status: 3. Site/type of joint replacement: Total knee arthroplasty
Indirectness of population	No indirectness
Interventions	(n=80) Intervention 1: Supervised postoperative rehabilitation from first postoperative appointment - Individually supervised rehabilitation. Clinic-based group - Patients were required to attend outpatient physical therapy between weeks 2 to 12 after surgery, for as many as two sessions per week, for approximately 1 hour per session. After week 12 patients were permitted to continue with clinic-based rehabilitation on the advice of their surgeon. Outpatient physical therapists were provided with copies of the Stages 1 and 2 exercise booklets, and were asked to use these exercises as the basic component of their rehabilitation programme. They were not advised that the patient was participating in a study comparing two rehabilitation programmes. Therapists were permitted to modify or add exercises, use therapeutic modalities, joint mobilisations or other measures as they deemed appropriate. They were requested to complete the common home exercises at home twice on days they attended clinic sessions. . Duration 1 year. Concurrent medication/care: The common home exercise programme was developed for routine TKA rehabilitation at the author's institution and consisted of basic and more advanced ROM and strengthening exercises. Each patient received stages 1 and 2 booklets, which included written and pictorial

	descriptions of each exercise and educational information on using ice, controlling swelling, walking and ROM. They were instructed to complete the common home exercises three time daily until their 12 week follow-up, at which time they were advised to continue the home exercises at least once daily, indefinitely. . Indirectness: No indirectness Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy: (n=80) Intervention 2: Self-directed rehabilitation. Home -based group - a physical therapist familiar with the common home exercises telephoned each patient in the home-based group at least once during weeks 2 to 6 and once during weeks 7 to 12 after surgery to ask whether the patient was having any problems with the exercises, to remind them of the importance of completing the exercises and to provide advice on wound care, scar treatment and pain control. During each telephone call which lasted approximately 5-15 mins, the patient was asked when and how often he or she wished to be telephoned in the future. Patients also were provided with a contact telephone number to call if additional questions arose. . Duration 1 year. Concurrent medication/care: The common home exercise programme was developed for routine TKA rehabilitation at the author's institution and consisted of basic and more advanced ROM and strengthening exercises. Each patient received stages 1 and 2 booklets, which included written and pictorial descriptions of each exercise and educational information on using ice, controlling swelling, walking and ROM. They were instructed to complete the common home exercises three time daily until their 12 week follow-up, at which time they were advised to continue the home exercises at least once daily, indefinitely. . Indirectness: No indirectness Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy:
Funding	Academic or government funding (This study was funded through a grant from the National Health Research and Development Program (Ottawa, Canada).)
Protocol outcomes not reported by the study	Quality of life at 6 to 24 months; Patient Reported Outcome Measures (PROMs) at 6 to 24 months; Revision of joint replacement at time to event; Reoperation including dislocation at within 24 months; Hospital readmissions at within 90 days; Thromboembolic complications at within 90 days; Pain at 6 to 24 months; Function at 6 to 24 months

Study	Mockford 2008[58]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=150)
Countries and setting	Conducted in United Kingdom
Line of therapy	first line
Duration of study	Intervention + follow up: 1 year
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	All patients attending for primary TKA under the care of one surgeon were targeted for entry. All patient underwent TKA.
Exclusion criteria	None stated.
Recruitment/selection of patients	Recruitment took place on the day of admission to hospital.
Age, sex and family origin	Age - Other: Mean -70.15. Sex (M:F): 88 female, 54 male. Family origin: N/A
Further population details	1. Age: 2. Cognitive status: 3. Site/type of joint replacement: Total knee arthroplasty
Indirectness of population	No indirectness
Interventions	(n=71) Intervention 1: Supervised postoperative rehabilitation from first postoperative appointment - Individually supervised rehabilitation. Standard outpatient physiotherapy regime. . Duration 6 weeks. Concurrent medication/care: All patients were given a home exercise regime to follow on discharge. A letter was also sent to the patient's GP on day of discharge requesting them not to organise outpatient physiotherapy. . Indirectness: No indirectness Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy: (n=72) Intervention 2: Self-directed rehabilitation. No physiotherapy. . Duration 6 weeks. Concurrent medication/care: All patients were given a home exercise regime to follow on discharge. A letter was also sent to the patient's GP on day of discharge requesting them not to organise outpatient physiotherapy. . Indirectness: No indirectness Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy:
Funding	Academic or government funding (Benefits or support was received from the Belfast Arthroplasty Research Trust.)
Protocol outcomes not reported by the study	Quality of life at 6 to 24 months; Patient Reported Outcome Measures (PROMs) at 6 to 24 months; Revision of joint replacement at time to event; Reoperation including dislocation at within 24 months; Hospital

	readmissions at within 90 days; Thromboembolic complications at within 90 days; Pain at 6 to 24 months; Function at 6 to 24 months

Study	**Monaghan 2017[62]**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=63)
Countries and setting	Conducted in United Kingdom
Line of therapy	first line
Duration of study	Intervention + follow up: 6 weeks
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients who had undergone THR for osteoarthritis, aged ≥50yrs, able to read and understand instructions in English, willing to attend classes twice weekly for 6 weeks and willing to participate in an exercise programme without physical assistance.
Exclusion criteria	Medical instability, underlying terminal disease and suspicion of infection following joint replacement.
Age, sex and family origin	Age - Mean (SD): 68.5 (8.5). Sex (M:F): 37 male, 26 female. Family origin: N/A
Further population details	1. Age: 2. Cognitive status: 3. Site/type of joint replacement: Hip replacement
Extra comments	Patients with previous THR or total knee replacement were not excluded.
Indirectness of population	No indirectness
Interventions	(n=32) Intervention 1: Supervised postoperative rehabilitation from first postoperative appointment - Individually supervised rehabilitation. Functional exercise and usual care - 3 experienced physiotherapists supervised the functional exercise classes at each of the three community hospital-based clinical sites. Training provided before commencement of classes in the form of a practical workshop and written illustrated manuals were provided that included an exercise log book which was completed by the treating therapist at each attendance. They were taught 12 exercises by the supervising physiotherapist. The physiotherapist monitored form and exercise intensity, progressing the exercises as necessary. Each session was 35mins in length. Patients attended classes twice weekly for 6 weeks and were not given any additional exercises as a home exercise programme. . Duration 6 weeks. Concurrent medication/care: Both groups followed the usual care pathway. This involved the provision of an educational and immediate postoperative exercise booklet on admission and assessment by the orthopaedic surgeon at 6 weeks. The

	exercises outlined in the booklet for both groups consisted of early postoperative exercises for the duration of the hospital stay. These included foot and ankle pumps, static quadriceps, static gluteal contractions, active hip flexion and hip abduction. Following surgery, all patients are advised to walk daily with crutches until review by the orthopaedic surgeon at 6 weeks, increasing the distance gradually to approximately 1 mile after 1 month. No instructions for any additions exercises were given to either group on discharge. . Indirectness: No indirectness Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy: (n=31) Intervention 2: Self-directed rehabilitation. Both groups followed the usual care pathway. This involved the provision of an educational and immediate postoperative exercise booklet on admission and assessment by the orthopaedic surgeon at 6 weeks. The exercises outlined in the booklet for both groups consisted of early postoperative exercises for the duration of the hospital stay. These included foot and ankle pumps, static quadriceps, static gluteal contractions, active hip flexion and hip abduction. Following surgery, all patients are advised to walk daily with crutches until review by the orthopaedic surgeon at 6 weeks, increasing the distance gradually to approximately 1 mile after 1 month. No instructions for any additions exercises were given to either group on discharge. Duration 6 weeks. Concurrent medication/care: Both groups followed the usual care pathway. This involved the provision of an educational and immediate postoperative exercise booklet on admission and assessment by the orthopaedic surgeon at 6 weeks. The exercises outlined in the booklet for both groups consisted of early postoperative exercises for the duration of the hospital stay. These included foot and ankle pumps, static quadriceps, static gluteal contractions, active hip flexion and hip abduction. Following surgery, all patients are advised to walk daily with crutches until review by the orthopaedic surgeon at 6 weeks, increasing the distance gradually to approximately 1 mile after 1 month. No instructions for any additions exercises were given to either group on discharge. . Indirectness: No indirectness Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy:
Funding	Academic or government funding (Funded by a research training fellowship for health care professional's award 2012-2014 as part pf a PhD programme.)
Protocol outcomes not reported by the study	Quality of life at 6 to 24 months; Patient Reported Outcome Measures (PROMs) at 6 to 24 months; Revision of joint replacement at time to event; Reoperation including dislocation at within 24 months; Hospital readmissions at within 90 days; Thromboembolic complications at within 90 days; Pain at 6 to 24 months; Function at 6 to 24 months

Study	Piqueras 2013[69]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=142)
Countries and setting	Conducted in Spain
Line of therapy	first line
Duration of study	Intervention + follow up: 3 months
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients were eligible for inclusion if they met the following criteria: • successful primary TKA surgery; • post-TKA active range of motion: flexion 80º and extension –10º, without signs of stiffness; • ability to walk with the use of a walking aid; • ability to read and understand Spanish; • ability to understand and accept the trial procedures and to sign an informed consent form in accordance with national legislation.
Exclusion criteria	Patients were excluded in case of: • sensory, cognitive and/or praxic impairment; • concomitant medical conditions that may influence the rehabilitation process; • discharge to destination other than home; • patients with any local or systemic complication (e.g. surgical wound infection, suspicion of deep vein thrombosis) in the 3-month follow-up period were also excluded.
Age, sex and family origin	Age - Mean (SD): 73.3 (6.5). Sex (M:F): 50 male, 131 female. Family origin: N/A
Further population details	1. Age: 2. Cognitive status: 3. Site/type of joint replacement: Total knee arthroplasty
Indirectness of population	No indirectness
Interventions	(n=91) Intervention 1: Self-directed rehabilitation. Control group received the standard clinical protocol of TKA rehabilitation consisting of 1-h sessions for 10 days. . Duration 10 days. Concurrent medication/care: In all cases, functional rehabilitation started the day after TKA. All participants were instructed by a physical therapist in weight bearing to tolerance with an assistive device and underwent inpatient care and outpatient intervention (outpatient physical therapy or IVT) for the first 3 weeks after surgery. Inpatient care consisted of

	assisted walking within 24 h, knee range of motion exercises and preparing for the return home. Under the study protocol, all participants performed the first 5 sessions under therapist supervision in the Knee Function Unit of the Physical Medicine and Rehabilitation Department to ensure proper monitoring and avoid unnecessary risks related to surgical incisions and stitches. Before starting home-based intervention, patients were examined by a doctor to ensure the absence of complications that might result in exclusion from the study. . Indirectness: No indirectness Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy: (n=90) Intervention 2: Supervised postoperative rehabilitation from first postoperative appointment - Individually supervised rehabilitation. Patients received 1-h IVT sessions for 10 days (5 sessions performed under a therapist's supervision to verify the absence of medical complications that would require exclusion from the study and 5 sessions performed at home). The IVT is an interactive virtual software-hardware platform that facilitates the development of remote rehabilitation therapy for multiple diseases. As described above, the patient receives the information needed to perform the exercises and the therapist can remotely monitor the patient's performance. For the purpose of this trial, the IVT system was designed for lower limb motor recovery in patients undergoing TKA. Duration 10 days. Concurrent medication/care: In all cases, functional rehabilitation started the day after TKA. All participants were instructed by a physical therapist in weight bearing to tolerance with an assistive device and underwent inpatient care and outpatient intervention (outpatient physical therapy or IVT) for the first 3 weeks after surgery. Inpatient care consisted of assisted walking within 24 h, knee range of motion exercises and preparing for the return home. Under the study protocol, all participants performed the first 5 sessions under therapist supervision in the Knee Function Unit of the Physical Medicine and Rehabilitation Department to ensure proper monitoring and avoid unnecessary risks related to surgical incisions and stitches. Before starting home-based intervention, patients were examined by a doctor to ensure the absence of complications that might result in exclusion from the study. . Indirectness: No indirectness Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy:
Funding	Academic or government funding (This study was partially financed by Telefónica Research and Development.)
Protocol outcomes not reported by the study	Quality of life at 6 to 24 months; Patient Reported Outcome Measures (PROMs) at 6 to 24 months; Revision of joint replacement at time to event; Reoperation including dislocation at within 24 months; Hospital readmissions at within 90 days; Thromboembolic complications at within 90 days; Pain at 6 to 24 months; Function at 6 to 24 months

Study	Piva 2019[70]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=240)
Countries and setting	Conducted in USA
Line of therapy	Part of comparison
Duration of study	Intervention + follow up: 6 months
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Stratified then randomised
Inclusion criteria	Inclusion criteria were unilateral primary TKR, age 60 years or older, TKR 2 to 4 months before screening, moderate functional limitations defined by Western Ontario and McMaster Universities Osteoarthritis Index–Physical Function (WOMAC-PF) of 9 or higher, ability to read and write English, willingness to be randomized, and medical clearance to exercise.
Exclusion criteria	Exclusion criteria were contraindications to exercise, neuromuscular disorders of the lower extremities, inability to independently walk 50 m, regular participation in supervised exercise, terminal illness, and intent to undergo another TKR, or unavailability during the study period.
Age, gender and ethnicity	Age - Mean (SD): 69.6 (6.6). Gender (M:F): 148 female, 92 male. Ethnicity: reported as group 1, group 2, group 3 White 86 (89.6) 77 (80.2) 37 (77.1) African American 10 (10.4) 18 (18.8) 11 (22.9) American Indian/Alaskan Native 0 1 (1.0) 0 Hispanic or Latino, No. (%) 0 1 (1.0) 1 (2.1)
Further population details	1. Age: Above working age 2. Cognitive status: Not stated / Unclear 3. Site/type of joint replacement: Total knee arthroplasty
Extra comments	Adaptive randomization was used with the minimal sufficient balance algorithm

	11,12 using factors related to functional recovery, including age, sex, body mass index, surgical knee flexion, and WOMAC-PF. .
Indirectness of population	No indirectness
Interventions	(n=96) Intervention 1: Supervised postoperative rehabilitation from first postoperative appointment - Individually supervised rehabilitation. Clinic-based individualized physical therapy consisted of 12 sessions (approximately 60 minutes) of exercise supervised by physical therapists (physical therapy arm) over 12 weeks. Sessions were 2 times per week in weeks 1 through 3, a single time per week in weeks 4 through 7, and then bimonthly. Each session included warm-up; moderate- intensity to vigorous-intensity (rating of somewhat hard to hard on a perceived exertion scale) resistance training of the major lower extremity muscle groups; moderate-intensity (rating of moderate to somewhat hard on the perceived exertion scale) aerobic training on a treadmill or bicycle; and functional activities, such as walking fast and in narrow paths, squatting, and rhythmic stepping Exercises were tailored to individuals' impairments and progressed in intensity and complexity provided they did not increase pain or effusion. Participants were taught a home exercise program and were asked to exercise at least 2 times per week (either in the clinic or at home) during the intervention phase, for a total of 24 session's. . Duration 6 months. Concurrent medication/care: n/a. Indirectness: No indirectness Further details: 1. Number of supervised sessions: >3 sessions 2. Telephone calls: No use of telephone calls for supervision appointments (Clinic-based individualized physical therapy consisted of 12 sessions (approximately 60 minutes) of exercise supervised by physical therapists. (Physical therapy arm) over 12 weeks. Sessions were 2 times per week in weeks 1 through 3, a single time per week in weeks 4 through 7, and then bimonthly). 3. Use of hydrotherapy: Not stated / Unclear (n=96) Intervention 2: Supervised postoperative rehabilitation from first postoperative appointment - Group-based supervised rehabilitation. Community-based group exercise involved participation in supervised classes for older adults at senior community centers (community arm). Participants were asked to attend at least 2 exercise classes per week for 3 months, for a total of 24 classes (approximately 60 minutes) taught by certified senior fitness instructors. Participants were instructed to partake in evidence-based exercise classes for older adults that have shown to be challenging for active older adults and safe for more frail individuals (e.g., Enhance Fitness [Sound Generations] and Silver Sneakers Circuit [TivityHealth, Inc]).The program focused on dynamic cardiovascular exercise, strength training, balance and flexibility. Attendance at each class was documented by the community centres and then sent to the research coordinator. . Duration 6 months. Concurrent medication/care: n/a. Indirectness: No indirectness Further details: 1. Number of supervised sessions: >3 sessions (2 exercise classes per week for 3 months,

	for a total of 24 classes). 2. Telephone calls: Not applicable 3. Use of hydrotherapy: Not applicable (n=48) Intervention 3: Self-directed rehabilitation. In the usual medical care arm, no attempt was made to interfere with the care received by participants. This arm served as a waiting list (control arm). After completing the 6-month waiting period (data collection phase), these participants were offered participation in the exercise interventions. Duration 6 months. Concurrent medication/care: n/a. Indirectness: No indirectness Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy:
Funding	Academic or government funding (This research was funded through a Patient-Centered Outcomes Research Institute award (CER-1310-06994) (Dr Piva, principal investigator).

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: CLINIC-BASED INDIVIDUAL PHYSICAL THERAPY versus USUAL MEDICAL CARE (WAIT-LISTED)

Protocol outcome 1: Quality of life at 6 to 24 months
- Actual outcome: Quality of life using RAND 36-PCS scale at 6 months at 6 months; Group 1: mean 46 (SD 9); n=89, Group 2: mean 44 (SD 10); n=45
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Comments - ; Indirectness of outcome: No indirectness ; Group 1 Number missing: 7, Reason: Withdrew, unrelated adverse event, illness in family or un-contactable
; Group 2 Number missing: 3, Reason: Withdrew or un-contactable

Protocol outcome 2: Reoperation including dislocation at within 24 months
- Actual outcome: Patient reported outcome using WOMAC-Physical function (PF) scale at 6 months
at 6 months; Group 1: mean 9.8 (SD 7.2); n=89, Group 2: mean 11.8 (SD 7.5); n=45
Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 7, Reason: Withdrew, unrelated adverse event, illness in family or un-contactable

; Group 2 Number missing: 3, Reason: Withdrew or un-contactable

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: COMMUNITY-BASED GROUP EXERCISE versus USUAL MEDICAL

CARE (WAIT-LISTED) Protocol outcome 1: Quality of life at 6 to 24 months - Actual outcome: Quality of life using RAND 36-PCS scale at 6 months at 6 months; Group 1: mean 45 (SD 9); n=88, Group 2: mean 44 (SD 10); n=45 Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Comments - ; Indirectness of outcome: No indirectness ; Group 1 Number missing: 8, Reason: Withdrew (2 due to unknown reason, 1 felt study was burdensome) or were un-contactable ; Group 2 Number missing: 3, Reason: Withdrew or un-contactable Protocol outcome 2: Patient Reported Outcome Measures (PROMs) at 6 to 24 months - Actual outcome: Patient reported outcome using WOMAC-Physical function (PF) scale at 6 months at 6 months; Group 1: mean 10.8 (SD 7.9); n=88, Group 2: mean 11.8 (SD 7.5); n=45 Risk of bias: All domain - Very high, Selection - High, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 8, Reason: Withdrew (2 due to unknown reason, 1 felt study was burdensome) or were un-contactable; Group 2 Number missing: 3, Reason: Withdrew or un-contactable	
Protocol outcomes not reported by the study	Revision of joint replacement at time to event; Hospital readmissions at within 90 days; Thromboembolic complications at within 90 days; Pain at 6 to 24 months; Function at 6 to 24 months

ISBN

Study	Rajan 2004[72]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=120)
Countries and setting	Conducted in United Kingdom; Setting:
Line of therapy	first line
Duration of study	Follow up (post intervention): 1 year
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	All patients with monoarticular arthrosis between the ages of 55–90 years who had less than 40 degrees of fixed flexion contracture, walked at least 10 meters unaided and had undergone a primary TKA were included.
Exclusion criteria	Patients with a concurrent hip or ankle problem were excluded.
Recruitment/selection of patients	The target population consisted of patients who required a TKA and were admitted for this procedure in Lincoln County Hospital.
Age, sex and family origin	Age - Mean (SD): 68.5 (9.65). Sex (M:F): 43 male, 73. Family origin: Not stated.
Further population details	1. Age: 2. Cognitive status: 3. Site/type of joint replacement: Total knee arthroplasty
Indirectness of population	No indirectness
Interventions	(n=59) Intervention 1: Supervised postoperative rehabilitation from first postoperative appointment - Individually supervised rehabilitation. Outpatient physiotherapy. Outpatient physiotherapy is usually given, on average, 4–6 times after discharge from hospital. Had inpatient physiotherapy and outpatient physiotherapy. Duration N/A. Concurrent medication/care: All patients were given a home exercise regime to follow on discharge. Indirectness: No indirectness Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy: (n=61) Intervention 2: Self-directed rehabilitation. No outpatient therapy. Received inpatient physiotherapy only. . Duration N/A. Concurrent medication/care: All patients were given a home exercise regime to follow on discharge. Indirectness: No indirectness Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy:
Funding	Funding not stated
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: INDIVIDUALLY SUPERVISED REHABILITATION versus SELF-DIRECTED REHABILITATION	

Protocol outcome 1: Function at 6 to 24 months - Actual outcome: Range of motion in degrees at 6 months at 6 months; MD; 2.8 (95%CI -0.19 to 5.8, Comments: Adjusted mean difference (95% CI)); Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 3/59=0.0508, Reason: One patient had no outpatient physiotherapy, one transferred to a different area and one had an infection requiring a revision total knee arthroplasty.; Group 2 Number missing: 1/61= 0.016, Reason: One of them died - Actual outcome: Range of motion in degrees at 1 year at 1 year; MD; 2.2 (95%CI -0.47 to 5, Comments: Adjusted mean difference (95% CI)); Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 3/59=0.0508, Reason: One patient had no outpatient physiotherapy, one transferred to a different area and one had an infection requiring a revision total knee arthroplasty.; Group 2 Number missing: 1/61= 0.016, Reason: One of them died	
Protocol outcomes not reported by the study	Quality of life at 6 to 24 months; Patient Reported Outcome Measures (PROMs) at 6 to 24 months; Revision of joint replacement at time to event; Reoperation including dislocation at within 24 months; Hospital readmissions at within 90 days; Thromboembolic complications at within 90 days; Pain at 6 to 24 months

ISBN

Study	Tousignant 2011[81]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=48)
Countries and setting	Conducted in Canada
Line of therapy	first line
Duration of study	Intervention + follow up: 4 months
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	N/A
Exclusion criteria	N/A
Recruitment/selection of patients	Patients who had TKA were recruited prior to discharge from two acute care hospitals. Potential participants were first approached by their hospital physiotherapist in the post-operative unit to determine their interest in the research project.
Age, sex and family origin	Age - Mean (SD): 66 (11.5). Sex (M:F): N/A. Family origin: N/A
Further population details	1. Age: 2. Cognitive status: 3. Site/type of joint replacement: Total knee arthroplasty
Indirectness of population	No indirectness
Interventions	(n=24) Intervention 1: Supervised postoperative rehabilitation from first postoperative appointment - Individually supervised rehabilitation. The tele treatments were delivered at a rate of two sessions per week for eight weeks (i.e. a total of 16 sessions). For the experimental group, someone was expected to be at the participant's home during tele treatment to ensure the patient's safety during transfers and locomotion, and in case of emergency. This person was a family member or friend who had received prior training in the use of the technology that had been installed, but not on the therapy. . Duration 2 months. Concurrent medication/care: The physiotherapy for all participants was designed for functional rehabilitation. It was based on reducing disabilities and improving function in daily activities through progressive exercises. The mean duration of each therapy session was about one hour (including treatment assessment and recommendations between treatments). The home visit/outpatient clinic treatments were delivered as usual over a period of about two months. . Indirectness: No indirectness Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy: (n=24) Intervention 2: Self-directed rehabilitation. Control group participants were referred by the institution to the usual home care services. Duration 2 months. Concurrent medication/care: The physiotherapy for all

	participants was designed for functional rehabilitation. It was based on reducing disabilities and improving function in daily activities through progressive exercises. The mean duration of each therapy session was about one hour (including treatment assessment and recommendations between treatments). The home visit/outpatient clinic treatments were delivered as usual over a period of about two months. . Indirectness: No indirectness Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy:
Funding	Academic or government funding (The research was supported in part by a grant from the Fonds de la Recherche en Sante du Quebec.)
Protocol outcomes not reported by the study	Quality of life at 6 to 24 months; Patient Reported Outcome Measures (PROMs) at 6 to 24 months; Revision of joint replacement at time to event; Reoperation including dislocation at within 24 months; Hospital readmissions at within 90 days; Thromboembolic complications at within 90 days; Pain at 6 to 24 months; Function at 6 to 24 months

ISBN

Study	Unlu 2007[86]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=26)
Countries and setting	Conducted in Singapore
Line of therapy	first line
Duration of study	Intervention + follow up: 6 weeks
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	N/A
Exclusion criteria	N/A
Recruitment/selection of patients	They reviewed the medical records of 80 patients who had total hip arthroplasty for hip osteoarthritis in the Orthopedics and Traumatology Clinic of our hospital within the previous two years. A duration of 12–24 months had passed since time of operation.
Age, sex and family origin	Age - Mean (SD): 51.91 (8.82). Sex (M:F): 18 female, 8 male . Family origin: N/A
Further population details	1. Age: 2. Cognitive status: 3. Site/type of joint replacement: Hip replacement
Indirectness of population	No indirectness
Interventions	(n=9) Intervention 1: Self-directed rehabilitation. Home exercise programme - patients were recommended to follow a home exercise programme consisting of range of motion, isometric and eccentric contractile hip exercises bilaterally. An experienced physiotherapist explained the exercises in a practice session. The patients were asked to perform these exercises twice a day for six weeks. These patients were contacted once a week and queried regarding any problems encountered during this period. Appropriate modifications were applied to the exercises (either decreasing the number of repetitions or omitting the exercise for a few days due to pain or fatigue). Duration 6 weeks. Concurrent medication/care: N/A. Indirectness: No indirectness Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy: (n=8) Intervention 2: Supervised postoperative rehabilitation from first postoperative appointment - Individually supervised rehabilitation. Exercise under physiotherapist supervision in hospital - patients were prescribed exercise in hospital under supervision for six weeks. The same exercise procedure as in the first group was applied to these patients, with the only difference being direct physiotherapist supervision during the exercise session. Duration 6 weeks. Concurrent medication/care: N/A. Indirectness: No indirectness

ISBN

	Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy: (n=9) Intervention 3: Self-directed rehabilitation. Control group - patients were assigned only walking. . Duration 6 weeks. Concurrent medication/care: N/A. Indirectness: No indirectness Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy:
Funding	Funding not stated
Protocol outcomes not reported by the study	Quality of life at 6 to 24 months; Patient Reported Outcome Measures (PROMs) at 6 to 24 months; Revision of joint replacement at time to event; Reoperation including dislocation at within 24 months; Hospital readmissions at within 90 days; Thromboembolic complications at within 90 days; Pain at 6 to 24 months; Function at 6 to 24 months

ISBN

Study	Vuorenmaa 2014[89]
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=108)
Countries and setting	Conducted in Finland
Line of therapy	first line
Duration of study	Intervention + follow up: 6 months
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Criteria were diagnosed knee OA, primary arthroplasty of the knee in question and age over 18.
Exclusion criteria	Exclusion criteria were other surgery for the lower limbs planned to be performed within 12 months, dementia, fibromyalgia, other serious co-morbidities preventing active training and difficulty visiting a physiotherapist due to a long travelling distance.
Age, sex and family origin	Age - Mean (SD): 69 (8.5). Sex (M:F): 66 female, 42 male. Family origin: N/A
Further population details	1. Age: 2. Cognitive status: 3. Site/type of joint replacement: Total knee arthroplasty
Indirectness of population	No indirectness: Met physiotherapist at 1 and 4 months after
Interventions	(n=53) Intervention 1: Supervised postoperative rehabilitation from first postoperative appointment - Individually supervised rehabilitation. Home-based exercise group - They were given individual guidance at baseline (2 months post-operatively) and at 1 and 4 months thereafter by the same physiotherapist. At each visit they received written information on the exercises and were instructed to keep a weekly exercise diary, in which they recorded the number of home exercise sessions they completed, as well as adverse events. They were also permitted to telephone or visit the physiotherapist if more advice was needed. Duration 6 months. Concurrent medication/care: On the second day after the operation all of the participants were allowed to perform full weigh bearing on the operated leg or as much as they could tolerate. For safety reasons crutches were recommended for 4-5 weeks after the operations. On discharge from hospital the participants received advice concerning the application of cold packs and a written exercise programme, which included active and passive knee-ROM exercises, knee flexor and extensor exercises, and hip abductor and extensor exercises in the standing position, using the weight of an extremity as resistance. They were instructed to perform these exercises 1-2 times a day, with 10-15 repetitions. They were also advised to be active, gradually increasing their walking distance over time. . Indirectness: No indirectness Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy:

ISBN

	(n=55) Intervention 2: Self-directed rehabilitation. The control group did not receive any additional guidance after the baseline measurements, in accordance with normal care. . Duration 6 months . Concurrent medication/care: On the second day after the operation all of the participants were allowed to perform full weigh bearing on the operated leg or as much as they could tolerate. For safety reasons crutches were recommended for 4-5 weeks after the operations. On discharge from hospital the participants received advice concerning the application of cold packs and a written exercise programme, which included active and passive knee-ROM exercises, knee flexor and extensor exercises, and hip abductor and extensor exercises in the standing position, using the weight of an extremity as resistance. They were instructed to perform these exercises 1-2 times a day, with 10-15 repetitions. They were also advised to be active, gradually increasing their walking distance over time. . Indirectness: No indirectness Further details: 1. Number of supervised sessions: 2. Telephone calls: 3. Use of hydrotherapy:
Funding	Academic or government funding (This study was supported in part by a grant from the Central Finland Health Care District. The authors have no conflicts of interest to declare.)

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: INDIVIDUALLY SUPERVISED REHABILITATION versus SELF-DIRECTED REHABILITATION

Protocol outcome 1: Quality of life at 6 to 24 months
- Actual outcome: SF-36, physical scale 1 year at 1 year; Mean; , Comments: Mean changes (CI)
intervention - 8 (6 to 11)
Control - 6 (4 to 9);
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 2/53, Reason: Lost to follow up, re-operation; Group 2 Number missing: 2/55, Reason: Lost to follow-up
- Actual outcome: SF-36, mental scale 1 year at 1 year; Mean; , Comments: Mean change (CI)
intervention - 4 (1 to 7)
Control - 3 (0 to 6);
Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 2/53, Reason: Lost to follow up, re-operation; Group 2 Number missing: 2/55, Reason: Lost to follow-up

Protocol outcome 2: Patient Reported Outcome Measures (PROMs) at 6 to 24 months
- Actual outcome: WOMAC - pain, 1 year at 1 year; Mean; , Comments: Mean decreases (95% CI)
Intervention = -15 (-20 to -10)
Control = -14 (-19 to -9)

Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 2/53, Reason: Lost to follow up, re-operation; Group 2 Number missing: 2/55, Reason: Lost to follow-up

- Actual outcome: WOMAC - functional difficulty, 1 year at 1 year; Mean; , Comments: Mean decrease (95% CI) Intervention = -18 (-24 to -12) Control = -13 (-19 to -8); Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low; Indirectness of outcome: No indirectness ; Group 1 Number missing: 2/53, Reason: Lost to follow up, re-operation; Group 2 Number missing: 2/55, Reason: Lost to follow-up	
Protocol outcomes not reported by the study	Revision of joint replacement at time to event; Reoperation including dislocation at within 24 months; Hospital readmissions at within 90 days; Thromboembolic complications at within 90 days; Pain at 6 to 24 months; Function at 6 to 24 months

ISBN

Appendix E: Forest plots

E.1 Group-based supervised rehabilitation versus self-directed rehabilitation

Figure 2: Quality of life at 6 to 24 months, measured by HOOS, KOOS scale, 0-100, high is good outcome

	Supervised Rehabilitation			Self-directed Rehab				Std. Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI
Artz, 2017	61.5	32.3	21	45.1	29.2	15	33.3%	0.52 [-0.16, 1.19]
Heiberg, 2012	81	15.09	35	83	14.65	33	66.7%	-0.13 [-0.61, 0.34]
Total (95% CI)			**56**			**48**	**100.0%**	**0.08 [-0.31, 0.47]**

Heterogeneity: Chi² = 2.37, df = 1 (P = 0.12); I² = 58%
Test for overall effect: Z = 0.42 (P = 0.68)

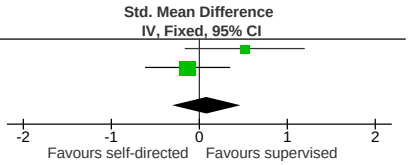


Figure 3: Quality of life at 6 to 24 months (SF-36 – MCS scale)

	Supervised Rehabilitation			Self-directed Rehab			Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	IV, Fixed, 95% CI
Coulter, 2017	81.1	23.5	56	78.6	22.68	42	2.50 [-6.72, 11.72]

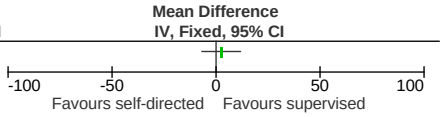


Figure 4: Quality of life, 6 to 24 months, SF-36/RAND-36 scale - PCS

	Supervised Rehabilitation			Self-directed Rehab				Std. Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI
Coulter, 2017	71.4	29.15	56	68.5	28.06	42	44.6%	0.10 [-0.30, 0.50]
Piva 2019	45	9	88	44	10	45	55.4%	0.11 [-0.25, 0.47]
Total (95% CI)			**144**			**87**	**100.0%**	**0.10 [-0.16, 0.37]**

Heterogeneity: Chi² = 0.00, df = 1 (P = 0.98); I² = 0%
Test for overall effect: Z = 0.76 (P = 0.45)

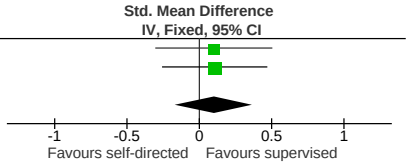


Figure 5: PROMs - pain at 6 to 24 months ((WOMAC, HOOS, KOOS scale)

	Supervised Rehabilitation			Self-directed Rehab				Std. Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI
Artz, 2017	21.4	25.9	21	29.1	27.1	15	28.1%	-0.29 [-0.95, 0.38]
Beaupre, 2014	91.7	13.2	11	87	18.9	10	16.8%	0.28 [-0.58, 1.14]
Heiberg, 2012	94	7.55	35	94	7.33	33	55.1%	0.00 [-0.48, 0.48]
Total (95% CI)			**67**			**58**	**100.0%**	**-0.03 [-0.39, 0.32]**

Heterogeneity: Chi² = 1.07, df = 2 (P = 0.58); I² = 0%
Test for overall effect: Z = 0.18 (P = 0.85)

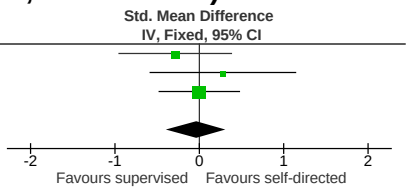


Figure 6: PROMs – function at 6 to 24 months (KOOS, WOMAC -PF, WOMAC and HOOS scale))

	Supervised Rehabilitation			Self-directed Rehab				Std. Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI
Artz, 2017	20.4	23.4	21	26.5	26.4	15	14.4%	-0.24 [-0.91, 0.42]
Beaupre, 2014	90.8	12.7	11	85.6	15.6	10	8.5%	0.35 [-0.51, 1.22]
Heiberg, 2012	92	7.55	35	91	8.79	33	28.0%	0.12 [-0.36, 0.60]
Piva 2019	10.8	7.9	88	11.8	7.5	45	49.1%	-0.13 [-0.49, 0.23]
Total (95% CI)			**155**			**103**	**100.0%**	**-0.03 [-0.29, 0.22]**

Heterogeneity: Chi² = 1.81, df = 3 (P = 0.61); I² = 0%
Test for overall effect: Z = 0.26 (P = 0.79)

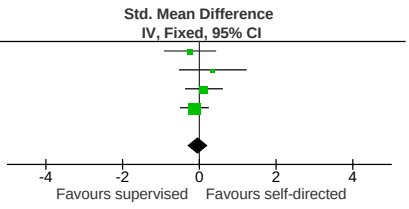


Figure 7: PROMS – symptoms at 6 to 24 months (KOOS, HOOS scale)

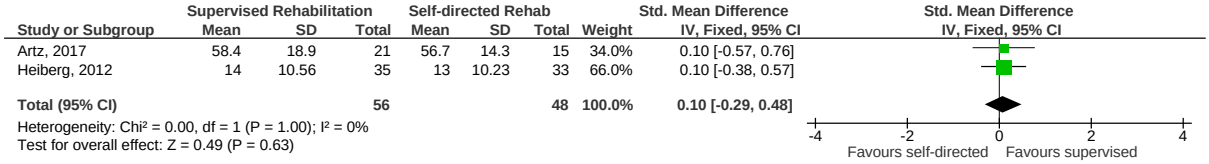


Figure 8: PROMs – total score at 6 to 24 months (WOMAC scale)

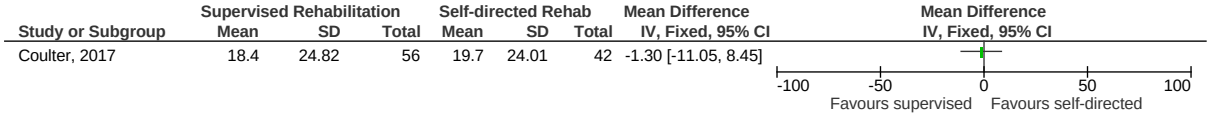
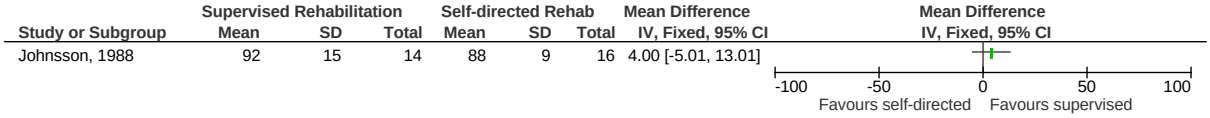


Figure 9: Function at 6 to 24 months (Range of motion)



E.2 Individually supervised rehabilitation versus self-directed rehabilitation

Figure 10: Quality of life at 6 to 24 months (RAND-36, SF-36 scale, physical health scores subscale)

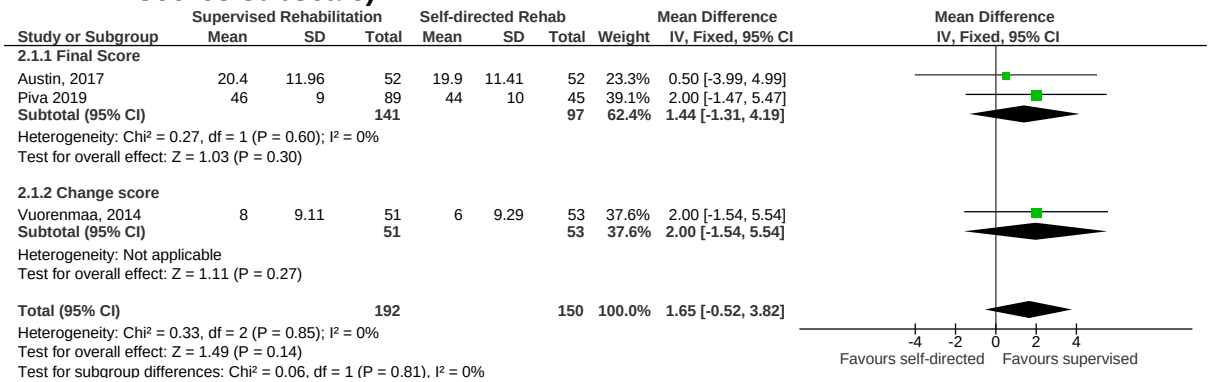


Figure 11: Quality of life at 6 to 24 months (SF-36 – MCS scale)

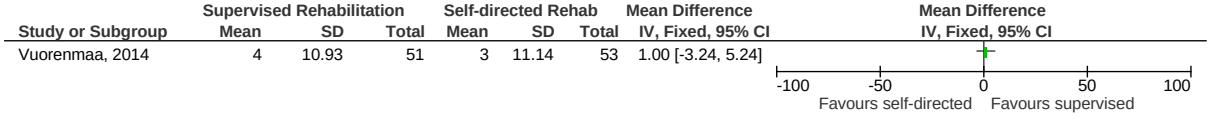


Figure 12: PROMs – function at 6 to 24 months (WOMAC, WOMAC-PF scale)

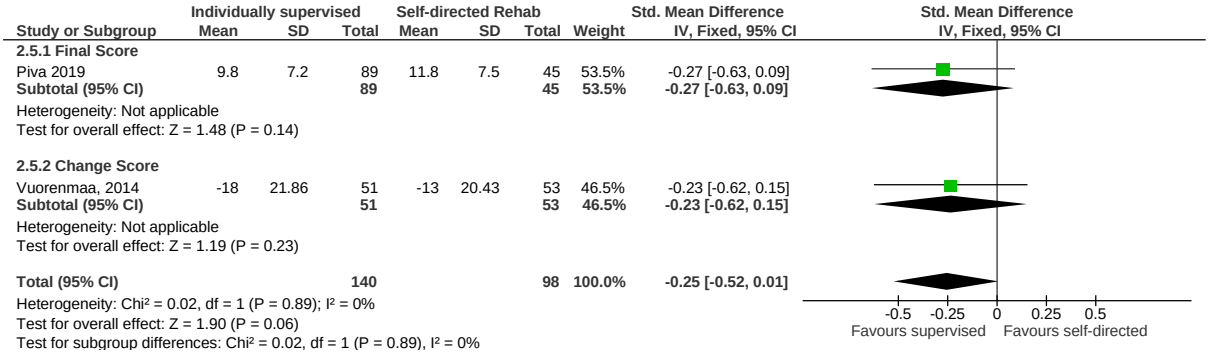


Figure 13: PROMs – pain at 6 to 24 months (WOMAC scale)

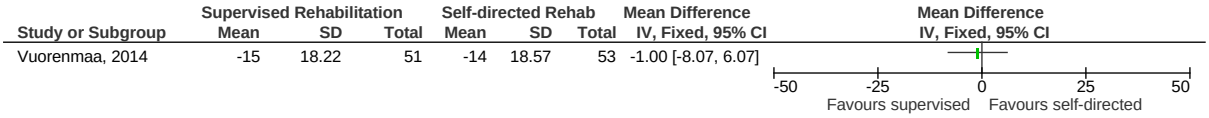


Figure 14: Reoperation including dislocation within 24 months

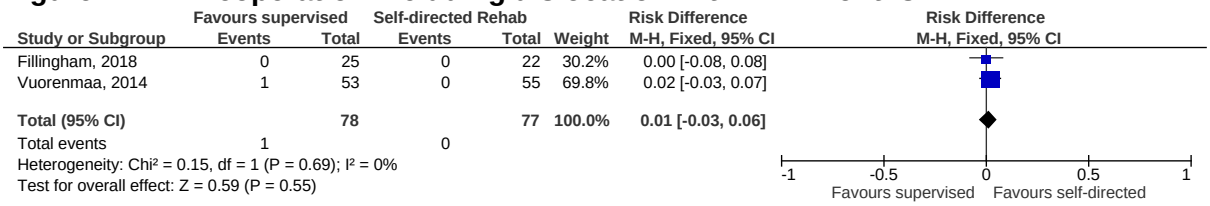
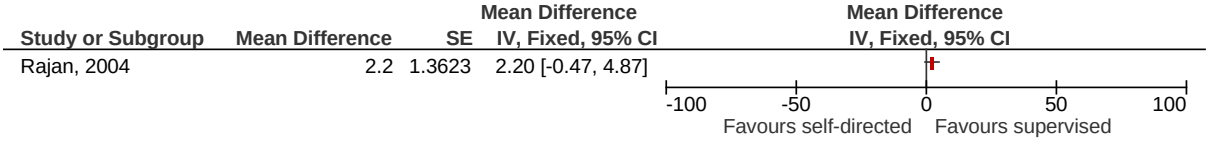


Figure 15: Function at 6 to 24 months (Range of motion)



Appendix F: GRADE tables

Table 10: Clinical evidence profile: Group-based supervised rehabilitation versus self-directed rehabilitation

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Group-based supervised rehabilitation versus self-directed rehabilitation	Control	Relative (95% CI)	Absolute		
Quality of life at 6 to 24 months (follow-up 6-12 months; measured with: KOOS, HOOS scale; range of scores: 0-100; Better indicated by higher values)												
2	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	56	48	-	SMD 0.08 higher (0.31 lower to 0.47 higher)	⊕⊕⊕O MODERATE	CRITICAL
Quality of life at 6 to 24 months (follow-up 6.5 months; measured with: SF-36 scale, MCS; range of scores: 0-100; Better indicated by higher values)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	56	42	-	MD 2.5 higher (6.72 lower to 11.72 higher)	⊕⊕OO LOW	CRITICAL
Quality of life at 6 to 24 months (follow-up 6- 6.5 months; measured with: SF-36, RAND-36 scale, PCS; range of scores: 0-100; Better indicated by higher values)												
2	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	144	87	-	SMD 0.10 higher (0.16 lower to 0.37 higher)	⊕⊕OO LOW	CRITICAL
PROMs - Pain at 6 to 24 months (follow-up 6-12 months; measured with: KOOS, WOMAC, HOOS scale; range of scores: 0-100; Better indicated by lower values)												
3	randomised trials	serious[1]	no serious inconsistency	serious[3]	no serious imprecision	none	67	58	-	SMD 0.03 lower (0.39 lower to	⊕⊕OO LOW	CRITICAL

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										0.32 higher)		
PROMs - Function at 6 to 24 months (follow-up 6-12 months; measured with: WOMAC, HOOS, KOOS, WOMAC-PF scale; range of scores: 0-100; Better indicated by lower values)												
4	randomised trials	very serious[1]	no serious inconsistency	serious[3]	no serious imprecision[2]	none	155	103	-	SMD 0.03 lower (0.29 lower to 0.22 higher)	⊕OOO VERY LOW	CRITICAL
PROMs - Symptoms at 6 to 24 months (follow-up 6-12 months; measured with: KOOS, HOOS scale; range of scores: 0-100; Better indicated by higher values)												
2	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	56	48	-	SMD 0.10 higher (0.29 lower to 0.48 higher)	⊕⊕⊕O MODERATE	CRITICAL
PROMs - Total score (follow-up 6.5 months; measured with: WOMAC scale; range of scores: 0-100; Better indicated by lower values)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	56	42	-	MD 1.3 lower (11.05 lower to 8.45 higher)	⊕⊕⊕O MODERATE	CRITICAL
Revision of joint replacement - not reported												
0	-	-	-	-	-	none	-	-	-	-		CRITICAL
Reoperation including dislocation within 24 months - not reported												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	0/35 (0%)	0/33 (0%)	Not estimable	0 fewer per 1000 (from 60 fewer to 60 more)	⊕⊕⊕O MODERATE	CRITICAL
Function at 6 to 24 months (follow-up 6 months; measured with: Range of motion; Better indicated by higher values)												
1	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	very serious[2]	none	14	16	-	MD 4 higher (5.01 lower to 13.01	⊕OOO VERY LOW	IMPORTANT

										higher)		
Thromboembolic complications within 90 days (follow-up 12 months)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	0/35 (0%)	0/33 (0%)	Not estimable	0 fewer per 1000 (from 60 fewer to 60 more)	⊕⊕⊕O MODERATE	IMPORTANT

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias.
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs.
[3] Downgraded by 1 or 2 increments for intervention indirectness.

Table 11: Clinical evidence profile: Individually supervised rehabilitation versus self-directed rehabilitation

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Individually supervised rehabilitation versus self-directed rehabilitation**	**Control**	**Relative (95% CI)**	**Absolute**		
Quality of life at 6 to 24 months (follow-up 6-12 months; measured with: RAND-36, SF-36 scale, physical health & functioning; range of scores: 0-100; Better indicated by higher values)												
3	randomised trials	very serious[1]	no serious inconsistency	serious[2]	very serious[3]	none	192	150	-	MD 1.65 higher (0.52 lower to 3.82 higher)	⊕OOO VERY LOW	CRITICAL
Quality of life at 6 to 24 months (follow-up 12 months; measured with: SF-36 scale, MCS; range of scores: 0-100; Better indicated by higher values)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	51	53	-	MD 1 higher (3.24 lower to 5.24 higher)	⊕⊕⊕O MODERATE	CRITICAL
PROMs - Function at 6 to 24 months (follow-up 12 months; measured with: WOMAC, WOMAC-PF scale; range of scores: 0-100; Better indicated by lower values)												
2	randomised trials	very serious[1]	no serious inconsistency	no serious indirectness	serious[3]	none	140	98	-	SMD 0.25 lower (0.52 lower to 0.01 higher)	⊕OOO VERY LOW	CRITICAL

PROMs - Pain at 6 to 24 months (follow-up 12 months; measured with: WOMAC scale; range of scores: 0-100; Better indicated by lower values)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	51	53	-	MD 1.00 lower (8.07 lower to 6.07 higher)	⊕⊕⊕O MODERATE	CRITICAL
Revision of joint replacement - not reported												
0	-	-	-	-	-	none	-	-	-	-		CRITICAL
Reoperation including dislocation within 24 months (follow-up 14 months)												
2	randomised trials	serious[1]	serious[4]	no serious indirectness	very serious[2]	none	1/78 (1.3%)	0/77 (0%)	Risk difference 0.01 (-0.03 to 0.06)	10 more per 1000 (from 30 fewer to 60 more)	⊕OOO VERY LOW	CRITICAL
Function at 6 to 24 months (follow-up 12 months; measured with: Range of motion; Better indicated by higher values)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	serious[2]	none	56	56	-	MD 2.2 higher (0.47 lower to 4.87 higher)	⊕⊕OO LOW	IMPORTANT
Thromboembolic complications within 90 days (follow-up 6 weeks)												
1	randomised trials	serious[1]	no serious inconsistency	no serious indirectness	no serious imprecision	none	0/25 (0%)	0/22 (0%)	Not estimable	0 fewer per 1000 (from 80 fewer to 80 more)	⊕⊕⊕O MODERATE	IMPORTANT

[1] Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias.
[2] Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs.
[3] Downgraded by 1 or 2 increments because the majority of the evidence included an indirect or very indirect population respectively.

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Appendix G: Health economic evidence selection

Figure 16: Flow chart of health economic study selection for the guideline

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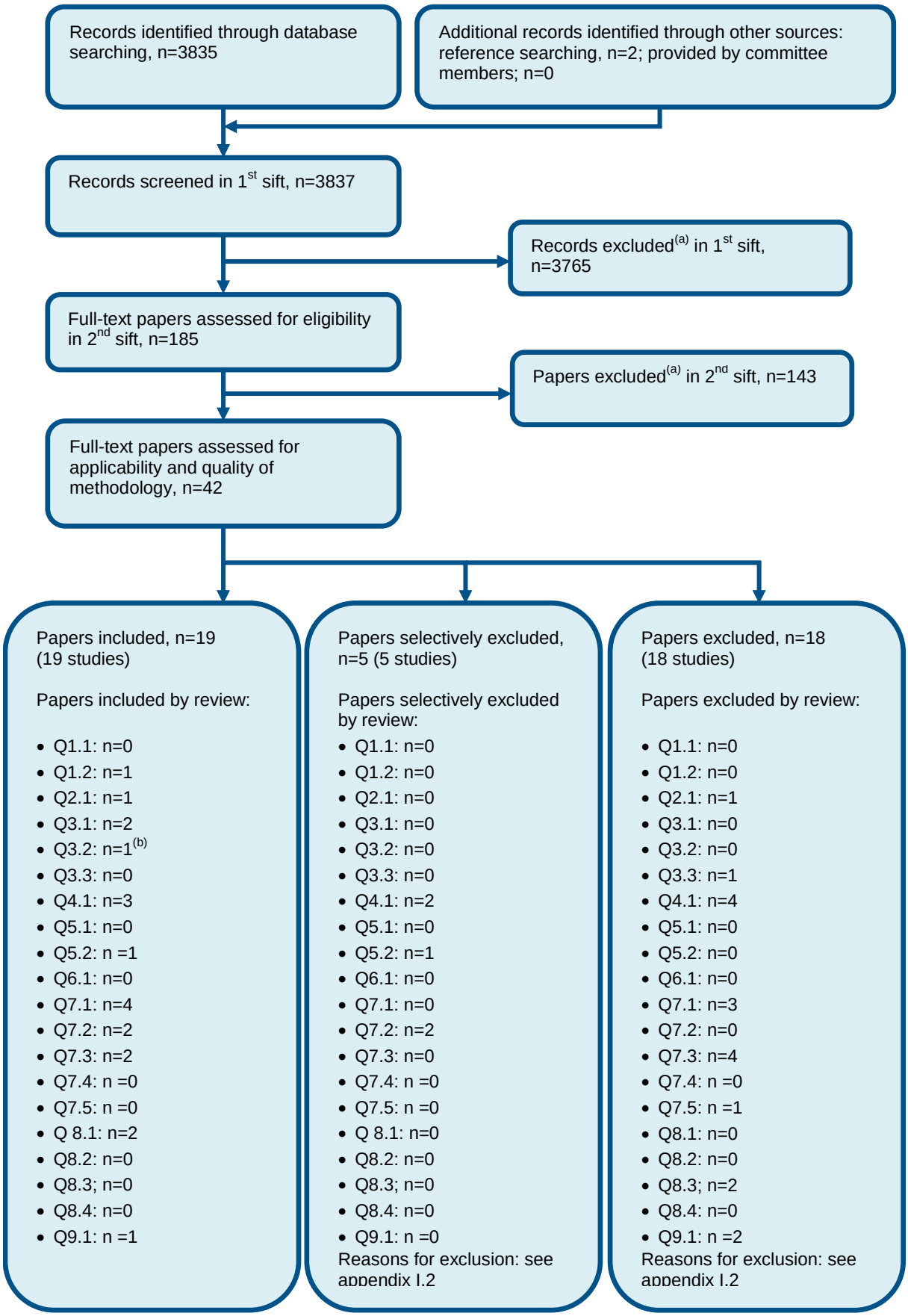

a) Non-relevant population, intervention, comparison, design or setting; non-English language
b) One study was applicable to both Q3.1 and Q3.2

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Appendix H: Health economic evidence tables

None

ISBN

1 Appendix I: Health economic analysis

2 None.

3 Appendix J: Excluded studies

J.1 4 Excluded clinical studies

5 **Table 12: Studies excluded from the clinical review**

Study	Exclusion reason
Allegrante 2007[1]	Incorrect population
Anonymous 2003[2]	Only project record available, full publication unavailable
Artz 2015[4]	Systematic Review unsuitable for inclusion - references individually checked
Barker 2013[7]	Inappropriate comparison
Barker 2016[6]	Protocol
Bini 2017[9]	Incorrect interventions
Bruun-olsen 2013[10]	Inappropriate comparison
Buhagiar 2013[11]	Protocol
Bulthuis 2007[12]	Not review population.
Carmeli 2006[13]	Not all randomised
Christiansen 2018[14]	Trial protocol
Christiansen 2019[15]	Incorrect interventions
Diong 2016[18]	Systematic Review unsuitable for inclusion - references individually checked
Dowsey 1999[19]	Incorrect interventions
Eichler 2017[20]	Inappropriate comparison
Florez-garcia 2017[22]	Systematic Review unsuitable for inclusion - references individually checked
Fransen 2017[23]	Inappropriate comparison
Frost 2002[24]	Inappropriate comparison
Gao 2011[27]	Unavailable
Hagsten 2006[28]	Not review population
Han 2015[29]	Inappropriate comparison.
Henderson 2018[32]	Systematic Review unsuitable for inclusion - references individually checked
Hensman-crook 2011[33]	Citation only
Holmgren 2012[34]	Not review population
Hsu 2019[35]	Incorrect interventions
Iyengar 2007[36]	Inappropriate comparison
Jin 2018[37]	Incorrect interventions
Joice 2017[39]	Incorrect study design
Juhakoski 2011[41]	Not review population
Kauppila 2010[42]	Incorrect interventions
Kelly 1999[43]	Incorrect study design
Ko 2013[44]	Inappropriate comparison

Study	Exclusion reason
Larsen 2008[46]	Inappropriate comparison
Lenguerrand 2019[47]	Not review population
Levine 2013[48]	Incorrect interventions
Li 2017[49]	Duplicate
Lin 2009[50]	Protocol only
Liu 2011[52]	Unavailable
Liu 2018[51]	Incorrect study design
Losina 2013[53]	Protocol only
Lowe 2015[54]	Systematic Review unsuitable for inclusion - references individually checked
Medical Advisory Secretariat 2005[55]	Health Technology Assessment unsuitable for inclusion - all included studies checked
Mikkelsen 2014[56]	Incorrect interventions
Minns lowe 2012[57]	Incorrect interventions. No significant difference between interventions
Moffet 2004[59]	Inappropriate comparison
Moffet 2015[61]	Incorrect interventions
Moffet 2017[60]	Incorrect interventions
Monaghan 2012[63]	Protocol only
Naglie 2002[64]	Inappropriate comparison
Okoro 2013[66]	Incorrect study design
Okoro 2016[67]	Inappropriate comparison
Ozdemir 2017[68]	Systematic Review unsuitable for inclusion - references individually checked
Poulsen 2013[71]	Not review population
Riddle 2012[73]	Incorrect interventions
Russell 2003[74]	Incorrect interventions
Russell 2011[75]	Inappropriate comparison
Shukla 2017[76]	Systematic Review unsuitable for inclusion - references individually checked
Simpson 2014[77]	Protocol only
Strom 2006[78]	Incorrect interventions
Tal-akabi 2007[79]	Incorrect interventions
Taraldsen 2014[80]	Incorrect interventions
Tsauo 2005[83]	Not review population
Tseng 2016[84]	Not review population
Umpierres 2014[85]	Incorrect interventions
Vadher 2018[87]	Trial protocol
Vesterby 2017[88]	Inappropriate comparison
Walker 1991[90]	Inappropriate comparison
Wang 2018[91]	Incorrect interventions
Weaver 2003[92]	Not review population
Wei 2010[93]	Unavailable
Worland 1998[94]	Inappropriate comparison
Wylde 2016[95]	Trial protocol

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J.21 Excluded health economic studies

Table 13: Studies excluded from the health economic review

Reference	Reason for exclusion
Fusco 2016[25]	This study was assessed as not applicable because, after careful consideration, neither the intervention, nor the comparator, was deemed self-directed.
Tousignant 2015[82]	This study was assessed as not applicable because, after careful consideration, neither the intervention, nor the comparator, was deemed self-directed.

Appendix K: Research recommendations

K.1 Supporting rehabilitation after hip or knee replacement for people with additional needs

Research question: What are the best ways to support rehabilitation after hip or knee replacement for people with additional needs (such as people with dementia, a learning difficulty or multiple disabling medical comorbidities)?

Why this is important:

Individuals, irrespective of their medical co-morbidities or health status, should be provided with interventions, which will assist in their recovery. Hip, knee and shoulder replacement surgery is offered to individuals who have clinical need for chronic joint pain and associated disability. Accordingly, this is offered to individuals with a variety of other pre-existing medical conditions such as dementia, learning difficulties, medical co-morbidities These can impact an individual's capability to fully adhere to rehabilitation pathways, which can be self-directed either fully or partly. It is important to understand the best ways to provide rehabilitation to people with hidden and/or visible disabilities to ensure that they recovery following hip, knee and shoulder replacement surgery, and are not disadvantaged by their existing medical status. Due to the variety of medical disabilities which may impact on their recovery and overall prognosis, it is important that understanding a flexible model of care is know so patients and their families/carers can gain the best outcome from these joint replacement operations. This health inequality may be addressed by ensuring that more appropriate interventions such as one-to-one or groups sessions are facilitated by adequately skilled health care professionals in appropriate environments with sufficient time and resources. By ensuring such flexibility in rehabilitation provision, the outcomes for these individuals in respect to their rehabilitation and recovery may be enhanced to ensure that they are not disadvantaged by service provision structure because of their hidden and/or visible disabilities (co-morbid health conditions?).

Criteria for selecting high-priority research recommendations:

PICO question	Population: Adults with hidden or visible disabilities (such as dementia, learning difficulties, multiple disabling medical co-morbidities) who undergo hip, knee or shoulder replacement surgery. Intervention(s): Post-operative rehabilitation (physiotherapy and occupational therapy) providing exercises, education and health promotion advice and support to return to meaningful activities (activities of daily living/occupational pursuits). Intervention may be provided one-to-one or in a group setting with appropriately qualified staff who are provided with adequate time and resources to tailor rehabilitation interventions to the specific needs of these complex patient groups. Intervention may also be provided to carers (formal or informal) to provide them with the support, guidance and confidence to be able to facilitate post-operative recovery to the patients they support. Comparison: Where appropriate in a trial, conventional rehabilitation as dictated by local rehabilitation provision. Outcome(s): Pain, function, health related quality of life, adverse events, health economic measures (direct and indirect costs), caregiver burden and psychological outcomes (anxiety and depression).
Study design	Randomised controlled trial
Other details	Importance to patients or the population: individuals, irrespective of their medical co-morbidities or health status, should be provided with

	interventions, which will assist in their recovery. Accordingly, it is important to understand the best ways to provide rehabilitation to people with hidden and/or visible disabilities to ensure that they recovery following hip, knee and shoulder replacement surgery, and are not disadvantaged by their existing medical status. Due to the variety of medical disabilities which may impact on their recovery and overall prognosis, it is important that understanding a flexible model of care is know so patients and their families/carers can gain the best outcome from these joint replacement operations. Relevance to NICE guidance: NICE aims to minimise health inequalities through facilitating effective care to all individuals in the NHS. A specific research recommendation to ensure that rehabilitation following hip, knee and shoulder replacement can be effectiveness delivered to all individuals, irrespective of hidden and/or visible disabilities is therefore important. Relevance to the NHS: Joint replacement surgery is provided to individuals with a variety of medical co-morbidities. These hidden or visible disabilities may impact an individual's ability to adhere to post-operative rehabilitation. Understanding better ways to ensure that individuals, irrespective of their medical status, can access rehabilitation pathways is important to ensure parity of care and understand what the most effective means is to provide this to individuals with complex care needs. Current evidence base: high quality evidence on how to deliver rehabilitation interventions to individuals with hidden and/or visible disabilities following hip, knee and shoulder replacement surgery is lacking. Feasibility; designing and delivering a study to understand how to better deliver rehabilitation interventions for individuals with hidden and/or visible disabilities is challenging. This is difficult as firstly designing an intervention to account for the variety disabilities (both physical and mental health) can be difficult and would need to be sufficiently flexible to provide this nationally. Secondly, whilst this patient group exist, they are low in number compared to the joint replacement population as a whole and therefore recruiting to such a study and delivering interventions through a research study would be challenging. Other factors: given the variability in healthcare need for this population with complex care needs, this study would require the flexibility in intervention design and delivery to ensure that it is meaningful to both the patient and the carers/family members involved with the individual's day-to-day usual care. Due to this, it is anticipated that considerable intervention development work would be required prior to a trial.

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