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Multidisciplinary rehabilitation programmes following joint replacement at the hip and knee in chronic arthropathy (Review)

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[Intervention Review]

Multidisciplinary rehabilitation programmes following joint replacement at the hip and knee in chronic arthropathy

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ABSTRACT

Background

Joint replacements are common procedures and treatment of choice for those with intractable joint pain and disability arising from arthropathy of the hip or knee. Multidisciplinary rehabilitation is considered integral to the outcome of joint replacement.

Objectives

To assess the evidence for effectiveness of multidisciplinary rehabilitation on activity and participation in adults following hip or knee joint replacement for chronic arthropathy.

Search methods

We searched the Cochrane Musculoskeletal Group Trials Register, the Cochrane Central Register of Controlled Trials, MEDLINE, EMBASE and CINAHL up to September 2006.

Selection criteria

Randomised controlled trials (RCTs) that compared organised multidisciplinary rehabilitation with routine services following hip or knee replacement, and included outcome measures of activity and participation in accordance with the International Classification of Functioning, Health and Disability (ICF).

Data collection and analysis

Four authors independently extracted data and assessed methodological quality of included trials.

Main results

Five trials (619 participants) met the inclusion criteria; two addressed inpatient rehabilitation (261 participants) and three (358 participants) home-based settings. There were no trials addressing outpatient centre-based programmes. Pooling of data was not possible due to differences in study design and outcomes used. Methodological assessment showed all trials were of low quality. For inpatient settings early commencement of rehabilitation and clinical pathways led to more rapid attainment of functional milestones (disability) (Functional Independence Measure (FIM) transfer WMD 0.5, 95% CI 0.15, 0.85, number needed to treat to benefit (NNTB) = 6, FIM ambulation WMD 1.55 (95%CI 0.96, 2.14), NNTB = 3), shorter hospital stay, fewer post-operative complications and reduced costs in the first three to four months.

Home-based multidisciplinary care improved functional gain (Oxford Hip Score (OHS) WMD at 6 months -7.00 (95%CI -10.36, -3.64), NNT = 2 and quality of life (QoL) and reduced hospital stay in the medium term (six months). No trials addressed longer-term outcomes following hip replacement only.

Authors' conclusions

Based on the heterogeneity and the low quality of the included trials that precluded pooled meta-analysis, there is silver level evidence that following hip or knee joint replacement, early multidisciplinary rehabilitation can improve outcomes at the level of activity and participation. The optimal intensity, frequency and effects of rehabilitation over a longer period and associated social costs need further study. Future research should focus on improving methodological and scientific rigour of clinical trials, and use of standardised outcome measures, so that results can be pooled for statistical analysis.

PLAIN LANGUAGE SUMMARY

Multidisciplinary rehabilitation programmes following joint replacement at the hip and knee in chronic arthropathy

Joint replacements are common procedures and treatment of choice for those with intractable joint pain and disability arising from arthropathy of the hip or knee. Multidisciplinary rehabilitation is considered integral to the outcome of joint replacement.

Five trials (619 participants) met the inclusion criteria; two addressed inpatient rehabilitation (261 participants) and three (358 participants) home-based settings. There were no trials addressing outpatient centre-based programmes. Pooling of data was not possible due to differences in study design and outcomes used. Methodological assessment showed all trials were of low quality. For inpatient settings early commencement of rehabilitation and clinical pathways led to more rapid attainment of functional milestones (disability) (Functional Independence Measure (FIM) transfer WMD 0.5, 95% CI 0.15, 0.85, number needed to treat to benefit (NNTB) = 6, FIM ambulation WMD 1.55 (95%CI 0.96, 2.14), NNTB = 3), shorter hospital stay, fewer post-operative complications and reduced costs in the first three to four months. Home-based multidisciplinary care improved functional gain (Oxford Hip Score (OHS) WMD at 6 months -7.00 (95%CI -10.36, -3.64), NNT = 2 and quality of life (QoL) and reduced hospital stay in the medium term (six months). No trials addressed longer-term outcomes following hip replacement only.

Based on the heterogeneity and the low quality of the included trials that precluded pooled meta-analysis, there is silver level evidence that following hip or knee joint replacement, early multidisciplinary rehabilitation can improve outcomes at the level of activity and participation. The optimal intensity, frequency and effects of rehabilitation over a longer period and associated social costs need further study. Future research should focus on improving methodological and scientific rigour of clinical trials, and use of standardised outcome measures, so that results can be pooled for statistical analysis.

BACKGROUND

Total hip and knee joint replacement (THJR, TKJR) procedures are now commonplace, and have become treatments of choice for people with intractable joint pain and disability due to chronic arthropathy who fail conservative management (Brady 2000). In 2004, the reported rates (per 100,000 population) for primary hip joint replacement procedures for Australia, Canada, New Zealand and the United States of America, ranged from 70-150 (primary) and 9-22 (revision), whilst the rates for knee replacement ranged from 62-143 (primary) and 8-13 (revision) (CJRR 2006). These procedures are usually successful, with < 1% failure rate per year (Monte 1997; Tankersley 1997). When revision surgery is needed, this is usually because of prosthetic loosening, lysis and component wear and tear.

The joint replacement procedures may be undertaken in a number of contexts, including:

- acute injury e.g. fractured neck of femur;
- chronic arthropathy affecting just one joint or multiple joints, which may be secondary to a variety of conditions including arthritis (degenerative or inflammatory), abnormal development (eg congenital hip dysplasia), or following slipped femoral epiphysis and avascular necrosis.

For the purposes of this review, we were interested in joint replacement only in the context of chronic arthropathy.

The World Health Organization has developed an International Classification of Functioning, Disability and Health (ICF) (WHO 2001) which replaces its earlier classification of Impairment, Disability and Handicap (ICIDH) (WHO 1980). The ICF defines a common language for describing the impact of disease at different levels.

- 'Impairments' are problems with body (anatomical) structures or (physiological) function - the symptoms and signs of disease such as paresis, pain, etc.
- 'Activity limitation' (previously 'disability', WHO 1980) describes the difficulties that a person may have in executing everyday tasks such as self-care.
- 'Restriction in participation' (previously 'handicap', WHO 1980) relates to problems experienced by a person with involvement in societal participation and life situations such as employment or social activities.
- 'Contextual factors' include:

a) 'environmental' factors which make up the physical, social and attitudinal environment in which people live their lives;
b) 'personal factors' such as gender, race, self-efficacy, coping style, social and educational background, which may affect the person's experience of living with their condition.

Whilst the contextual factors are an important component of the ICF, they are generally not reported in the studies included in this review, as the ICF is predated by most of these trials. Therefore, they will not be addressed further. We have classified outcomes by impairment/disability and participation.

In the context of chronic arthropathy, the person undergoing joint replacement will typically be relieved of the major disabling factor in their life. However, to maximise the benefits of joint replacement, they may require rehabilitation in order to:
a) prevent complications such as deep vein thrombosis (DVT) (Morris 1998) and dislocation (McDonald 2000);
b) regain strength and fitness which may have deteriorated as a result of deconditioning and prolonged immobility; and
c) capitalise on their newfound mobility to regain independence and participation in society.

For many people, especially those with single joint pathology, unidisciplinary interventions (for example physiotherapy alone) may be all that is required. However a multidisciplinary, team-based approach (for example medical, nursing, physiotherapy and occupational therapy) may be required for those with more complex problems (such as multiple joint involvement or co-morbidities, prolonged surgery, post-operative complications); and also for those who are elderly and frail, cognitively impaired or socially isolated. Multidisciplinary rehabilitation will typically start during the inpatient admission, but continuation into the community/home setting may be required in order to address environmental and community integration issues. In Australia, elderly patients with multiple risk factors (such as age, co-morbidities, social set up) are referred for inpatient rehabilitation directly from the acute hospital. Alternative arrangements for medically stable patients can include ambulatory programmes (rehabilitation in the home programme, centre-based therapies), provided the environmental set-up is satisfactory. Practices may vary in different countries.

Other Cochrane reviews have addressed the effects of unidisciplinary therapy and limited interventions following hip or knee joint replacement, including:

- preoperative education (McDonald 2004); and
- continuous passive movement (CPM) (Milne 2003).

However, the evidence base for the effectiveness of multidisciplinary rehabilitation in people with hip or knee joint replacement is not yet established. As the pressure on health systems increases, affordable and appropriate healthcare planning is essential, and the use of more expensive multidisciplinary rehabilitation needs to be justified.

OBJECTIVES

We assessed the evidence for effectiveness of organised multidisciplinary rehabilitation in adults (aged 18 years and above) following hip or knee joint replacement surgery. Specific questions addressed by this review are:

- Does organised multidisciplinary rehabilitation achieve better outcomes than the absence of such services in people following hip or knee joint replacement?
- Which models of programmes are effective and in which setting?
- Which participants benefit most?
- Which specific outcomes are influenced (eg, activity, participation and quality of life)?
- Does a greater intensity (time or expertise, or both) of multidisciplinary rehabilitation lead to greater gains?
- Are there demonstrable cost benefits for multidisciplinary rehabilitation in hip or knee joint replacement?

METHODS

Criteria for considering studies for this review

Types of studies

We included all RCTs that applied multidisciplinary rehabilitation following hip or knee joint replacement, providing that they compared the named intervention with some form of control condition.

Types of participants

We included trials if the participants were above 18 years of age and had undergone hip and/or knee joint replacement surgery for chronic arthropathy, including osteoarthritis, rheumatoid arthritis, dysplastic or osteochondrotic disease.

Joint replacement procedures included:

- both total and hemi-arthroplasty;
- primary (first time) joint replacement;
- secondary (repeat) replacements;
- all types of prosthesis (metal, ceramic, hybrid).

We excluded surgical procedures for acute hip fracture, such as operative fixation (e.g. pins), from this review.

Types of interventions

Experimental intervention
For the purpose of this review, 'multidisciplinary rehabilitation' was defined as a rehabilitation programme delivered by two or more disciplines, and targeted towards improvement at the levels of activity or participation, or both. Rehabilitation programmes could include elements of medical, nursing, physical therapy (PT), occupational therapy (OT), psychology and counselling, social work (SW), dietetics, orthotics, recreation and vocational therapy.

We identified various aspects of multidisciplinary rehabilitation as follows.

- The 'timing' of multidisciplinary rehabilitation intervention, such as 'early' input (24-48 hours post surgery) versus 'late' multidisciplinary treatment (> 48 hours after surgery).
- The setting of rehabilitation programmes, including:

a) inpatient rehabilitation settings that provide 24-hour care, such as a specialist medical rehabilitation unit or a hospital ward unit (eg, general surgical units, orthopaedic units);
b) outpatient or day treatment settings, located within the hospital, a community centre/day centre or a specialist rehabilitation environment;
c) home-based setting in the persons' own home and local community.

- The use of critical pathways (pre-determined structured programmes for participants' recovery during the hospital stay) in joint replacement surgery compared with no pathways, routine care or both.
- The use of pain management strategies compared with routine care.

We excluded studies assessing the effect of the following.

- Therapy from a single discipline (physiotherapy), including studies on therapeutic modalities.
- Programmes that included complementary medicine (yoga, meditation) in the absence of rehabilitation.

Control intervention
For the purpose of this review, we considered the following control conditions.

- A lower level or different type of intervention, such as 'routinely available local services' or minimal intervention such as 'information only' or 'single session treatment'.
- Equivalent interventions given in different settings, such as inpatient versus community rehabilitation.
- Wait list conditions.

Types of outcome measures

We were interested in the outcomes that reflect the burden of disabling disease on participants, their families and the services that provide for them. We classified the various outcome measures used in the selected studies in this review, based on the ICF (WHO 2001). We looked at evidence of improvement at the different levels.

- 'Impairments' (eg, joint range of motion and muscle weakness).
- 'Activity limitation' (eg, mobility, transfer skills, independence in activities of daily living).
- 'Restriction in participation' (eg, extended activities of daily living, societal re-integration or quality of life).

The primary outcomes in this review include limitation in impairment and activity/function and secondary outcomes are limitation in participation. 'Other' outcomes for this review include cost of episode of care, length of stay, service utilisation, readmission, mortality rates and carer burden/strain. We also planned to study any adverse effects reported from rehabilitation intervention.

Additional Table 1 lists the various outcome instruments used, classified under the ICF categories. We also classified outcome measures into those that reflect benefit (improvements in health) and harm (adverse effects on health). It should be noted, however, that some validated measurement scales cross over the boundaries between the concepts of impairment, disability and participation (especially where they predate the publication of the WHO ICF). This occurs especially between the categories of impairment and disability. For example, the Harris Hip Score includes items relating both to impairment and symptoms as well as activity. Therefore, the outcome measures reported at these levels will be grouped together.

Impairment alone is almost never the primary target for multidisciplinary rehabilitation. Instead the focus is on minimising disability and maximising participation. Therefore, studies that reported outcomes only at the level of impairment were not included in this review.

We categorised studies according to length of follow up after baseline (the peri-operative period).

- 'Short term studies' - up to four months.
- 'Medium term studies' - up to six months.
- 'Long term studies' - up to 12 months.

Search methods for identification of studies

We sought relevant RCTs in the following: Cochrane Musculoskeletal Group Trials Register, the Cochrane Central Register of Controlled Trials (CENTRAL), MEDLINE (Ovid), EMBASE, CINAHL, Australian Medical Index, UK NHS National Research Register and citation search using SCISEARCH. We performed all searches up to September 2006. In addition, we searched reference lists of other articles and books and conference proceedings and contacted significant researchers in the field. There were no language restrictions.

The search terms used for MEDLINE are in Appendix 1.

Data collection and analysis

Study selection

Four authors (FK, LN, SG, TH) independently screened all abstracts and titles of studies that were identified by the search strategy for inclusion and appropriateness, based on the selection criteria. Once all potentially appropriate studies had been obtained, the authors evaluated each study independently for inclusion. If necessary, we obtained further information to determine if the trial met the criteria. If no consensus was reached about the possible inclusion/exclusion of any individual study, arbitration was undertaken by the fifth author (LTS). Authors were not masked to the name(s) of the author(s), institution(s) or publication source at any level of the review.

Data extraction and management

Four authors (FK, LN, SG, TH) independently extracted the data from each study that met the inclusion criteria. If insufficient data were available, we then contacted study authors to provide data and clarification. If the data were unavailable or insufficient, the study was reported but not included in the final analysis. We have summarised all studies that met the inclusion criteria in the table 'Characteristics of included studies', including details on design, participants, interventions and outcomes.

Methodological quality assessment

The same authors (FK, LN, SG, TH) assessed the methodological quality of studies included in this review, with any disagreements regarding scoring resolved by consensus.

We undertook the quality appraisal of individual studies using the following methodological quality assessment criteria which incorporated two scales:
a) the three Jadad criteria (Jadad 1996): randomisation, double blinding and description of withdrawals and dropouts; and
b) four items on the criteria list recommended by the Cochrane Bone, Joint and Muscle Trauma Group (CBJMTG) (Heintjies 2002).

The scoring system is listed in Additional Table 2.

The following criteria, as recommended by the Cochrane Collaboration (Higgins 2006) were then further selected to give an overall assessment of quality:
1) concealment of treatment allocation;
2) blinding of intervention provider, recipient and outcome assessor;
3) handling of withdrawals and dropouts.

We assessed studies as being of high or low methodological quality based on whether these criteria had been met. If one or more of the quality criteria were not met, or only partially met or unclear, we considered studies at moderate or high risk of bias, and therefore of low quality.

We also categorised trials on the basis of allocation concealment:
A: if allocation concealment was adequate;
B: if there was a small chance of disclosure of concealment or if unclear;
C: if concealment was inadequate;
D: if allocation concealment was not attempted or not used as a criterion to assess validity.

We undertook the grading of evidence using the method proposed by Tugwell at the request of the Cochrane Musculoskeletal Group (CMSG) (Tugwell 2004)(see Additional Table 3).

We undertook subgroup analysis using setting of rehabilitation intervention, as it provided the most useful information. We separated results for site of joint replacement (hip, knee and both hip and knee replacements).

We found the data to be too heterogenous to perform meta-analyses of all outcome measures. However, we have instead reported data of individual studies in separate forest plots where possible. The heterogeneity of data was further reflected in the clinical relevance tables (Additional Table 4, Table 5, Table 6).

RESULTS

Description of studies

Electronic and manual searches identified 990 titles and abstracts. Of these, we selected 50 studies for closer scrutiny after the first screening review. A handsearch of these articles confirmed inclusion of only five based on the review criteria; we excluded eight studies (and abstracts) for the reasons documented in the table 'Characteristics of excluded studies'.

The main reasons for exclusion were as follows.

1) Multidisciplinary rehabilitation was involved, but was not the test variable (n = 6). Variables included the following limited interventions:

- ketamine infusions (Adam 2005);
- use of an arm crank (Grange 2004);
- upper limb interval training (Maire 2003);
- arm-interval exercise programme (Maire 2004);
- reinforced versus routine hip restrictions (Peak 2005);
- early versus late weight bearing (Liu 2006).

2) Abstract only and/or details insufficient (n = 2).

- Abstract (Flynn 2000) - no completed published study was found.
- Details insufficient despite attempts to contact author (Yan 2005).

3) Rehabilitation was unidisciplinary only (n = 37).

We included a total of five RCTs (one with two reports) in this review (Dowsey 1999; Munin 1998; Shepperd 1998; Siggeirsdottir 2005; Weaver 2003). These studies were heterogeneous with respect to participant characteristics; indication for surgery; the type, duration and setting of multidisciplinary rehabilitation; follow-

up duration and evaluation time points; outcome measures and measurement instruments. The methodological quality was also variable, but generally low. We have presented relevant information in the table 'Characteristics of included studies', and further details are provided in Additional Table 7.

We found no studies addressing pain management or nutritional input after joint replacement surgery that fulfilled the review selection criteria.

The included studies were conducted in four different countries: one each in the UK, Iceland and Australia, and two in the USA. All trials had been published between 1998 and 2005, and were written in the English language. These trials involved a total of 619 participants.

Three trials (Dowsey 1999; Munin 1998; Shepperd 1998) were short-term studies with outcome points at three to four months from baseline, whilst two trials (Siggeirsdottir 2005; Weaver 2003) were medium-term studies where participants were followed up for up to six months. No long-term studies were identified.

Participant characteristics
The participants of studies considered in this review included 619 persons (565 completers) with THJR and TKJR. We have presented relevant information in the table 'Characteristics of included studies'.

- Four studies (Dowsey 1999; Munin 1998; Shepperd 1998; Weaver 2003) (569 participants) included both THJR and TKJR participants with a roughly equal numbers, although the participant breakdown in Dowsey 1999 was not provided.
- The remaining study (Siggeirsdottir 2005) (50 participants) included only THJR participants.
- The indication for joint replacement was specified in only two studies (Munin 1998; Siggeirsdottir 2005) and included osteoarthritis, which made up the largest proportion of participants, rheumatoid arthritis, primary segmental collapse of femoral head and trauma.

Age and gender
In the two trials (Dowsey 1999; Munin 1998) that compared different aspects of inpatient rehabilitation, mean age of participants ranged from 66 to 73.5 years and the percentage of women from 61% to 90%.

In the three trials (Shepperd 1998; Siggeirsdottir 2005; Weaver 2003) that compared home rehabilitation with standard hospital care or pre-existing home rehabilitation protocols, the mean participant ages ranged from 68 to 72 years. Just over half the participants were female (59%, 63% and 52% respectively).

Subject numbers
A large number of participants were excluded after randomisation: Dowsey 1999, 12 out of 175 (7%); Munin 1998, 15 out of 86 (17%); and Siggeirsdottir 2005, nine out of 59 (15%). There was discrepancy in the number of participants reported in the text and tables in Siggeirsdottir 2005, and unequal distribution of participant numbers in the intervention and control groups (n = 18 and 11) from one of the two recruiting hospitals. Further, only a small proportion of eligible participants actually participated in studies by Weaver 2003 (136 out of 228 (60%)) and Siggeirsdottir 2005 (50 out of 111 (45%)), due to a number of reasons including lack of consent and medical instability.

The five studies were grouped by setting into a) inpatient and b) home-based multidisciplinary rehabilitation programmes. There were no trials addressing outpatient centre-based programmes. Where information was available, data were also separated for site of joint replacement.

Inpatient rehabilitation
Two studies (Dowsey 1999; Munin 1998) with a total of 261 participants compared the efficacy of different aspects of inpatient multidisciplinary rehabilitation for both hip and knee joint replacement.

- Dowsey 1999 (175 participants) compared use of organised multidisciplinary rehabilitation (in the form of a clinical pathway) with conventional care.
- Munin 1998 (86 participants) compared commencement of early rehabilitation with delayed rehabilitation (day three versus day seven) in complex and high-risk patients.

Both were short-term studies, with evaluation points at three months for Dowsey 1999 and four months for Munin 1998. Although Dowsey stated that follow up was up to 12 months, no data were provided or available from the authors.

Home-based rehabilitation
Two studies (Shepperd 1998 (two reports); Siggeirsdottir 2005) with a total of 222 participants compared home rehabilitation with standard hospital care or with pre-existing home care protocols.

- Shepperd 1998 (172 participants) compared home rehabilitation with routine hospital care.
- Siggeirsdottir 2005 (50 participants) compared home rehabilitation that included pre- and post-operative education programmes with conventional rehabilitation.

The evaluation points were three months for Shepperd 1998 (short term) and two, four and six months for Siggeirsdottir 2005 (medium term).

One study (Weaver 2003) compared two home care programmes with different intensities, with evaluation at six months (medium term).

- Weaver 2003 (136 participants) compared a lower-intensity multidisciplinary home care programme (one pre- and five post-operative visits up to four weeks) with standard care (a pre-existing home care protocol of three to five post-operative visits per week for nine weeks (ie up to 45 visits in total).

Risk of bias in included studies

The summary of key indicators for randomisation, concealed allocation, intention to treat and blinding of outcome assessor appears in the table 'Characteristics of included studies'. The methodological quality description of the five included studies is provided in Additional Table 8.

We rated all studies as 'low quality' due to the absence of blinding. This included not only lack of participant/therapist blinding, but also outcome assessor blinding, which was of great concern. However, both inpatient trials (Dowsey 1999; Munin 1998)

had adequate concealment of allocation and intention to treat was specified. In the trials relating to home-based rehabilitation (Shepperd 1998; Siggeirsdottir 2005; Weaver 2003), only Shepperd 1998 and Siggeirsdottir 2005 had adequate allocation concealment and only Shepperd 1998 specified intention to treat. Only two of the five trials (Dowsey 1999; Shepperd 1998) were powered to detect significant changes in outcomes, so there was a risk of type I and II errors.

Three studies also had significant deviations from their methodology protocol.

- In the study by Shepperd 1998, 14/47 participants (30%) allocated to home care in the TKJR intervention group were unable to take this up, and stayed in hospital due to post-operative complications.
- In the study by Siggeirsdottir 2005, there was deviation from the original protocol where participants from another hospital were included due to major reorganisation within the original hospital.
- In the study by Weaver 2003, the figures presented for cost analysis represented only 73% of the sample, and description of withdrawals was incomplete.

Effects of interventions

We have provided detailed descriptions of the results of individual included studies in Additional Table 7.

We have described the assimilation of best evidence below for:
(a) inpatients; and
(b) home based setting.

None of the included studies addressed outpatient rehabilitation.

Pooling of data for quantitative analysis was not possible due to heterogeneity with respect to participant characteristics; indication for surgery; the type, duration and setting of multidisciplinary rehabilitation; follow-up duration and evaluation time points; outcome measures and measurement instruments. Instead, we conducted synthesis of best evidence using the Tugwell 2004 grading system. Finally, quantification of the results of the between-group differences have been provided, where possible, in graphs 01.01-0.1.11, 02.01-02.03, 03.01-03.03 and 04.01-04.13. Between-group differences in the form of weighted mean difference (WMD) and numbers needed to treat to benefit (NNTB) have also been incorporated into the text of the results section where appropriate.

Clinical relevance tables (Additional Table 4; Table 5; Table 6) have also been provided to assist readers with understanding the primary outcome measures (for both benefits and harms).

A) Effectiveness of aspects of inpatient multidisciplinary therapy versus control (conventional routine care)

Two trials of low quality addressing the efficacy of different aspects of inpatient multidisciplinary rehabilitation (Dowsey 1999; Munin 1998) recruited a total of 261 participants. Only one study (Munin 1998) specifically identified the type of participants which were elderly, frail patients with multiple co-morbidities. Pooling of data was confounded by the fact that the two studies examined different aspects of inpatient multidisciplinary rehabilitation: Dowsey 1999 examined the effects of organised care, whilst Munin 1998 examined the effect of early rehabilitation at different time points (Dowsey 1999 three months; Munin 1998 four months).

At the level of impairment/activity:

- Dowsey 1999 used days to sitting out of bed and days to ambulation;
- Munin 1998 used Functional Independence Measure (FIM) and Functional Status Index (FSI).

At the level of participation:

- Dowsey 1999 did not measure outcomes at this level;
- Munin 1998 used RAND 36-Item Health Survey (RAND-36).

Other outcomes:

- Dowsey 1999 evaluated complication rate, readmissions and length of stay;
- Munin 1998 evaluated length of stay and costs.

The grading and synthesis of best evidence from these two trials suggests the following, subsequent to hip or knee replacement.

- At the level of impairment/activity, there is 'silver' level (Tugwell 2004) evidence that early inpatient rehabilitation (Munin 1998) leads to more rapid attainment of functional milestones as measured by the FIM at day six to ten (although there were no significant differences in FSI at four months), and that organised rehabilitation via a clinical pathway (Dowsey 1999) leads to earlier ambulation in the short term (three to four months). For FIM transfer, the WMD is 0.5 (95%CI 0.15, 0.85) whilst WMD for FIM ambulation is 1.55 (95%CI 0.96, 2.14) and WMD for FIM stairs is 0.85 (95% CI 0.40, 1.30) (graphs 01.01, 01.02, 01.03). The NNTB ranged from 3 (95%CI 2,4) for FIM ambulation to 6 (95% CI 3,21) for FIM transfer and 13 (95% CI 6, 42) for FIM stairs (Additional Table 4).
- At the level of participation, there is no evidence that early or organised inpatient rehabilitation leads to improvements in quality of life as measured by RAND-36 (Munin 1998). WMD for RAND-36 (physical domain) is -1.30 (-13.37, 10.77) and 7.41 (0.21, 14.61) for RAND-36 (mental domain) (graphs 01.07, 01.08).
- As for other outcomes, there is also 'silver' level evidence that earlier (Munin 1998) and/or organised multidisciplinary rehabilitation (Dowsey 1999) reduces costs (Munin 1998), length of stay (Dowsey 1999; Munin 1998) and results in fewer complications (Dowsey 1999) in the short term (3-4 months) (Additional Table 7). There is no evidence, however, for lowering of the readmission rate (Dowsey 1999).

B) Effectiveness of home multidisciplinary therapy versus control (standard hospital care or pre-existing home care protocols)

The two trials addressing the efficacy of home-based multidisciplinary rehabilitation (Shepperd 1998; Siggeirsdottir 2005) recruited a total of 222 participants. One study (Weaver 2003) (136 participants) compared home programmes of different intensity. Only one study (Shepperd 1998) addressed the issue of caregiver strain, but found that there were no differences detected between carers in the rehabilitation group when compared to the control group.

Pooling of data from the three studies was again confounded by the design differences highlighted above, and in addition by the use of different outcome measures at different time points (see Additional Table 7).

At the level of impairment/activity:

- Shepperd 1998 and Siggeirsdottir 2005 both used Oxford Hip Score (OHS). In addition, Shepperd 1998 used Bristol Knee Score (BKS) and Siggeirsdottir 2005 used Meurle d'Abuigne and Postel (MAP) and Harris Hip Score (HHS);
- Weaver 2003 used Barthel Index (BI) and Western Ontario and McMaster University Osteoarthritis Index (WOMAC).

At the level of participation:

- Shepperd 1998 used Dartmouth COOP charts (DCC);
- Siggeirsdottir 2005 used Nottingham Health Profile (NHP);
- Weaver 2003 used Medical Outcomes Study Short Form 36 (SF-36).

Other outcomes:

- Shepperd 1998 examined Carer Strain Index (CSI), readmissions, mortality and cost;
- Siggeirsdottir 2005 examined post-operative complications and length of stay;
- Weaver 2003 examined adverse events and cost.

The grading and best evidence synthesis from the two low quality RCTs (Shepperd 1998; Siggeirsdottir 2005) (222 participants) addressing effectiveness of home rehabilitation suggests the following.

- At the level of impairment/activity (hip replacement), there is 'silver' level evidence that organised hospital at home multidisciplinary care can improve disability for up to six months as measured by the OHS (Siggeirsdottir 2005). WMD for OHS at 6 months is -7.00 (95%CI -10.36, -3.64) (graph 03.01) and NNT 2 (95%CI 2, 2) (Additional Table 5). However, no effect was shown with MAP or HHS in Siggeirsdottir 2005, or with OHS in Shepperd 1998.
- At the level of impairment/activity (knee replacement), there is no evidence that organised hospital at home multidisciplinary care improves disability as measured by BKS (Shepperd 1998).
- At the level of participation (hip replacement), there is 'silver' level evidence that home rehabilitation improves quality of life for up to six months as measured by DCC (Shepperd 1998) and NHP (Siggeirsdottir 2005).
- At the level of participation (knee replacement), there is no evidence that home rehabilitation improves quality of life as measured by DCC (Shepperd 1998).
- As for other outcomes, there is 'silver' level evidence that individualised home rehabilitation reduces the length of stay without increasing rate of complications following hip replacement (Siggeirsdottir 2005). However, there is no evidence that home rehabilitation reduces the rate of readmissions, mortality or costs following hip or knee joint replacement compared to hospital care (Shepperd 1998).

The grading and best evidence synthesis from the only low-quality RCT (Weaver 2003) (50 participants) addressing intensity of home rehabilitation suggests that following hip or knee replacement:

- At the level of impairment/activity, a lower intensity home rehabilitation programme has no lesser effect on disability as measured by BI and WOMAC, when compared with a standard home rehabilitation programme. WMD for BI is 2.80 (95% CI -0.67, 6.27) and 0.00 (95% CI -0.28, 0.28) for WOMAC.
- At the level of participation, a lower intensity home rehabilitation programme has no lesser effect on quality of life as measured by SF-36.
- As for other outcomes, there is 'silver' level evidence that a less intensive home rehabilitation programme reduces costs without compromising patient outcomes.

Adverse effects

Adverse effects of rehabilitation are possible, but rarely seen in practice. All studies looked for adverse effects but none reported any adverse effects attributable to the rehabilitation.

DISCUSSION

This review investigated the effectiveness of organised multidisciplinary rehabilitation in adults following hip or knee joint replacement, based on measures of activities and participation in the ICF (WHO 2001), and also on utility and service costs. Because of heterogeneity in the studies identified, it was not possible to pool data statistically. Instead, we performed best evidence synthesis using a qualitative analysis.

In relation to our original objectives:

Does organised multidisciplinary rehabilitation achieve better outcomes than the absence of such services in people following hip or knee joint replacement?

We identified no studies that provided direct evidence that multidisciplinary rehabilitation following THJR/TKJR achieved better outcomes compared with no treatment. However multidisciplinary rehabilitation versus usual or routine treatment is addressed below.

Which models of programmes are effective and in which setting? Which participants benefit most and which specific outcomes are influenced?

We found evidence for the effectiveness of multidisciplinary rehabilitation in both inpatient and home-based settings. There was 'silver' level evidence that early and/or organised inpatient multidisciplinary rehabilitation (for all persons following hip or knee replacement, including those who were elderly and those with complex co-morbidities), led to more rapid attainment of functional milestones in the shorter term, as well as fewer post-operative complications, shorter hospital stay and reduced costs. However, there was no evidence that earlier inpatient rehabilitation improved participation.

For home-based multidisciplinary rehabilitation, there was 'silver' level evidence for organised hospital at home care improving QoL (in the medium term) and disability in persons following hip replacement, but there was no such evidence for knee replacement.

The duration of follow up of persons after both hip and knee joint replacement was limited to short and medium term (three to

six months) following surgery. It was not possible to determine if gains made by participants in rehabilitation were maintained in the longer term (> 12 months).

Does a greater intensity (time or expertise, or both) of multidisciplinary rehabilitation lead to greater gains, and are there demonstrable cost benefits for multidisciplinary rehabilitation in hip or knee joint replacement?
From this review, it has not been possible to suggest best 'dose' of therapy. Further studies are needed to suggest optimum number, duration and intensity of treatment sessions.

One study (Munin 1998) provided 'silver' level evidence for modest cost benefits (equating to approximately $2000) arising from early inpatient rehabilitation. A different study (Weaver 2003) provided the same level of evidence that a limited four-week home rehabilitation programme could reduce the cost of intervention without adversely compromising patient outcomes in terms of functional status or quality of life. However, both this study and the study by Shepperd 1998 showed no difference in total reimbursement costs for hospital at home compared with conventional care, so the jury is still out on overall cost effectiveness of these home-based programmes.

Methodological considerations
For the purpose of this review, we categorised individual trials into 'high' or 'low' quality studies based on the Jadad and the CBJMTG methodological criteria, which have been developed to determine the risk of bias. We then graded the level of evidence according to the simple classification described by Tugwell 2004 into 'platinum', 'gold', 'silver' and 'bronze' grades. In the context of multidisciplinary rehabilitation, it has been recognised that it is effectively impossible to blind the service providers or the recipients to the nature of treatment (see below). All of these studies would have rated as low quality in any event. However, it should be possible to blind assessors but, in all five studies, even the assessors were unblinded. The rating system did not allow for differentiation of quality based on any other determinators such as intention to treat or allocation concealment. Alternative approaches, such as that recommended by Van Tulder 2003, provide a more comprehensive evaluation of quality indicators, and have been applied in other Cochrane reviews relating to multidisciplinary rehabilitation, but we have utilised the methods applied here at the specific request of the Cochrane Musculoskeletal Group, in order to maintain comparability with other reviews in the section.

The strength of findings was limited by the small number of studies and by methodological weaknesses. Only two studies were powered to detect significant changes in outcomes (Dowsey 1999; Shepperd 1998), so there was a risk of type I and II errors. Details of the participants and the interventions, especially in the control arm of the trial, were frequently missing and were not obtainable from the authors, despite attempts to contact them. Only one study provided details of unilateral compared with bilateral joint replacements (Weaver 2003). No studies provided details of differential analysis of bilateral versus unilateral joint replacements. Many studies did not provide the clinical indication for joint replacement (Dowsey 1999; Shepperd 1998; Weaver 2003). The outcome measures used in these studies to gauge improvements in function (disability) or participation varied widely. Further, local practices tended to vary in the different countries (Australia, Iceland, UK and USA), making it harder to interpret and compare outcomes. In some studies details of the rehabilitation programmes were insufficient and therefore difficult to standardise.

This review highlights some of the limitations and challenges for randomised controlled trial methodologies in complex interventions such as rehabilitation in the context of chronic arthropathy, which have also been highlighted by previous authors (Turner-Stokes 2005; Whyte 2002). These include the following.

- Heterogeneity with respect to participants, interventions and outcome measures used.
- Problems with recruitment, retention and follow up of participants, especially in the control arm of trials. Multi-centre trials may provide larger numbers but often at the expense of increased heterogeneity, with little net benefit.
- The outcomes measures used in rehabilitation may not be optimal for statistical analysis, as their ordinal nature obscures distribution in the target population.
- True blinding of participants and care providers in rehabilitation is effectively not possible. Participants often unwittingly volunteer information about their treatment during the course of assessment, and attempts to blind outcome assessor may not be guaranteed.
- Rehabilitation comprises concurrent complex interventions, which are difficult to quantify (such as goal setting), and depend on the specified interaction between the participant and the clinician. Many of the rehabilitation treatments are interactive and dependent on participant response, which potentially confounds simple division into 'treatment' and 'control' conditions.

Limitations of this review
The assimilation of available evidence was challenging due to the diversity of trials in this review. The authors accept that there may have been a degree of:

- selection bias from the literature search (Van Tulder 2003) (although four authors independently selected the studies for inclusion);
- publication bias (Egger 1998) if trials have not been published due to them having small participant numbers and negative results (although authors also sourced unpublished data);
- reference bias (Goetzsche 1987) for published studies included in this review.

The review has taken an inclusive approach to a broad area of clinical practice, and this approach has posed significant challenges for the assessment and assimilation of the available evidence. It may be contended that we have adopted too low a threshold for inclusion of studies of low quality. On the other hand, we believe that the presented synthesis of 'best evidence', based on assessment of methodological quality, has facilitated a helpful comparison of the various studies available. It also allows open acknowledgement of the 'limited evidence' which comes from these poorer (or single) studies, which is nevertheless the best available at the current time.

Our attempt to categorise evidence according to the WHO 2001 ICF posed some methodological problems, since many of the outcome measures used in trials crossed the boundaries between the different levels of the model. However, we still believe that

this model is helpful to clarify the experience of people who live with long-term chronic conditions. Future research should evaluate outcome on all levels, including contextual factors.

AUTHORS' CONCLUSIONS

Implications for practice

The evidence presented in this review provides modest support for the recommendation that people following hip or knee joint replacement should be assessed for their need for appropriate rehabilitation intervention. The assessment could be undertaken by any skilled member of the multidisciplinary team, in order to maximise their capacity for independent living and societal participation.

Implications for research

We identified no studies that provided direct evidence that multidisciplinary rehabilitation following THJR/TKJR achieved better outcomes compared with no treatment. However, taken together, the five trials included in this review provide a certain body of evidence that multidisciplinary rehabilitation can improve the experience of people following joint replacement in terms of both activity and participation. Many questions remain to be answered. Which group of people, following joint replacement, are most likely to require and gain benefit from a multidisciplinary approach? It is clear that home-based rehabilitation is not suitable for all people following joint replacement, so how should we decide who needs treatment in which setting? What is the optimum dose or intensity of rehabilitation, and which professional should be involved? Finally, with spiralling healthcare costs and the increased demand for rehabilitation services, it is important to gather proper evidence with regard to cost-effectiveness of different models and their full economic impact for health services, for people following joint replacement and their families and for society at large.

This review highlights the need for:

1) High quality RCTs, and other designs (including large prospective observation cohort studies) where appropriate, which assess:

- the effectiveness of specific rehabilitation interventions (and components);
- the appropriate intensity and settings of therapy;
- the cost effectiveness of comprehensive multidisciplinary rehabilitation programmes; and
- the impact of therapy on participants and their families.

2) Development of appropriate outcome measures, including:

- reliable and valid outcome measures which reflect domains of the ICF;
- measurement of the effects of rehabilitation over longer periods (over 12 months);
- incorporation of the perspective of the person following joint replacement, and further evaluation of the participation issues relevant to them (such as return to work, driving, community reintegration, leisure, parenting (or grand-parenting) and psychosocial issues);
- a consensus on an ICF core set of measurement of outcomes in post- joint replacement trials.

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* Indicates the major publication for the study

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Dowsey 1999

Methods	Randomisation - yes Assessor blinding - no ITT - yes
Participants	(Australia) N = 175 (no breakdown of THJR/TKJR numbers). N (completed study) = 163. Intervention: 94 Control: 81 Inclusion criteria - All THJR/TKJR Exclusion criteria - revision joint replacement, bilateral simultaneous joint arthropathy, joint replacement for acute trauma or complex tumour surgery. Indication of joint replacement - not specified Gender - M:F 56:107 Age - mean 66 years (range 67-93).
Interventions	Intervention: 'Clinical pathway' - comprehensive inpatient rehabilitation with early mobilisation and discharge. Control: Conventional routine care. Treating team responded to the will and condition of the participant in providing post-op care.
Outcomes	Impairment/Activity: Days to sitting out of bed. Days to ambulation.

Dowsey 1999 *(Continued)*

	Participation: None Other: Complication rate Readmissions Length of stay
Notes	12 participants excluded after randomisation based on exclusion criteria

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Low risk	A - Adequate

Munin 1998

Methods	Randomisation - yes Assessor blinding - no ITT- yes
Participants	(USA) N = 86 (35 THJR, 51 TKJR). N (completed study) = 71. Intervention 45 (19 THJR, 26 TKJR) Control 41 (16 THJR 25 TKJR). Inclusion criteria - High risk primary and revision THJR and TKJR who required inpatient care (including age > 70, living alone, multiple co-morbidities). Exclusion criteria - Tumours, acute fractures, femoral osteonecrosis or haemophilic arthropathy. Post-op conditions which precluded rehabilitation. Indication of joint replacement - osteoarthritis (89%), rheumatoid arthritis (11%) Gender - M:F 10:76. M:F (THJR) 5:30. M:F (TKJR) 5:46. Age - THJR mean 75 years, TKJR mean 73 years (no range given).
Interventions	Intervention: Early inpatient rehabilitation commencing day 3. Control: Inpatient rehabilitation commencing day 7. In acute care, all participants received 2x 30-minute PT sessions daily (from day 2 post-op) and 1 x 30-minute OT sessions daily (from day 3). In rehabilitation (from day 3 intervention, day 7 control), participants received two 60-minute sessions of PT and two 60-minute sessions of OT and also psychology and recreation.
Outcomes	Impairment/Activity: FIM FSI Participation: RAND-36 Other: Length of stay Cost
Notes	Baseline characteristics given only for 71 participants.

Munin 1998 *(Continued)*

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Low risk	A - Adequate

Shepperd 1998

Methods	Randomisation - yes. Assessor blinding- no ITT - yes
Participants	(UK) N = 172 (86 THJR, 86 TKJR). N (completed study) = 161. Intervention: 84; Control: 88 Inclusion criteria - home environment was suitable, carer consented to trial, clinically stable. Exclusion criteria - under 60 Indication for joint replacement - not specified Gender - M:F 71:101. M:F (THJR) 33:53. M:F (TKJR) 38:48. Age - Intervention: (THJR) mean (SD) 71 (7.7) years. (TKJR) mean (SD) 68 (7.9) years. Control: (THJR) mean (SD) 70 (8.7) years. (TKJR) mean (SD) 72 (6.8) years
Interventions	Intervention: Hospital at home care more than normally available in the community (nursing, PT, OT, pathology, speech therapy, mobile phone provided) Control: Routine hospital care
Outcomes	Impairment/Activity: BKS OHS Participation: DCC Other: CSI Readmissions Mortality Cost
Notes	Study also included participants with other diagnoses and the details of these participants have not been reported in this review. 14 (30%) of participants allocated to hospital at home remained in hospital.

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Low risk	A - Adequate

Siggeirsdottir 2005

Methods	Randomisation - yes

Siggeirsdottir 2005 *(Continued)*

	Assessor blinding - no ITT - no
Participants	(Iceland) N = 50. N (completed study) = 47. Intervention: 27 Control: 23. Inclusion criteria - primary THJR (osteoarthritis, rheumatoid arthritis, primary segmental collapse of femoral head, developmental disease and trauma). Exclusion criteria - Primary hip fracture, metastatic tumours, dementia. Indication for joint replacement - see inclusion criteria Gender - M:F 24:26. Age - mean 68 years (range 28-86)
Interventions	Intervention: Pre-op education and training (by PT ± OT, brochure). Discharge home visit (PT ± OT) and subsequent home visits (median number of visits 4, range 2-9 times) . Control: Conventional rehabilitation (no further description provided).
Outcomes	Impairment/Activity: OHS HHS MAP Participation: NHP Other: Post-op complications Length of stay
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Low risk	A - Adequate

Weaver 2003

Methods	Randomisation - yes Assessor blinding - no ITT - no
Participants	(USA) N = 136 (68 THJR, 68 TKJR). N (completed study) = 123. Intervention: 69 Control: 67. Inclusion criteria - THJR and TKJR, medicare eligible, geographic catchment. Exclusion criteria - Those assessed too close to time of surgery. Indication for joint replacement - not specified. Gender - M:F 221:85. Age - mean (SD) 72 (7) years.
Interventions	Intervention: Home care protocol (pre-op home visits and fewer post-op visits. THJR: 1 nurse and 1 PT visit pre-op, 1 nurse and 5 PT visits post op weeks 1-4. TKJR: 1 nurse and 1 PT visit pre-op, 1 nurse and 9 PT visits post op (weeks 1-4).

Weaver 2003 *(Continued)*

	Control: Existing home care protocol (no pre-op visits and more post-op visits). THJR: 2 nurse and 9-27 PT visits (weeks 1-9) TKJR: 2 nurse and 27-45 PT visits (weeks 1-9)
Outcomes	Impairment/Activity: BI WOMAC Participation: SF-36 Other: Adverse events Cost
Notes	20% underwent bilateral TKJR (remaining had one joint replaced only)

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Unclear risk	D - Not used

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Adam 2005	Variable is not MD rehabilitation
Avramidis 2003	Unidisciplinary rehabilitation only
Bourne 1998	Unidisciplinary rehabilitation only
Breit 2004	Unidisciplinary rehabilitation only
Chen 2004	Unidisciplinary rehabilitation only
Cheville 2001	Unidisciplinary rehabilitation only
Codine 2004	Unidisciplinary rehabilitation only
Eisermann 2004	Unidisciplinary rehabilitation only
Erler 2001	Unidisciplinary rehabilitation only
Flynn 2000	Abstract only
Frost 2002	Unidisciplinary rehabilitation only
Ganz 2004	Unidisciplinary rehabilitation only
Giaquinto 2006	Unidisciplinary rehabilitation only
Gilbey 2003	Unidisciplinary rehabilitation only

Study	Reason for exclusion
Gilbey et al 2003	Unidisciplinary rehabilitation only
Gotlin 1994	Unidisciplinary rehabilitation only
Grange 2004	Variable is not MD rehabilitation
Hesse 2003	Unidisciplinary rehabilitation only
Hewitt 2001	Unidisciplinary rehabilitation only
Jan 2004	Unidisciplinary rehabilitation only
Jesudason 2002	Unidisciplinary rehabilitation only
Kramer 2003	Unidisciplinary rehabilitation only
Liang 1987	Unidisciplinary rehabilitation only
Liu 2006	Variable is not MD rehabilitation
Lysack 2005	Unidisciplinary rehabilitation only
Maire 2003	Variable is not MD rehabilitation
Maire 2004	Variable is not MD rehabilitation
Martin 1991	Unidisciplinary rehabilitation only
Mayer 2005	Unidisciplinary rehabilitation only
Medeiros 1977	Unidisciplinary rehabilitation only
Mitchell 2005	Unidisciplinary rehabilitation only
Moffet 2004	Unidisciplinary rehabilitation only
Peak 2005	Variable is not MD rehabilitation
Rajan 2004	Unidisciplinary rehabilitation only
Reilly 2005	Unidisciplinary rehabilitation only
Roy 2005	Unidisciplinary rehabilitation only
Russell 2003	Unidisciplinary rehabilitation only
Strom 2006	Unidisciplinary rehabilitation only
Suetta 2004	Unidisciplinary rehabilitation only
Trudelle-Jacksn 2001	Unidisciplinary rehabilitation only
Trudelle-Jacksn 2004	Unidisciplinary rehabilitation only
Wang 2002	Unidisciplinary rehabilitation only

Study	Reason for exclusion
Werner 2004	Unidisciplinary rehabilitation only
Yan 2005	Insufficient detail
Zenios 2002	Unidisciplinary rehabilitation only

DATA AND ANALYSES

Comparison 1. Early versus standard inpatient rehabilitation

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 FIM transfer (activity)	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
2 FIM ambulation (activity)	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
3 FIM stairs (activity)	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
4 FSI pain (impairment)	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
5 FSI difficulty (activity)	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
6 FSI assistance (activity)	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
7 RAND-36 physical domain (participation)	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
8 RAND-36 mental domain (participation)	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
9 Cost (other)	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
10 Length of stay (other)	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
11 Post-op complications (other)	1		Odds Ratio (M-H, Fixed, 95% CI)	Subtotals only

Analysis 1.1. Comparison 1 Early versus standard inpatient rehabilitation, Outcome 1 FIM transfer (activity).

Study or subgroup	Treatment N	Treatment Mean(SD)	Control N	Control Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
Munin 1998	38	4.8 (0.8)	33	4.3 (0.7)	+	0%	0.5[0.15,0.85]

Favours control -10 -5 0 5 10 Favours treatment

Analysis 1.2. Comparison 1 Early versus standard inpatient rehabilitation, Outcome 2 FIM ambulation (activity).

Study or subgroup	Treatment N	Treatment Mean(SD)	Control N	Control Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
Munin 1998	38	3.6 (1.5)	33	2.1 (1)		0%	1.55[0.96,2.14]

Favours control -10 -5 0 5 10 Favours treatment

Analysis 1.3. Comparison 1 Early versus standard inpatient rehabilitation, Outcome 3 FIM stairs (activity).

Study or subgroup	Treatment N	Treatment Mean(SD)	Control N	Control Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
Munin 1998	38	2.1 (1.3)	33	1.3 (0.5)		0%	0.85[0.4,1.3]

Favours control -10 -5 0 5 10 Favours treatment

Analysis 1.4. Comparison 1 Early versus standard inpatient rehabilitation, Outcome 4 FSI pain (impairment).

Study or subgroup	Treatment N	Treatment Mean(SD)	Control N	Control Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
Munin 1998	38	11.6 (9.3)	33	9.6 (8)		0%	1.95[-2.06,5.96]

Favours treatment -10 -5 0 5 10 Favours control

Analysis 1.5. Comparison 1 Early versus standard inpatient rehabilitation, Outcome 5 FSI difficulty (activity).

Study or subgroup	Treatment N	Treatment Mean(SD)	Control N	Control Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
Munin 1998	38	8.4 (10.3)	33	6.2 (10.5)		0%	2.22[-2.62,7.06]

Favours treatment -10 -5 0 5 10 Favours control

Analysis 1.6. Comparison 1 Early versus standard inpatient rehabilitation, Outcome 6 FSI assistance (activity).

Study or subgroup	Treatment N	Treatment Mean(SD)	Control N	Control Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
Munin 1998	38	2.1 (9.7)	33	2.8 (8.9)		0%	-0.66[-4.99,3.67]

Favours treatment -10 -5 0 5 10 Favours control

Analysis 1.7. Comparison 1 Early versus standard inpatient rehabilitation, Outcome 7 RAND-36 physical domain (participation).

Study or subgroup	Treatment N	Treatment Mean(SD)	Control N	Control Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
Munin 1998	38	13.1 (23.4)	33	14.4 (27.9)		0%	-1.3[-13.37,10.77]

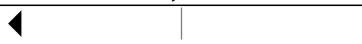
Favours control -10 -5 0 5 10 Favours treatment

Analysis 1.8. Comparison 1 Early versus standard inpatient rehabilitation, Outcome 8 RAND-36 mental domain (participation).

Study or subgroup	Treatment N	Treatment Mean(SD)	Control N	Control Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
Munin 1998	38	7.8 (16.7)	33	0.4 (14.2)		0%	7.41[0.21,14.61]

Analysis 1.9. Comparison 1 Early versus standard inpatient rehabilitation, Outcome 9 Cost (other).

Study or subgroup	Treatment N	Treatment Mean(SD)	Control N	Control Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
Munin 1998	38	25891 (3648)	33	27762 (3626)		0%	-1871[-3566.83,-175.17]

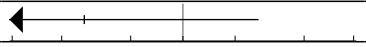


Analysis 1.10. Comparison 1 Early versus standard inpatient rehabilitation, Outcome 10 Length of stay (other).

Study or subgroup	Treatment N	Treatment Mean(SD)	Control N	Control Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
Munin 1998	45	11.7 (2.3)	41	14.5 (1.9)		0%	-2.8[-3.69,-1.91]

Analysis 1.11. Comparison 1 Early versus standard inpatient rehabilitation, Outcome 11 Post-op complications (other).

Study or subgroup	Treatment n/N	Control n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Munin 1998	1/38	3/33		0%	0.27[0.03,2.73]

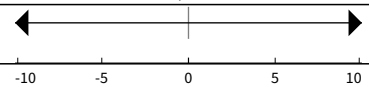


Comparison 2. Home rehabilitation versus routine hospital care

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Cost (other)	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
2 Readmissions (other)	1		Odds Ratio (M-H, Fixed, 95% CI)	Subtotals only
3 Mortality (other)	1		Odds Ratio (M-H, Fixed, 95% CI)	Subtotals only

Analysis 2.1. Comparison 2 Home rehabilitation versus routine hospital care, Outcome 1 Cost (other).

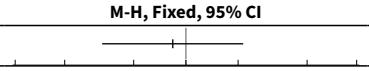
Study or subgroup	Treatment N	Treatment Mean(SD)	Control N	Control Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
Shepperd 1998	84	1461.6 (666.6)	88	1375.4 (637.8)		0%	86.26[-108.87,281.39]



Favours treatment — Favours control

Analysis 2.2. Comparison 2 Home rehabilitation versus routine hospital care, Outcome 2 Readmissions (other).

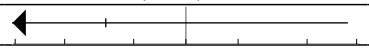
Study or subgroup	Treatment n/N	Control n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Shepperd 1998	9/84	11/88		0%	0.84[0.33,2.14]



Favours treatment — Favours control

Analysis 2.3. Comparison 2 Home rehabilitation versus routine hospital care, Outcome 3 Mortality (other).

Study or subgroup	Treatment n/N	Control n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Shepperd 1998	0/84	1/88		0%	0.35[0.01,8.59]



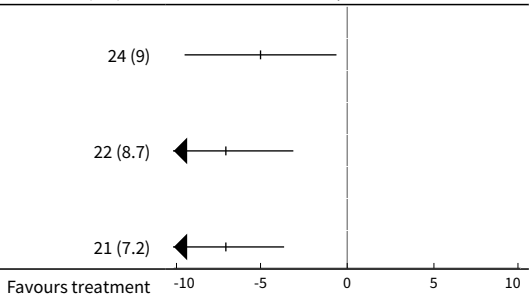
Favours treatment — Favours control

Comparison 3. Home rehabilitation versus conventional rehabilitation

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 OHS (activity)	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
1.1 OHS (activity) at 2 months	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
1.2 OHS (activity) at 4 months	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
1.3 OHS (activity) at 6 months	1		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
2 Length of stay (other)	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
3 Post-op complications (other)	1		Odds Ratio (M-H, Fixed, 95% CI)	Subtotals only

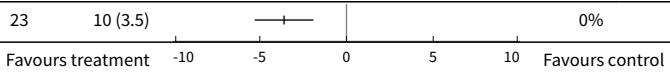
Analysis 3.1. Comparison 3 Home rehabilitation versus conventional rehabilitation, Outcome 1 OHS (activity).

Study or subgroup	Treatment N	Treatment Mean(SD)	Control N	Control Mean(SD)	Mean Difference Fixed, 95% CI	Mean Difference Fixed, 95% CI
3.1.1 OHS (activity) at 2 months						
Siggeirsdottir 2005	27	19 (6.3)	23	24 (9)		-5[-9.38,-0.62]
3.1.2 OHS (activity) at 4 months						
Siggeirsdottir 2005	27	15 (4.2)	23	22 (8.7)		-7[-10.89,-3.11]
3.1.3 OHS (activity) at 6 months						
Siggeirsdottir 2005	27	14 (4.3)	23	21 (7.2)		-7[-10.36,-3.64]



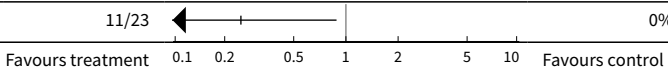
Analysis 3.2. Comparison 3 Home rehabilitation versus conventional rehabilitation, Outcome 2 Length of stay (other).

Study or subgroup	Treatment N	Treatment Mean(SD)	Control N	Control Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
Siggeirsdottir 2005	27	6.4 (2.4)	23	10 (3.5)		0%	-3.6[-5.29,-1.91]



Analysis 3.3. Comparison 3 Home rehabilitation versus conventional rehabilitation, Outcome 3 Post-op complications (other).

Study or subgroup	Treatment n/N	Control n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Siggeirsdottir 2005	5/27	11/23		0%	0.25[0.07,0.88]



Comparison 4. Low intensity versus standard home rehabilitation

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 BI (activity)	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
2 WOMAC (activity)	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
3 SF-36 general health (participation)	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
4 SF-36 physical function (participation)	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
5 SF-36 physical role (participation)	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
6 SF-36 emotional role (participation)	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
7 SF-36 social function (participation)	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
8 SF-36 bodily pain (participation)	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
9 SF-36 vitality (participation)	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
10 SF-36 mental health (participation)	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
11 Cost of home care reimbursement (other)	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
12 Cost of total reimbursement (other)	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
13 Adverse events (other)	1		Odds Ratio (M-H, Fixed, 95% CI)	Subtotals only

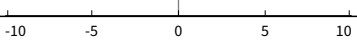
Analysis 4.1. Comparison 4 Low intensity versus standard home rehabilitation, Outcome 1 BI (activity).

Study or subgroup	Treatment N	Treatment Mean(SD)	Control N	Control Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
Weaver 2003	69	98.9 (10.8)	67	96.1 (9.8)		0%	2.8[-0.67,6.27]

Favours control — Favours treatment

Analysis 4.2. Comparison 4 Low intensity versus standard home rehabilitation, Outcome 2 WOMAC (activity).

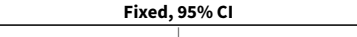
Study or subgroup	Treatment N	Treatment Mean(SD)	Control N	Control Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
Weaver 2003	69	4.5 (0.8)	67	4.5 (0.8)		0%	0[-0.28,0.28]



Favours control — Favours treatment

Analysis 4.3. Comparison 4 Low intensity versus standard home rehabilitation, Outcome 3 SF-36 general health (participation).

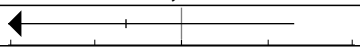
Study or subgroup	Treatment N	Treatment Mean(SD)	Control N	Control Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
Weaver 2003	69	78.9 (20.8)	67	78.9 (19.6)		0%	0[-6.79,6.79]



Favours control — Favours treatment

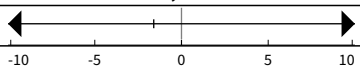
Analysis 4.4. Comparison 4 Low intensity versus standard home rehabilitation, Outcome 4 SF-36 physical function (participation).

Study or subgroup	Treatment N	Treatment Mean(SD)	Control N	Control Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
Weaver 2003	69	63.4 (29.1)	67	66.6 (28.7)		0%	-3.2[-12.9,6.5]



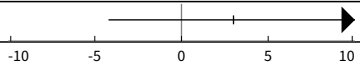
Analysis 4.5. Comparison 4 Low intensity versus standard home rehabilitation, Outcome 5 SF-36 physical role (participation).

Study or subgroup	Treatment N	Treatment Mean(SD)	Control N	Control Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
Weaver 2003	69	75.4 (40.7)	67	77 (40.1)		0%	-1.6[-15.18,11.98]



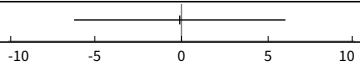
Analysis 4.6. Comparison 4 Low intensity versus standard home rehabilitation, Outcome 6 SF-36 emotional role (participation).

Study or subgroup	Treatment N	Treatment Mean(SD)	Control N	Control Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
Weaver 2003	69	95 (21.6)	67	92 (21.3)		0%	3[-4.21,10.21]



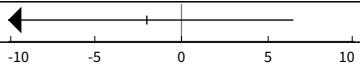
Analysis 4.7. Comparison 4 Low intensity versus standard home rehabilitation, Outcome 7 SF-36 social function (participation).

Study or subgroup	Treatment N	Treatment Mean(SD)	Control N	Control Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
Weaver 2003	69	91.6 (18.3)	67	91.7 (18)		0%	-0.1[-6.2,6]



Analysis 4.8. Comparison 4 Low intensity versus standard home rehabilitation, Outcome 8 SF-36 bodily pain (participation).

Study or subgroup	Treatment N	Treatment Mean(SD)	Control N	Control Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
Weaver 2003	69	73.4 (25.8)	67	75.4 (24.6)		0%	-2[-10.46,6.46]



Analysis 4.9. Comparison 4 Low intensity versus standard home rehabilitation, Outcome 9 SF-36 vitality (participation).

Study or subgroup	Treatment N	Treatment Mean(SD)	Control N	Control Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
Weaver 2003	69	56.3 (22.4)	67	60.4 (21.3)		0%	-4.1[-11.45,3.25]

Favours control -10 -5 0 5 10 Favours treatment

Analysis 4.10. Comparison 4 Low intensity versus standard home rehabilitation, Outcome 10 SF-36 mental health (participation).

Study or subgroup	Treatment N	Treatment Mean(SD)	Control N	Control Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
Weaver 2003	69	83.4 (15.8)	67	82.6 (15.6)		0%	0.8[-4.47,6.07]

Favours control -10 -5 0 5 10 Favours treatment

Analysis 4.11. Comparison 4 Low intensity versus standard home rehabilitation, Outcome 11 Cost of home care reimbursement (other).

Study or subgroup	Treatment N	Treatment Mean(SD)	Control N	Control Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
Weaver 2003	69	1488 (0)	67	2163 (0)			Not estimable

Favours treatment -10 -5 0 5 10 Favours control

Analysis 4.12. Comparison 4 Low intensity versus standard home rehabilitation, Outcome 12 Cost of total reimbursement (other).

Study or subgroup	Treatment N	Treatment Mean(SD)	Control N	Control Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
Weaver 2003	69	24663 (0)	67	24295 (0)			Not estimable

Favours treatment -10 -5 0 5 10 Favours control

Analysis 4.13. Comparison 4 Low intensity versus standard home rehabilitation, Outcome 13 Adverse events (other).

Study or subgroup	Treatment n/N	Control n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Weaver 2003	1/69	4/67		0%	0.23[0.03,2.13]

Favours treatment 0.1 0.2 0.5 1 2 5 10 Favours control

ADDITIONAL TABLES

Table 1. List of outcome measures

Outcome at level of	Outcome measures	Description	Benefit / harm*
Primary Outcomes			
Impairment/ Activity limitation	Barthel Self Care Index (BI)	ADL (range 0-100, high score=more function)	Benefit
	Bristol Knee Score (BKS)	ADL, pain (range 0-50, high score=more function)	Benefit
	Days to sitting out of bed	First day sitting out of bed following surgery	Benefit
	Days to ambulation	First day walking following surgery	Benefit
	Functional Independence Measure (FIM)	ADL (range 18-126, high score=more function)	Benefit
	Functional Status Index (FSI)	ADL (range 36-216, low score=more function)	Benefit
	Harris Hip Score (HHS)	ADL, pain (range 0-100, high score=more function)	Benefit
	Meurle d'Abuigne and Postel (MAP)	Pain, ADL (range 3-18, high score=less impairment)	Benefit
	Oxford Hip Score (OHS)	ADL, pain (range 12-60, low score=more function)	Benefit
	Western Ontario and McMasters University Osteoarthritis Index (WOMAC)	ADL, pain, stiffness (range 1-5, high score=more function)	Benefit
Secondary Outcomes			
Participation	Quality of Life		
	Dartmouth COOP charts (DCC)	QoL (range 1-5, lower score=better QoL)	Benefit
	Nottingham Health Profile (NHP)	QoL (range 0-100, lower score=better QoL)	Benefit
	RAND 36-Item Health Survey (RAND-36)	QoL (range 0-100, high score=better QoL)	Benefit
	36-item Short Form Health Survey Questionnaire (SF-36)	QoL (range 0-100, high score=better QoL)	Benefit
Other Outcomes	Adverse events/Complications (post-op)	Adverse events that occur as a direct cause of joint replacement, including wound infections and deep vein thrombosis)	Harm
	Carer Strain Index (CSI)	Carer strain/burden (range 0-13, high score=more burden)	Harm
	Cost of care	Cost relating to patient care	Harm

Table 1. List of outcome measures *(Continued)*

	Length of stay	From the time of the hospital admission to the time of discharge	Harm
	Mortality	Number of deaths as a result of joint replacement surgery	Harm
	Readmissions	Readmission to hospital from the community for complications	Harm
	* "Benefit" denotes outcome measures that measure improvements in health whilst "Harm" denotes outcome measures that measure adverse effects on health.		

Table 2. Criteria for assessment of methodological quality

Criteria		
Jadad criteria		
J-1	Was the study described as randomised?	yes/no
J-2	Was the study described as double blind?	yes/no
J-3	Was there a description of withdrawals and dropouts?	yes/no
CBJMTG criteria		
MA	Was the assigned treatment adequately concealed prior to allocation?	Yes = method did not allow disclosure of assignment. No = small but possible chance of disclosure of assignment or unclear , or quasi-randomised or open lists/tables.
	Level of allocation concealment	Clearly yes is A, unclear = B, inadequate = C, clearly no = D.
MB	Were the outcomes of the participant withdrawals described and included in the analysis (intention to treat)?	Yes = withdrawals well described and accounted for in analysis. No = withdrawals described but analysis not possible or no mention, inadequate mention or obvious differences and no adjustment.
MF	Were the treatment providers blind to assignment status after allocation?	Yes = effective action taken to blind treatment providers. No = small or moderate chance of unblinding of treatment providers or not possible, or not mentioned (unless double blind) or possible but not done.
MH	Were the inclusion and exclusion criteria clearly defined?	Yes = clearly defined. No = inadequately defined or not defined.

Table 3. Grading of evidence

Tugwell 2004
Platinum: A published systematic review that has at least two individual controlled trials, each satisfying the following : Sample sizes of at least 50 per group. If they do not find a statistically significant difference, they are adequately powered for a 20% relative difference in the relevant outcome. Blinding of patients and assessors for outcomes. Handling of withdrawals >80% follow up (imputations based on methods such as Last Observation Carried Forward (LOCF) is acceptable). Concealment of treatment allocation.
Gold: At least one randomised clinical trial meets all of the following criteria for the major outcome(s) as reported: Sample sizes of at least 50 per group. If they do not find a statistically significant difference, they are adequately powered for a 20% relative difference in the relevant outcome. Blinding of patients and assessors for outcomes. Handling of withdrawals > 80% follow up (imputations based on methods such as LOCF is acceptable). Concealment of treatment allocation.
Silver: If a systematic review or randomised trial does not meet the above criteria. Silver ranking would also include evidence from at least one study of non-randomised cohorts who did and did not receive the therapy or evidence from at least one high-quality case-control study. A randomised trial with a 'head-to-head' comparison of agents is considered Silver level ranking, unless a reference is provided to a comparison of one of the agents to placebo showing at least a 20% relative difference.
Bronze: At least one high-quality case series without controls (including simple before/after studies in which the patient acts as their own control) or if it is derived from expert opinion based on clinical experience without reference to any of the foregoing (for example, argument from physiology, bench research or first principles).

Table 4. Clinical relevance table (early vs standard inpatient rehabilitation)

Outcome (scale)	#patients (#trials)	Control baseline m	Wt absolute change	Relative % change	NNT (B) or NNT (H)	Stat. significance	Quality of evidence
Activity (FIM transfer)	71(1)	3.37	8% (0.50 more points on a 1-7 scale)	15% (I)	NNT (B) = 6	Statistically significant	Silver
95% confidence interval			(3%, 14%)	(4%, 25%)	(3, 21)		
Activity (FIM ambulation)	71(1)	1.18	26% (1.55 more points on a 1-7 scale)	131% (I)	NNT (B) = 3	Statistically significant	Silver
95% confidence interval			(16%, 36%)	(81%, 181%)	(2, 4)		
Activity (FIM stairs)	71(1)	1	14% (0.85 more points on a 1-7 scale)	85% (I)	NNT (B) = 13	Statistically significant	Silver
95% confidence interval			(7%, 22%)	(40%, 130%)	(6, 42)		
Impairment (FSI pain)	71(1)	no baseline data	4% (1.95 more points on a 18-72 scale)		n/a	Not statistically significant	Silver
95% confidence interval			(-4%, 11%)				
Activity (FSI difficulty)	71(1)	no baseline data	4% (2.22 more points on a 18-72 scale)		n/a	Not statistically significant	Silver
95% confidence interval			(-5%, 13%)				
Activity (FSI assistance)	71(1)	no baseline data	-1% (0.66 less points on a 0-72 scale)		n/a	Not statistically significant	Silver
95% confidence interval			(-7%, 5%)				
Legend		m=mean		I=improvement	NNT/H=Number Needed to Treat to Benefit or Harm. n/a = not applicable		

Table 5. Clinical relevance table (home rehabilitation vs conventional rehabilitation)

Outcome (scale)	#patients(#trials)	Control baseline m	Wt absolute change	Relative % change	NNT (B) or NNT (H)	Stat. significance	Quality of evidence
Activity (OHS) at 2 months	50(1)	37	-10% (5 fewer points on a 12-60 point scale)	-14% (I)	NNT (B) = 2	Statistically significant	Silver
95% confidence interval			(-20%, -1%)	(-25%, -2%)	(2, 4)		
Activity (OHS) at 4 months	50(1)	37	-15% (7 fewer points on a 12-60 point scale)	-19% (I)	NNT (B) = 2	Statistically significant	Silver
95% confidence interval			(-23%, -6%)	(-29%, -8%)	(2, 2)		
Activity (OHS) at 6 months	50(1)	37	-15% (7 fewer points on a 12-60 point scale)	-19% (I)	NNT (B) = 2	Statistically significant	Silver
95% confidence interval			(-22%, -8%)	(-28%, -10%)	(2, 2)		
Legend		m=mean		I=improvement	NNT/H=Number Needed to Treat to Benefit or Harm. n/a=not applicable		

Table 6. Clinical relevance table (low intensity vs standard home rehabilitation)

Outcome (scale)	#patients(#trials)	Control baseline m	Wt absolute change	Relative % change	NNT (B) or NNT (H)	Stat. significance	Quality of evidence
Activity (BI)	136(1)	96.6	3% (2.8 points more on a 0-100 scale)	3%	n/a	Not statistically significant	Silver
95% confidence interval			(-1%, 6%)	(-1%, 6%)			

Table 6. Clinical relevance table (low intensity vs standard home rehabilitation) *(Continued)*

Activity (WOMAC)	136(1)	4.2	0% (0 points more on a 1-5 scale)	0%	n/a	Not statistically significant	Silver
95% confidence interval			(-7%, 7%)	(-7%, 7%)			
Legend		m=mean		I=improvement	NNT/H=Number Needed to Treat to Benefit or Harm. n/a=not applicable		

Table 7. Description of results of included studies

Author	Description
Dowsey 1999	Low quality (hip or knee replacement)
Assessment points	Baseline, 3 months (short-term only)
Statistical tests	Multiple linear regression, t-test, z-test
Summary of results (significant outcomes)	In favour of intervention group: Impairment/Activity: Days to sitting out of bed (intervention 19.4, control 3.42, 95%CI* 1.05-1.95, p=0.001). Days to ambulation (intervention 2.19, control 3.61 days, 95%CI* 0.94-1.98, p =0.001) Participation: none Other: Complications (intervention 10 participants, control 20, 95%CI* 0.036 - 0.27, p=0.01). Length of stay (intervention mean 7.1, control 8.6 days, 95%CI* 1.03-1.30, p=0.011) * 95% confidence interval for difference of means or proportions.
Summary of results (non-significant outcomes)	Impairment/Activity: None Participation: None Other: Readmission rate (intervention 4 participants, control 9, 95%CI* 0.006-0.174, p=0.06). * 95% confidence interval for difference of means or proportions.
Author's conclusions	Clinical pathway for persons following THJR/TKJR is an effective method for improving outcomes and decreasing length of stay.
Munin 1998	Low quality (hip or knee replacement)
Assessment points	Baseline (1 month prior to surgery), 4 months (short-term only)
Statistical tests	Analysis of variance, MANOVA, chi-squared test
Summary of results (significant outcomes)	In favour of intervention group: Impairment/Activity (at days 6-10): FIM (transfer) (intervention mean (SD) 4.8 (0.8), control 4.3 (0.7), p<0.01); FIM (ambulation) (intervention mean (SD) 3.63 (1.51), control 2.08 (1.02), p<0.001); FIM (stairs) (intervention mean (SD) 2.12 (1.32), control 1.27 (0.45), p<0.01) Participation: None Other: Length of stay (intervention mean (SD) 11.7 (2.3) days, control 14.5 (1.9), p<0.001). Cost (intervention mean (SD) $25891($3648), control $27762 ($3626), p<0.03).
Summary of results (non-significant outcomes)	Impairment/Activity (hip)*: FSI (pain) (intervention mean (SD) 8.07 (9.51), control 9.25 (12.17); FSI (difficulty) (intervention 8.73 (6.98), control 6.92 (10.52); FSI (assistance) intervention 2.33 (8.3), control 4.75 (13.48). Impairment/Activity (knee)*: FSI (pain) (intervention mean (SD) 11.58 (9.27), control 9.63 (7.95); FSI (difficulty) (intervention 8.38 (10.3), control 6.16 (10.46); FSI (assistance) intervention 2.13 (9.68), control 2.79 (8.91). Participation (hip)*: RAND-36 (physical domain) (intervention mean (SD) 14.06 (27.7), control 19.58 (16.3); RAND-36 (mental domain) (intervention mean (SD) 3.75 (10.38), control 5 (10.39) Participation (knee)*: RAND-36 (physical domain) (intervention mean (SD) 13.13 (23.4), control 14.43 (27.85); RAND-36 (mental domain) (intervention mean (SD) 7.83 (16.74), control 0.42 (14.23) Others: Post-op complications (intervention 1 participant, control 3, chi-square [1 df] = 1.44, p= 0.30). * FSI and RAND-36 scores are reported as change scores.
Author's conclusions	High-risk persons post THJR/TKJR could tolerate early intensive rehabilitation, resulting in faster attainment of short-term functional milestones in fewer days, using less total cost.

Table 7. Description of results of included studies *(Continued)*

Shepperd 1998	Low quality (hip or knee replacement)
Assessment points	Baseline, three months (short-term only)
Statistical tests	Unpaired two tailed t tests, Mann-Whitney U test, chi-squared test, sensitivity analyses
Summary of results (signifcant outcomes)	In favour of intervention group: Impairment/Activity: DCC - THJR only (difference in change from base value 0.50, 95% CI 0.13 to 0.88). Participation: None Other: None
Summary of results (non-significant outcomes)	Impairment/Activity: OHS (intervention mean change from baseline value 4.77, control 3.13, difference 1.64, 95% CI -1.23 to 4.50). BKS (intervention mean change from baseline value-3.00, control -4.06, difference 1.06, 95% CI -1.58 to 3.70) Participation: None Other: CSI (hip) (intervention median change from baseline value 0.00, control 1.00, p = 0.34). CSI (knee) (intervention mean change from baseline value 0.25, control -0.58, difference 0.83, 95% CI -0.79 to 2.45). Readmissions (hip) (intervention 2 participants, control 1). Mortality (hip) (intervention none, control 1). Readmissions (knee) (intervention 7 participants, control 10). Mortality (knee) (none in either group). Total healthcare costs (hip) (intervention mean (SD) (£) 911.39 (563.76), control 815.70 (347.99), p = 0.59). Total healthcare costs (knee) (intervention mean (SD) (£) 1461.62 (666.61), control 1375.36 (637.76), p = 0.55).
Author's conclusions	Persons following THJR in hospital at home showed improvement in quality of life when compared with hospital care. Hospital at home care compared to routine hospital care did not reduce total healthcare costs.

Siggeirsdottir 2005	Low quality (hip replacement only)
Assessment points	Baseline (1 day pre-op), 2, 4 and 6 months (short- and medium-term)
Statistical tests	Friedman test, Wilcoxon matched-pairs test, Mann-Whitney U test, chi-squared test
Summary of results (significant outcomes)	n favour of intervention group: Impairment/Activity: OHS (at 2 months) (intervention mean (SD) 19 (6.3), control 24 (9.0), p = 0.03). OHS (at 4 months) (intervention mean (SD) 15 (4.2), control 22 (8.7), p=0.007). OHS (at 6 months) (intervention mean (SD) 14 (4.3), control 21 (7.2), p = 0.001). Participation: NHP (no data. Only p values given - presume significant results only). At 2 months pain, p = 0.02. At 4 months emotional reaction, p = 0.02, social isolation, p = 0.01. At 6 months pain, p = 0.02, social isolation, p = 0.03, lack of energy, p = 0.007, physical mobility, p = 0.003. Other: Length of stay (intervention mean (SD) 6.4 days (2.4), control 10 days (3.5), p < 0.001).
Summary of results (non-significant outcomes)	Impairment/Activity: MAP (no data given, p = 0.05). HHS at 2 months (intervention median (IQR) 76 (56-93), control 71 (31-83). Participation: None Other: Post-op complications (intervention 5 participants, control 11, p = 0.3).
Author's conclusions	Pre-operative education and post-operative home-based rehabilitation in THJR is effective in improving function and quality of life.

Table 7. Description of results of included studies *(Continued)*

Weaver 2003	Low quality (hip or knee replacement)
Assessment points	Baseline, 6 months (medium-term only)
Statistical tests	Analysis of Covariance
Summary of results (significant outcomes)	In favour of intervention group: Impairment/Activity: None Participation: None Other (No variance provided): Length of time on home care programme (intervention mean 29.2 days, control 40.6 days, p = 0.035). Home care reimbursement (intervention mean $1488, control $2163, p < 0.001).
Summary of results (non-significant outcomes)	Impairment/Activity: BI (intervention mean ± Standard Error (SE) 98.9±1.3, control 96.1±1.2, p = 0.121), WOMAC (intervention mean±SE 4.5±0.1, control 4.5±0.1 p=0.731). Participation: SF-36 (general health) (intervention mean±SE 78.9±2.5, control 78.9±2.4 p = 0.984); SF-36 (physical function) (intervention mean±SE 63.4±3.5, control 66.6±3.5, p = 0.512); SF-36 (physical role) (intervention mean±SE 75.4±4.9, control 77.0±4.9, p=0.824); SF-36 (emotional role) (intervention mean±SE 95.0±2.6, control 92.0±2.6, p=0.431); SF-36 (social function) (intervention mean ±SE 91.6±2.2, control 91.7±2.2, p=0.969); SF-36 (bodily pain) (intervention mean±SE 73.4±3.1, control 75.4±3.0, p=0.642); SF-36 (vitality) (intervention mean±SE 56.3±2.7, control 60.4±2.6, p=0.280); SF-36 (mental health) (intervention mean±SE 83.4±1.9, control 82.6±1.9, p = 0.759) Other (No variance provided): Adverse events (intervention 1 participant, control 4). Total reimbursement costs (intervention $24,663, control $24,295 p = 0.96).
Author's conclusions	A more efficient delivery of care without compromising patient outcomes was achieved with fewer home visits following total hip and knee joint replacement.

Table 8. Methodology quality of included studies

Criteria	**Study ID**				
Jadad	Dowsey 1999	Munin 1998	Shepperd 1998	Siggeirsdottir 2005	Weaver 2003
J1-Randomisation	Yes	Yes	Yes	Yes	Yes
J2 - Double blind *	No	No	No	No	No
J3 - Description of withdrawals and dropouts *	Yes	Yes	Yes	Yes	Yes
CBJMTG					
MA - Allocation concealment (level) *	Yes (A)	Yes (A)	Yes (A)	Yes (A)	No (D)
MB - ITT	Yes	Yes	Yes	No	No
MF - Treatment providers blinded *	No	No	No	No	No
MH - Inclusion and exclusion criteria defined	Yes	Yes	Yes	Yes	Yes
Overall quality **	Low	Low	Low	Low	Low

* Criteria used to determine risk of bias.

Table 8. Methodology quality of included studies *(Continued)*

** High quality = All criteria met (low risk of bias)
Low quality = Not all criteria met (moderate or high risk of bias)

APPENDICES

Appendix 1. MEDLINE search strategy

1. exp Arthroplasty, Replacement, Knee/
2. exp Knee Prosthesis/
3. exp Knee Joint/
4. exp Joint Prosthesis/
5. knee.mp.
6. (replace$ or arthroplast$ or implant$ or endoprosthe$ or prosthe$).mp.
7. exp "Prostheses and Implants"/
8. 3 or 5
9. or/4,6-7
10. 8 and 9
11. or/1-2,10
12. exp Arthroplasty, Replacement, Hip/
13. exp Hip Prosthesis/
14. exp Hip Joint/
15. (hip or hips).tw.
16. 14 or 15
17. 16 and 9
18. or/13-14,17
19. 11 or 18
20. exp REHABILITATION/
21. exp REHABILITATION CENTERS/
22. exp REHABILITATION NURSING/
23. rehab$.mp.
24. exp Patient Care Team/
25. multidisciplinar$.tw.
26. interdisciplinar$.tw.
27. multiprofessional$.tw.
28. multimodal$.tw.
29. exp Patient Care Management/
30. exp Occupational Therapy/
31. occupational therap$.tw.
32. exp Physical Therapy Techniques/
33. exp "Physical Therapy (Specialty)"/
34. exp Physical Therapy Department, Hospital/
35. physical therap$.tw.
36. physiotherap$.tw.
37. (early adj1 (mobil$ or discharg$ or ambulat$)).tw.
38. exp Critical Pathways/
39. exp Therapy, Computer-Assisted/
40. exp Exercise Therapy/
41. (exercis$ adj3 therap$).tw.
42. exp Social Work/
43. exp Social Support/
44. (social adj1 (work$ or support)).tw.
45. exp Pain Clinics/
46. pain clinic$.tw.
47. (pain center$ or pain centre$).tw.
48. pain service$.tw.

49. pain relief unit$.tw.
50. exp Patient Education/
51. exp Health Education/
52. exp Diet Therapy/
53. exp NUTRITION/
54. exp Nutritional Support/
55. ((diet$ or nutrition$) adj5 (therap$ or modif$ or program$)).tw.
56. ((treatment$ or therap$ or training or education$ or healthcare) adj10 (program$ or intervention$ or approach$)).tw.
57. or/20-56
58. 19 and 57

WHAT'S NEW

Date	Event	Description
7 November 2008	Amended	Converted to new review format. CMSG ID: A014-R

HISTORY

Protocol first published: Issue 4, 2004
Review first published: Issue 2, 2008

Date	Event	Description
13 December 2007	New citation required and conclusions have changed	Substantive amendment

CONTRIBUTIONS OF AUTHORS

Fary Khan: overall content of the review.
Louisa Ng: primary support, study selection, data analysis and extraction, methodological analysis, feedback on clinical aspects, text of review.
Senen Gonzalez: study selection, data extraction, methodological scoring.
Tom Hale: study selection, data extraction, methodological scoring.
Lynne Turner-Stokes: study selection, design, textual feedback.

DECLARATIONS OF INTEREST

None known.

SOURCES OF SUPPORT

Internal sources

- Rehabilitation Department, Royal Melbourne Hospital, Royal Park Campus, Melbourne, Australia.

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INDEX TERMS

Medical Subject Headings (MeSH)

Arthroplasty, Replacement, Hip [*rehabilitation]; Arthroplasty, Replacement, Knee [*rehabilitation]; Program Evaluation; Randomized Controlled Trials as Topic

MeSH check words

Aged; Female; Humans; Male