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Repetitive task training for improving functional ability after stroke (Review)

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[Intervention Review]

Repetitive task training for improving functional ability after stroke

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ABSTRACT

Background

Repetitive task training (RTT) involves the active practice of task-specific motor activities and is a component of current therapy approaches in stroke rehabilitation.

Objectives

Primary objective: To determine if RTT improves upper limb function/reach and lower limb function/balance in adults after stroke.

Secondary objectives: 1) To determine the effect of RTT on secondary outcome measures including activities of daily living, global motor function, quality of life/health status and adverse events. 2) To determine the factors that could influence primary and secondary outcome measures, including the effect of 'dose' of task practice; type of task (whole therapy, mixed or single task); timing of the intervention and type of intervention.

Search methods

We searched the Cochrane Stroke Group Trials Register (4 March 2016); the Cochrane Central Register of Controlled Trials (CENTRAL) (the Cochrane Library 2016, Issue 5: 1 October 2006 to 24 June 2016); MEDLINE (1 October 2006 to 8 March 2016); Embase (1 October 2006 to 8 March 2016); CINAHL (2006 to 23 June 2016); AMED (2006 to 21 June 2016) and SPORTSDiscus (2006 to 21 June 2016).

Selection criteria

Randomised/quasi-randomised trials in adults after stroke, where the intervention was an active motor sequence performed repetitively within a single training session, aimed towards a clear functional goal.

Data collection and analysis

Two review authors independently screened abstracts, extracted data and appraised trials. We determined the quality of evidence within each study and outcome group using the Cochrane 'Risk of bias' tool and GRADE (Grades of Recommendation, Assessment, Development and Evaluation) criteria. We did not assess follow-up outcome data using GRADE. We contacted trial authors for additional information.

Main results

We included 33 trials with 36 intervention-control pairs and 1853 participants. The risk of bias present in many studies was unclear due to poor reporting; the evidence has therefore been rated 'moderate' or 'low' when using the GRADE system.

There is *low-quality evidence* that RTT improves arm function (standardised mean difference (SMD) 0.25, 95% confidence interval (CI) 0.01 to 0.49; 11 studies, number of participants analysed = 749), hand function (SMD 0.25, 95% CI 0.00 to 0.51; eight studies, number of participants analysed = 619), and lower limb functional measures (SMD 0.29, 95% CI 0.10 to 0.48; five trials, number of participants analysed = 419).

There is *moderate-quality evidence* that RTT improves walking distance (mean difference (MD) 34.80, 95% CI 18.19 to 51.41; nine studies, number of participants analysed = 610) and functional ambulation (SMD 0.35, 95% CI 0.04 to 0.66; eight studies, number of participants analysed = 525). We found significant differences between groups for both upper-limb (SMD 0.92, 95% CI 0.58 to 1.26; three studies, number of participants analysed = 153) and lower-limb (SMD 0.34, 95% CI 0.16 to 0.52; eight studies, number of participants analysed = 471) outcomes up to six months post treatment but not after six months. Effects were not modified by intervention type, dosage of task practice or time since stroke for upper or lower limb. There was insufficient evidence to be certain about the risk of adverse events.

Authors' conclusions

There is low- to moderate-quality evidence that RTT improves upper and lower limb function; improvements were sustained up to six months post treatment. Further research should focus on the type and amount of training, including ways of measuring the number of repetitions actually performed by participants. The definition of RTT will need revisiting prior to further updates of this review in order to ensure it remains clinically meaningful and distinguishable from other interventions.

PLAIN LANGUAGE SUMMARY

Repetitive task training for improving functional ability after stroke

Review question: What are the effects of repeated practice of functional tasks on recovery after stroke when compared with usual care or placebo treatments?

Background: Stroke can cause problems with movement, often down one side of the body. While some recovery is common over time, about one third of people have continuing problems. Repeated practice of functional tasks (e.g. lifting a cup) is a treatment approach used to help with recovery of movement after stroke. This approach is based on the simple idea that in order to improve our ability to perform tasks we need to practice doing that particular task numerous times, like when we first learned to write. The types of practice that people do, and the time that they spend practicing, may affect how well this treatment works. To explore this further we also looked at different aspects of repetitive practice that may influence how well it works.

Study characteristics: We identified 33 studies with 1853 participants. Studies included a wide range of tasks to practice, including lifting a ball, walking, standing up from sitting and circuit training with a different task at each station. The evidence is current to June 2016.

Key results: In comparison with usual care (standard physiotherapy) or placebo groups, people who practiced functional tasks showed small improvements in arm function, hand function, walking distance and measures of walking ability. Improvements in arm and leg function were maintained up to six months later. There was not enough evidence to be certain about the risk of adverse events, for example falls. Further research is needed to determine the best type of task practice, and whether more sustained practice could show better results.

Quality of the evidence: We classified the quality of the evidence as low for arm function, hand function and lower limb functional measures, and as moderate for walking distance and functional ambulation. The quality of the evidence for each outcome was limited

due poor reporting of study details (particularly in earlier studies), inconsistent results across studies and small numbers of study participants in some comparisons.

SUMMARY OF FINDINGS FOR THE MAIN COMPARISON [Explanation]

Repetitive task training compared with usual care or attention control for patients with stroke

Patient or population: people with stroke
Settings: hospital, clinic or home
Intervention: repetitive task training (RTT)
Comparison: usual care, attention control or no treatment

Outcomes	Illustrative comparative risks (95% CI)		Relative effect (95% CI)	No of participants (studies)	Quality of the evidence (GRADE)	Comments
	Assumed risk	Corresponding risk				
	Estimated score / value with control	Absolute reduction in score / value with RTT [a]				
Arm function	Arm function score in the repetitive task training groups was on average 0.25 standard deviations (0.01 to 0.49) higher than in the control groups SD units, measured using different instruments; higher scores mean better arm function		SMD 0.25, 95% CI 0.01 to 0.49	11 studies 749 participants	⊕⊕◯◯ **low**	Downgraded by one level for inconsistency (I^2 58%). Downgraded by one level for study design (random sequence generation unclear in 4/11 trials and high risk in 1/11 trials in the meta-analysis; allocation concealment unclear in 7/11 trials and high risk in 1/11 trials)
Hand function	Hand function score in the repetitive task training groups was on average 0.25 standard deviations (0.00 to 0.51) higher than in the control groups SD units, measured using different instruments; higher scores mean better hand function		SMD 0.25, 95% CI 0.00 to 0.51	8 studies 619 participants	⊕⊕◯◯ **low**	Downgraded by one level for inconsistency (I^2 54%). Downgraded by one level for study design

						(random sequence generation unclear in 2/8 trials and high risk in 1/8 trials in the meta-analysis; allocation concealment unclear in 4/8 trials and high risk in 1/8 trials)
Walking distance: change from baseline	The mean change in walking distance (metres walked in six minutes; a higher score means greater walking distance) in the control groups ranged from -1.0 to 118.5	The mean change in walking distance (metres walked in six minutes; a higher score means greater walking distance) in the repetitive training group ranged from 19 to 221	MD 34.80, 95% CI 18.19 to 51.41	9 studies 610 participants	⊕⊕⊕◯ **moderate**	Downgraded by one level for study design (random sequence generation unclear in 6/9 trials in the meta-analysis; allocation concealment unclear in 6/9 trials and high risk in 3/9 trials)
Walking speed	The mean walking speed in the control groups ranged from 0.29 to 2.47 metres per second. A higher score means faster walking speed	The mean walking speed in the intervention groups ranged from 0.39 to 2.03 metres per second. A higher score means faster walking speed	SMD 0.39, 95% CI -0.02 to 0.79	12 studies 685 participants	⊕⊕◯◯ **low**	Downgraded by one level for inconsistency (I^2 80%). Downgraded by one level for study design (random sequence generation unclear in 7/12 trials in the meta-analysis; allocation concealment unclear in 9/12 trials and high risk in 3/12 trials)
Functional ambulation	Functional ambulation score in the repetitive task training groups was on average 0.35 standard deviations (0.04 to 0.66) higher than in the control groups SD units, measured using different instruments; higher scores mean better function		SMD 0.35, 95% CI 0.04 to 0.66	8 studies 525 participants	⊕⊕⊕◯ **moderate**	Downgraded by one level for study design (random sequence generation unclear in 4/8 trials in the meta-analy-

					sis; allocation concealment unclear in 7/8 trials and high risk in 1/8 trials)
Lower limb functional measures	Lower limb functional measures in the repetitive task training groups were on average 0.29 standard deviations (0.10 to 0.48) higher than in the control groups SD units, measured using different instruments; higher scores mean better function	SMD 0.29, 95% CI 0.10 to 0.48	5 studies 419 participants	⊕⊕◯◯ **low**	Downgraded by one level for study design (random sequence generation unclear in 3/5 trials in the meta-analysis; allocation concealment unclear in 3/5 trials and high risk in 1/5 trials) Downgraded by one level for publication bias; 4 out of 5 are small studies (less than 50 participants)
Global motor function scales	Global motor function in the repetitive task training groups was on average 0.38 standard deviations (0.11 to 0.65) higher than in the control groups SD units, measured using different instruments; higher scores mean better function	SMD 0.38, 95% CI 0.11 to 0.65	5 studies 222 participants	⊕⊕⊕◯ **moderate**	Downgraded by one level for study design (random sequence generation unclear in 4/5 trials in the meta-analysis; allocation concealment unclear in 4/5 trials and high risk in 1/5 trials)
Adverse events	Barreca 2004: 3/25 (12%) falls in the intervention group versus 4/23 (17.4%) in the control group, OR 0.65, 95% CI 0.13 to 3.27 Holmgren 2010: 11 participants in total fell during study (32%), five in the intervention group and six in the attention control group van de Port 2012: 29 falls reported in the circuit training group and 26 in the usual physiotherapy group (P = 0.93). Two serious adverse events were reported in the circuit training group: one participant fell and consulted a GP and one patient experienced arrhythmias during one session				

	Winstein 2016: 168 serious adverse events involving 109 participants. The most common were hospitalisation (n = 143, 25% of randomised participants) and recurrent stroke (n = 42, 9% of randomised participants). Adverse events were not presented by trial arm Salbach 2004: intervention-related reasons for withdrawal that could be interpreted as adverse events included one participant out of 47 in a mobility training group who experienced the onset of groin pain. Four participants also fell during the mobility intervention but did not suffer injury and continued to participate in the group. Two falls also occurred during evaluation Two trials narratively reported no adverse effects (de Sèze 2001; McClellan 2004).	

[a] As a rule of thumb, 0.2 SD represents a small difference, 0.5 a moderate, and 0.8 a large difference
CI: confidence interval; **MD:** mean difference; **SMD:** standardised mean difference; **OR:** odds ratio; **SD:** standard deviation

GRADE Working Group grades of evidence
High quality: Further research is very unlikely to change our confidence in the estimate of effect.
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Very low quality: We are very uncertain about the estimate.

BACKGROUND

Description of the condition

Although the age-related incidence of stroke may be falling, the absolute number of people who have a stroke every year and the overall global burden of stroke in terms of disability-adjusted life-years are increasing (Feigin 2014). Stroke is still the major cause of long-term neurological disability in adults (Wolfe 2000). Prevalence rates of disability and impairment vary according to sampling of cohorts, but in the acute stage of stroke approximately half of all stroke survivors are left with severe functional problems (Lawrence 2001). Estimates of recovery of independent ambulation in studies recruiting cohorts early after stroke range from 41% to 85% (Dallas 2008; Feigin 1996; Kwah 2013; Verbeek 2011; Wade 1987; Wandel 2000); those of recovery of independent upper limb function range from 32% to 34% (Au-Yeung 2009; Heller 1987; Nijland 2010). Only 5% to 20% of people with initial upper limb impairment after stroke fully regain arm function, with 30% to 66% regaining no functional use at six months (Heller 1987; Nakayama 1994; Sunderland 1989; Wade 1983). At three weeks and six months after stroke, 40% and 15% of people are unable to walk independently indoors (Wade 1987), with only 18% regaining unrestricted walking ability (Lord 2004).

Description of the intervention

Systematic reviews of treatment interventions for the paretic upper limb suggest that participants benefit from exercise programmes in which functional tasks are directly trained (Van Peppen 2004). A meta-analysis has shown that more intensive therapy may at least improve the rate of activities of daily living (ADL) recovery (Kwakkel 2004), particularly if a direct functional approach is adopted (Kwakkel 1999; Van der Lee 2001). More recently, a review of the evidence for physical therapy post stroke concluded there is strong evidence for high intensity practice (additional therapy time of 17 hours over 10 weeks) with a high number of repetitions within a single-treatment session and a functional goal (Verbeek 2014). Repetitive task practice combines elements of both intensity of practice and functional relevance.

How the intervention might work

Many aspects of rehabilitation involve repetition of movement. Repeated motor practice has been hypothesised to reduce muscle weakness and spasticity (Nuyens 2002), and to form the physiological basis of motor learning (Butefisch 1995), while sensorimotor coupling contributes to the adaptation and recovery of neuronal pathways (Dobkin 2004). Active cognitive involvement, functional relevance and knowledge of performance are hypothesised to enhance learning (Carr 1987; Schmidt 2014). However, most interventions evaluated in randomised controlled trials (RCTs) do not explicitly target specific pathophysiological processes (Langhorne 2009).

Why it is important to do this review

Repetitive task training (RTT) has the potential to be a resource-efficient component of stroke rehabilitation, including delivery in a group setting, or self-initiated practice in the home environment. Repetition of movement is the basic mechanism of action associated with many interventions showing promise in improving motor function (Langhorne 2009) (e.g. constraint-induced movement therapy (Corbetta 2015), treadmill training (Mehrholz 2014), and training with electromechanical devices, for example robots (Mehrholz 2015b)). This review is important as it considers whether RTT alone leads to functional gains in the absence of other mechanisms of action.

OBJECTIVES

Primary objective: To determine if repetitive task training (RTT) improves upper limb function/reach and lower limb function/balance in adults after stroke.

Secondary objectives: 1) To determine the effect of RTT on secondary outcome measures including activities of daily living (ADL), global motor function, quality of life/health status, and adverse events. 2) To determine the factors that could influence primary and secondary outcome measures, including the effect of 'dose' of task practice; type of task (whole therapy, mixed or single task); timing of the intervention; and type of intervention.

METHODS

Criteria for considering studies for this review

Types of studies

We included RCTs and quasi-randomised trials (defined as methods of allocating people to a trial that are not random, but are intended to produce similar groups when used to allocate participants, such as those allocating by date or alternation (Higgins 2011)). One arm of the trial had to include RTT, compared against usual practice (including 'no treatment'), or an attention control

group. We excluded studies where RTT was a component of both the experimental and control treatments. Examples of attention control treatments are comparable time spent receiving therapy on a different limb, or participating in an activity with no potential motor benefits. We accepted usual practice comparison groups when the intervention received by the control group was considered a normal or usual component of stroke rehabilitation practices, including neurophysiological or orthopaedic approaches. We assumed that, early after stroke, usual practice would mean that people would receive some therapy.

Types of participants

Adults (18 years and older) who have suffered a stroke. Stroke is defined by the World Health Organization (WHO) as "a syndrome of rapidly developing symptoms and signs of focal, and at times global, loss of cerebral function lasting more than 24 hours or leading to death, with no apparent cause other than that of vascular origin" (WHO 1989). We included trials starting any time after an acute stroke and in any setting. We excluded studies of participants with mixed aetiology (for example, participants with acquired brain injury) unless data were available relating to the participants with stroke only.

Types of interventions

One arm of the trial had to include an intervention where an active motor sequence was performed repetitively within a single training session, and where the practice was aimed towards a clear functional goal. Functional goals could involve complex whole tasks (e.g. picking up a cup), or pre-task movements for a whole limb or limb segment such as grasp, grip, or movement in a trajectory to facilitate an ADL-type activity (e.g. sit-to-stand). To be included, trials of repetitive activity were required to involve complex multijoint movement with functional measurement of outcome, rather than the exercise of a single joint or muscle group orientated to motor performance outcomes.

We included any intensity and duration of task training schedule but only included trials if the time duration or number of repetitions within a session of practice and the number of sessions delivered could be identified. We included trials that clearly used motor relearning as a whole therapy approach if we could identify the amount of task-specific training received.

We included trials combining RTT with person-delivered, mechanical or robotic movement assistance if the purpose of the assistance was to facilitate a task-related repetition. We excluded studies if assisted movement was predominant, or could not easily be related to a functional goal.

We excluded trials if they combined RTT with another intervention where the influence of task repetition could not be isolated, for example electrical stimulation, virtual environments, forced use, bilateral movement, or mental rehearsal. We also excluded trials if the intervention used mechanical means simply to increase strength or endurance.

We contacted trial authors for clarification of the nature of the intervention if it was unclear whether the trial met our definition.

Types of outcome measures

Primary outcomes

The primary outcomes we chose were global and limb-specific functional measures. Due to the large range of measures used across trials, selection of outcome measures was done by the review authors to facilitate quantitative pooling. If more than one measure was available in an outcome category, we prioritised measures of functional motor ability used in the primary trials as follows in the different categories.

- Upper limb function/reach
  - Arm function: Motor Assessment Scale - upper limb component, Action Research Arm Test, Frenchay Arm Test, Wolf Motor Function Test, Functional Test of the Hemiparetic Upper Extremity, Box and Block Test, Southern Motor Group Assessment
  - Hand function: Motor Assessment Scale - hand, Jebsen Test of Hand Function*, Peg Test*, Stroke Impact Scale - hand domain
  - Sitting balance/reach: Reaching Performance Scale, Functional Reach
- Lower limb function/standing balance
  - Lower limb function: walking distance, walking speed, functional ambulation, Timed Up and Go Test/sit-to-stand*; measures of lower limb function, such as the Rivermead Motor Assessment, Sødring Motor Evaluation Scale, Walking Ability Questionnaire, Stroke Impact Scale - mobility domain.
  - Standing balance/reach: Berg Balance Scale, Standing Equilibrium Index, Functional Reach, Activities Based Confidence Scale, Timed Balance Test

Secondary outcomes

- Activities of daily living (ADL)
  - Barthel Index, Functional Independence Measure, Modified Rankin Scale, Global Dependency Scale, Canadian Occupational Performance Measure
- Global motor function (including arm, leg and trunk and gross motor function [e.g. the ability to move from lying to sitting on the side of the bed])
  - Motor Assessment Scale, Rivermead Motor Assessment Scale, Sødring Motor Evaluation Scale
- Measures of quality of life, health status, user satisfaction, carer burden, motivation or perceived improvement
  - For example, Nottingham Health Profile*, SF36, Dartmouth Cooperative Chart*

- Adverse events
    - For example, pain, injury, falls

*Items marked with an asterisk are measures where a low score equals a positive outcome. The data were expressed as negative values for these studies. In all other measures, a high score indicates a good outcome, and data were expressed as positive values.

Timing of outcome assessment

Primary outcome timing was at the end of the treatment period. If the end of the treatment period was not clearly defined, we chose outcome measures at three months post treatment as primary, because we considered this to be the average period of rehabilitation input. Outcome data are presented for follow-up less than six months post treatment, and between six months to one year post treatment. At both follow-up points, we entered data for the primary outcome if a primary outcome was specified and data were available; otherwise, we included data for available outcomes with similar outcomes chosen across studies where data were provided for more than one outcome.

Search methods for identification of studies

See the 'Specialized register' section in the Cochrane Stroke Group module. We searched for trials in all languages and arranged translation of relevant papers where necessary.

Electronic searches

We searched the Cochrane Stroke Group Trials Register; this was searched by the Managing Editor on 4 March 2016. In addition, we searched the following electronic databases: the Cochrane Central Register of Controlled Trials (CENTRAL: the Cochrane Library 2016, Issue 5: 1 October 2006 to 24 June 2016; Appendix 1); MEDLINE (1 October 2006 to 8 March 2016; Appendix 2); Embase (1 October 2006 to 8 March 2016; Appendix 3); CINAHL (2006 to 23 June 2016; Appendix 4); AMED (2006 to 21 June 2016; Appendix 5); and SPORTSDiscus (2006 to 21 June 2016; Appendix 6). We developed the MEDLINE search strategy with the help of the Cochrane Stroke Group Information Specialist and adapted it for the other databases.

Searching other resources

We searched reference lists of relevant studies and contacted authors to identify missing data. In an effort to identify further published, unpublished and ongoing trials we searched the following resources using broad descriptors for stroke, rehabilitation, and physical therapy:

- ClinicalTrials.gov 15 June 2016 (http://clinicaltrials.gov/);
- World Health Organization (WHO) International Clinical Trials Registry Platform Search Portal 15 June 2016 (http://apps.who.int/trialsearch/).

Data collection and analysis

Selection of studies

Two review authors (from JC, LC, BF, JH, NM, LT) independently screened references identified from the searches of the electronic databases and excluded irrelevant studies. We obtained the full-text papers of the remaining studies and the same two review authors assessed these for inclusion according to the inclusion criteria. We resolved disagreements through discussion and by referral to a third review author as necessary. We provided reasons for excluding potentially relevant studies.

Data extraction and management

Two review authors (from JC, LC, NM, LT) independently conducted data extraction using a pre-designed data extraction form for each selected study. Data extracted included citation details, method of randomisation, study population, intervention methods and delivery, reasons for losses to follow-up, post therapy and follow-up outcome measures, and methodological quality. In addition, we extracted information relating to treatment monitoring, acceptability, and adherence where available. We resolved disagreements by discussion, and by referral to a third author (LT) as necessary. We contacted study authors by email to request any missing information necessary for the review.

Assessment of risk of bias in included studies

Two review authors (LT and NM) used Cochrane's 'Risk of bias' tool to independently assess the methodological quality of the included studies (Higgins 2011). The tool covers the domains of sequence generation, allocation concealment, blinding of outcome assessors, incomplete outcome data and selective reporting. We classified items as 'low risk', 'high risk' or 'unclear risk' of bias. We resolved disagreements with help from a third review author (JC).

Measures of treatment effect

For continuous outcomes using similar measurement scales, we used the mean difference (MD) with 95% confidence intervals (CIs). If similar outcomes were measured using different outcome scales, we combined results using standardised mean difference (SMD) and 95% CIs. For continuous outcomes, we extracted means and standard deviations of post-therapy scores. We also extracted means and standard deviations of change from baseline scores where available across trials. We used the Chi^2 test to explore differences between subgroups.

One outcome contained both dichotomous and continuous measurement units, which we analysed using the generic inverse variance method. Four different outcome measures were used in seven trials. Three of these were continuous measures: Timed Up &

Go Test (Blennerhassett 2004b; Dean 2000; Salbach 2004a); Motor Assessment Scale sit-to-stand (Langhammer 2000; Van Vliet 2005); sit-to-stand (time in seconds) (Howe 2005), the exception being 'Number of people able to stand independently and safely on two consecutive occasions' (Barreca 2004). For the six trials with continuous outcomes, we calculated the SMD and corresponding standard error in Review Manager 5 (RevMan 2014) from the SMD estimate and CI and re-entered for the GIV-based meta-analysis of sit-to stand. For Barreca 2004, we converted the log OR and its standard error (SE) to an approximate SMD scale.

Unit of analysis issues

Studies with multiple treatment groups

Two trials compared upper versus lower limb training, so are included as four intervention-control pairs (Blennerhassett 2004; Salbach 2004). Blennerhassett 2004a refers to a upper limb training group versus lower limb attention control, and Blennerhassett 2004b refers to an lower limb training group versus upper limb training attention control. Salbach 2004a refers to a lower limb training group versus upper limb training attention control, and Salbach 2004b refers to the upper limb training group versus lower limb training attention control. In the subgroup and sensitivity analyses, these intervention-control pairs are not included as separate trials, as we considered that the impacts of the interventions on upper and lower limb function in the same person might not be completely independent. Results for the primary outcome of the lower limb training groups were selected as representative, as studies were showing that treatment effects were greater in the lower limb than in the upper limb. One trial compared upper and lower limb training groups against the same control group (Kwakkel 1999). To avoid the control group being included twice, and to use a limb-specific rather than a global or ADL measure, we selected the lower limb training versus splint control comparison for the sensitivity analyses.

Dealing with missing data

If data were not in a form suitable for quantitative pooling, we contacted trial authors for additional information .We attempted to obtain post therapy scores from trial authors who had reported median and inter-quartile ranges. We presented trials reporting change scores with standard deviations in separate analyses.

Assessment of heterogeneity

We assessed the degree of heterogeneity among the trials using the I^2 statistic for each outcome. If less than or equal to 50%, we used a fixed-effect meta-analysis. If the I^2 statistic was greater than 50%, we explored the individual trial characteristics to identify potential sources of heterogeneity. We then performed meta-analysis using both fixed-effect and random-effects modelling to assess sensitivity to the choice of modelling approach.
We addressed clinical and methodological diversity by incorporating subgroup or sensitivity analyses for type of participant (time from stroke), intervention (type and amount of intervention), and study design (comparison group, equivalence of treatment).
To test for subgroup effects we used the Chi^2 test with a 5% significance level.

Assessment of reporting biases

We searched clinical trial registers to assist in reducing publication bias. We also investigated selective outcome reporting through the comparison of the methods section of papers with the results reported.

Data synthesis

Where there were acceptable levels of heterogeneity, we pooled results. We used both random-effects and fixed-effect meta-analysis with 95% CI using Review Manager 5 (RevMan 2014). We pooled outcomes measured with different instruments using the SMD.
We documented the quality of evidence for each outcome based on criteria considered within the GRADE (Grading of Recommendations Assessment, Development and Evaluation) approach (Guyatt 2008); this includes the following.

- Risk of bias due to flawed design or conduct of studies (sequence generation, allocation concealment, blinding of outcome assessors and incomplete outcome data). We re-assessed all studies from the original review using the updated 'Risk of bias' tool (Higgins 2011).
- Imprecision (e.g. when confidence intervals for treatment effect are wide).
- Inconsistency (e.g. when point estimates vary widely, the I^2 is large).
- Indirectness (e.g. variations in participants, interventions, comparisons and outcomes).
- Publication bias (may be explored with the use of funnel plots and classed as not suspected, suspected, strongly suspected or very strongly suspected).

Three review authors (JC, NM and LT) assessed and documented risk of bias related to study design, imprecision, inconsistency, indirectness and publication bias for each outcome within comparisons presented.
We employed GRADE to interpret findings and to create a 'Summary of findings' table (Guyatt 2008) for the following outcomes: arm function, hand function, walking distance, walking speed, functional ambulation, lower limb functional measures and global motor function. The table provides outcome-specific information concerning the overall quality of evidence from studies included in the comparison, the magnitude of effect of the intervention and

the sum of available data on the outcomes considered. We downgraded the evidence from 'high quality' by one level for serious (or by two for very serious) study limitations (risk of bias, indirectness of evidence, serious inconsistency, imprecision of effect estimates or potential publication bias). We did not assess follow-up outcomes using GRADE.

Subgroup analysis and investigation of heterogeneity

We undertook planned subgroup analyses for all primary outcomes separately for upper limb and lower limb function, due to the potential differential impact (Table 1). Planned subgroup analyses were as follows:

- dosage of task practice: dosage of task practice was calculated by multiplying the number of weeks, by the number of sessions per week, by the session duration in hours. Trials were divided into those providing up to and including 20 hours training, and those providing more than 20 hours training in total;
- time since stroke: mean time since stroke at recruitment was used to classify trials as within zero to six months post stroke or more than six months post stroke. As a number of trials recruited very early post stroke, a post-hoc analysis grouping was included for trials recruiting within 14 days of stroke;
- type of intervention: trials were classified as either 1) whole therapy approaches, where rehabilitation in total was directed by a motor relearning or movement science approach, 2) mixed functional task training, where therapy included a mixed combination of functional tasks, and 3) single task training, where one task was practiced repeatedly.

We intended to consider if effect sizes were related to whether training was based on pre-functional versus functional activities, or pre-intervention level of disability. In the event, we excluded most pre-functional trials because they contained a large proportion of passive or active-assisted movement, and levels of disability proved too difficult to classify because of mixed groups of participants and unsuitable measures and data for this purpose. Therefore, we have not presented these planned subgroup analyses.

We prioritised outcomes for subgroup analyses by the study authors' primary outcome choice, or the review authors' judgement as to the most suitable measure for the intervention, for example a balance measure for trials training balance functions. If more than one measure was available, we prioritised lower limb outcomes in the following order: 1) walking speed, 2) walking distance, 3) functional ambulation, and 4) lower limb functional measures. We prioritised upper limb outcomes as 1) arm function, and 2) hand function. We omitted one trial from the subgroup and sensitivity analyses because it used a dichotomous outcome (Barreca 2004).

Sensitivity analysis

We carried out planned sensitivity analyses for allocation concealment (adequate or inadequate/unclear). In addition, we included post hoc sensitivity analyses to consider the impact of different comparison groups (attention control, usual care), equivalence of therapy time (equivalent time, additional time), and intervention delivery (individual versus group). We did not undertake planned sensitivity analyses for intervention setting (hospital versus home) because of an insufficient numbers of trials.

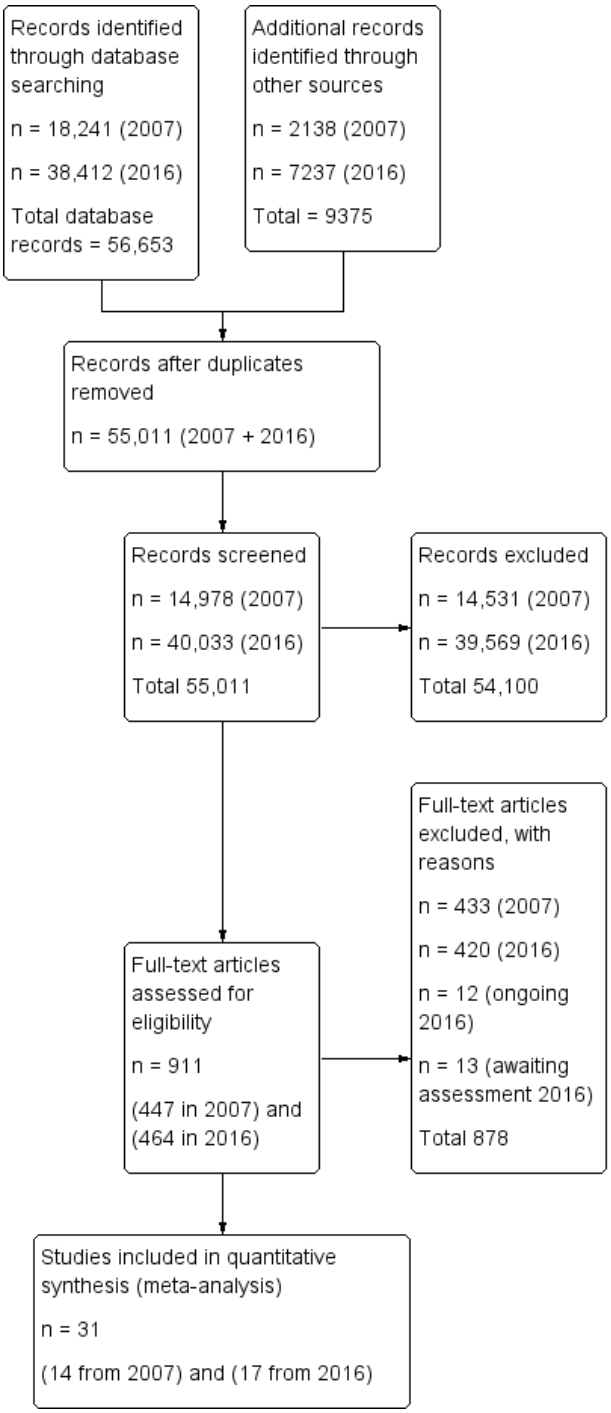
RESULTS

Description of studies

Results of the search

We identified 66,028 records from the database searches. After deduplication we screened 55,011 records and excluded 54,100 as not relevant. In total 911 records progressed to filtering in full text (Figure 1). Out of the 911 full papers retrieved, we excluded a further 878. We subsequently excluded studies where there was uncertainty whether or not they met the inclusion criteria - details are presented in the Characteristics of excluded studies table, In total, we identified 19 new studies and added them to the 14 studies previously included in the 2007 review. A total of 33 studies are now included in the review. We categorised 11 studies as ongoing (Characteristics of ongoing studies) and 14 studies as awaiting assessment (Characteristics of studies awaiting classification).

Figure 1. Study flow diagram (2007 review and update 2016 figures)



Included studies

We identified 33 trials, comprising 36 intervention-control pairs, which met the inclusion criteria. One paper (Kwakkel 1999) refers to a trial with two intervention-control pairs which have been referenced separately in the review: Kwakkel 1999a refers to a lower limb training group versus splint control, Kwakkel 1999b refers to an upper limb training group versus splint control. Blennerhassett 2004 includes two intervention-control pairs: Blennerhassett 2004a refers to an upper limb training group versus lower limb attention control, and Blennerhassett 2004b refers to a lower limb training group versus upper limb training attention control. Salbach 2004 has two intervention-control pairs: Salbach 2004a refers to a lower limb training group versus upper limb training attention control, and Salbach 2004b refers to the upper limb training group versus lower limb training attention control. In five trials (Baer 2007; Olawale 2011; Peurala 2009; Winstein 2004; Winstein 2016) there were three arms. We only included the data for the intervention-control pair of repetitive task training (RTT) versus control in the review.

Design

Of the 33 included trials, 32 were RCTs (Arya 2012; Baer 2007; Barreca 2004; Blennerhassett 2004; Dean 1997; Dean 2000; Dean 2007; de Sèze 2001; Frimpong 2014; Gordon 2013; Holmgren 2010; Howe 2005; Kim 2012; Kim 2014; Kim 2016; Kwakkel 1999; Langhammer 2000; Lennon 2009; McClellan 2004; Mudge 2009; Olawale 2011; Park 2011; Peurala 2009; Ross 2009; Salbach 2004; Song 2015; Tung 2010; van de Port 2012; Van Vliet 2005; Winstein 2004; Winstein 2016; Yen 2005), and one is a quasi-randomised trial (Turton 1990). Four of the trials were pilot randomised controlled trials (Dean 2000; de Sèze 2001; Howe 2005; Winstein 2004). Four of the trials were multicentre (Arya 2012; Kwakkel 1999; van de Port 2012; Winstein 2016). Nine of the trials were stratified before randomisation using: baseline level of walking deficit (Lennon 2009; Peurala 2009; Salbach 2004), cognition and falls risk (Holmgren 2010), gender and side of stroke (Langhammer 2000); rehabilitation centre (van de Port 2012), stroke severity (Baer 2007; Winstein 2004), and motor severity and time from stroke onset (Winstein 2016).

Sample size

Eleven trials had 25 participants or less (Dean 1997; Dean 2000; Dean 2007; de Sèze 2001; Frimpong 2014; Kim 2012; Kim 2014; Kim 2016; Park 2011; Song 2015; Turton 1990). Ten trials had between 26 and 49 participants (Barreca 2004; Blennerhassett 2004; Holmgren 2010; Howe 2005; McClellan 2004; Peurala 2009; Ross 2009; Tung 2010; Winstein 2004; Yen 2005). Twelve trials had 50 participants or more (Arya 2012; Baer 2007; Gordon 2013; Kwakkel 1999; Langhammer 2000; Lennon 2009; Mudge 2009; Olawale 2011; Salbach 2004; van de Port 2012; Van Vliet 2005; Winstein 2016).

Country

Of the 33 trials, three were carried out in Canada (Barreca 2004; Dean 2000; Salbach 2004), five in Australia (Blennerhassett 2004; Dean 1997; Dean 2007; McClellan 2004; Ross 2009), four in the UK (Baer 2007; Howe 2005; Turton 1990; Van Vliet 2005), two in Taiwan (Tung 2010; Yen 2005), five in Korea (Kim 2012; Kim 2014; Kim 2016; Park 2011; Song 2015), two in the Netherlands (Kwakkel 1999; van de Port 2012), two in the USA (Winstein 2004; Winstein 2016), one in Norway (Langhammer 2000), two in Africa (Frimpong 2014; Olawale 2011), one in India (Arya 2012), one in Jamaica (Gordon 2013), one in Sweden (Holmgren 2010), one in Finland (Peurala 2009), one in Ireland (Lennon 2009), one in New Zealand (Mudge 2009), and one in France (de Sèze 2001).

Participants

The 33 trials included 2014 participants, of which 1853 were included in the 36 intervention-control pairs relevant to this review. All of the trials included both genders, with 10 trials having more than 60% male participants (Arya 2012; Barreca 2004; Dean 1997; Dean 2007; Frimpong 2014; Holmgren 2010; Kim 2016; Salbach 2004; Tung 2010; van de Port 2012). In 10 trials, the participants had a mean age of less than 60 (Arya 2012; Blennerhassett 2004; Frimpong 2014; Kim 2012; Kim 2014; Olawale 2011; Park 2011; Tung 2010; Turton 1990; van de Port 2012), and in seven trials the mean age was over 70 (Baer 2007; Holmgren 2010; Howe 2005; Langhammer 2000; Lennon 2009; Salbach 2004; Van Vliet 2005). Fourteen trials included only participants after a first stroke (Arya 2012; Dean 2000; Dean 2007; de Sèze 2001; Frimpong 2014; Kim 2014; Kim 2016; Kwakkel 1999; Langhammer 2000; Park 2011; Peurala 2009; Tung 2010; Winstein 2004; Yen 2005). Six trials included participants with either first or recurrent stroke (Blennerhassett 2004; Holmgren 2010; Howe 2005; Lennon 2009; Mudge 2009; Salbach 2004). In the remaining trials, it was unclear whether inclusion was limited to first stroke only.

Mean time since stroke

Mean time since stroke was one month or less in 10 trials (Barreca 2004; Dean 2007; Howe 2005; Kim 2016; Kwakkel

1999; Langhammer 2000; Lennon 2009; Peurala 2009; Van Vliet 2005; Winstein 2004), between one and three months in five trials (Arya 2012; Blennerhassett 2004; de Sèze 2001; Frimpong 2014; Winstein 2016), between three and six months in four trials (Holmgren 2010; McClellan 2004; Turton 1990; van de Port 2012), and between six and 12 months in five trials (Gordon 2013; Kim 2014; Olawale 2011; Salbach 2004; Yen 2005). Participants were in the chronic phase of stroke in nine trials (Baer 2007; Dean 1997; Dean 2000; Kim 2012; Mudge 2009; Park 2011; Ross 2009; Song 2015; Tung 2010).

Interventions

Upper limb RTT interventions were tested in six trials (Arya 2012; Ross 2009; Turton 1990; Winstein 2004; Winstein 2016; Yen 2005). Lower limb repetitive task-oriented training interventions were tested in 17 trials (Barreca 2004; Dean 2000; Frimpong 2014; Gordon 2013; Holmgren 2010; Kim 2012; Kim 2014; Kim 2016; Lennon 2009; McClellan 2004; Mudge 2009; Olawale 2011; Park 2011; Peurala 2009; Song 2015; Tung 2010; van de Port 2012). Of these trials, two of the interventions focused specifically on sit-to-stand practice (Barreca 2004; Tung 2010) and six of the interventions focused on walking practice (Gordon 2013; Kim 2014; Lennon 2009; Olawale 2011; Park 2011; Peurala 2009). Three trials investigated RTT interventions for both the upper and lower limb (Blennerhassett 2004; Kwakkel 1999; Salbach 2004). Four trials investigated RTT interventions that focused specifically on: sitting balance (Dean 1997; Dean 2007), trunk control (de Sèze 2001), and balance (Howe 2005), and two trials investigated whole therapy approaches (Langhammer 2000; Van Vliet 2005).

Setting

The intervention was delivered solely in an inpatient setting in 11 trials (Barreca 2004; Blennerhassett 2004; Dean 2007; Frimpong 2014; de Sèze 2001; Howe 2005; Kim 2014; Kwakkel 1999; Lennon 2009; Peurala 2009; Winstein 2016). In three trials the intervention was delivered during both inpatient and outpatient rehabilitation (Ross 2009; Van Vliet 2005; Winstein 2004), with one trial continuing to deliver the intervention in community settings and the patients' own homes (Langhammer 2000). Nine trials delivered the intervention as outpatient rehabilitation (Arya 2012; Dean 2000; Mudge 2009; Olawale 2011; Park 2011; Salbach 2004; Tung 2010; van de Port 2012; Yen 2005). Two trials delivered the intervention in community settings (Gordon 2013; Holmgren 2010), and four trials delivered the intervention solely in the patients' home environments (Baer 2007; Dean 1997; McClellan 2004; Turton 1990). In three trials it was not clear in which setting the intervention was delivered (Kim 2012; Kim 2016; Song 2015).

Amount of task practice

The number of hours of task practice varied considerably across the interventions. Six trials were estimated to have provided less than 10 hours training in total (Dean 1997; Dean 2007; Howe 2005; Lennon 2009; Tung 2010; Van Vliet 2005). A further 16 trials provided between 10 and 21 hours training (Arya 2012; Barreca 2004; Blennerhassett 2004; Dean 2000; Frimpong 2014; Gordon 2013; Kim 2012; Kim 2014; Langhammer 2000; Mudge 2009; Olawale 2011; Park 2011; Peurala 2009; Salbach 2004; Song 2015; Winstein 2004). Four trials provided between 30 and 40 hours training (Kim 2016; Ross 2009; van de Port 2012; Winstein 2016), and four trials prescribed more than 40 hours therapy (Kwakkel 1999; McClellan 2004; Turton 1990; Yen 2005). In one trial, the number of hours was not reported (Baer 2007). As only four of the included trials reported the duration of the RTT component of the task training sessions (Arya 2012; Mudge 2009; Peurala 2009; Ross 2009), we have used figures for the total duration of the task training sessions as these were more frequently reported in the included studies.

Duration of training

The length of time that training was spread over varied from two to four weeks in 19 trials (Arya 2012; Baer 2007; Blennerhassett 2004; Dean 1997; Dean 2000; Dean 2007; de Sèze 2001; Howe 2005; Kim 2012; Kim 2014; Kim 2016; Lennon 2009; Mudge 2009; Park 2011; Peurala 2009; Song 2015; Tung 2010; Winstein 2004; Yen 2005). The intervention was between four and 12 weeks in eight trials (Barreca 2004; Frimpong 2014; Holmgren 2010; McClellan 2004; Ross 2009; Salbach 2004; Turton 1990; Winstein 2016) and between 12 and 20 weeks in four trials (Gordon 2013; Kwakkel 1999; Olawale 2011; van de Port 2012). For two trials, the duration of training was over the inpatient rehabilitation period, with therapy for some participants in an outpatient setting if required (Langhammer 2000; Van Vliet 2005).

Intervention delivery

The RTT interventions were delivered by trained therapists in all but four of the included trials. In three trials trained staff input was restricted to prescription and review of self-administered homework exercise programmes (Baer 2007; McClellan 2004; Turton 1990). Trained therapy assistants provided balance training in one trial (Howe 2005), and registered practical nurses delivered sit-to-stand training in one trial (Barreca 2004). A group or circuit training approach was used in eight studies (Barreca 2004; Blennerhassett 2004; Dean 2000; Frimpong 2014; Kim 2016; Mudge 2009; Song 2015; van de Port 2012). In one trial it was unclear who delivered the intervention (Kim 2014).

Comparison interventions

Eleven trials compared the intervention against an attention control: two trials used a recreation or cognitive therapy control group (Barreca 2004; Dean 1997), two used educational sessions (Holmgren 2010; Mudge 2009), one used a splint control (Kwakkel 1999), one used light massage (Gordon 2013), one used a sham sitting protocol (Dean 2007) and four used a comparison training programme for the upper or lower limb (Blennerhassett 2004; Dean 2000; McClellan 2004; Salbach 2004). Eighteen trials compared the intervention against usual care. Equivalent hours of therapy were provided in eight trials (Arya 2012; de Sèze 2001; Langhammer 2000; Lennon 2009; Olawale 2011; van de Port 2012; Van Vliet 2005; Winstein 2016).The RTT group received additional practice in 14 trials (Baer 2007; Frimpong 2014; Holmgren 2010; Howe 2005; Kim 2012; Kim 2014; Kim 2016; Park 2011; Peurala 2009; Ross 2009; Song 2015; Tung 2010; Turton 1990; Winstein 2004). It is unclear whether the duration of therapy for the intervention-control pair was equivalent for Yen 2005.

Outcomes

The 33 included trials used a wide range of different outcome measures, measurement statistics, and time intervals for follow-up. Measures selected by the review team for each outcome category are detailed below, and in Table 2 for ease of reference per outcome category. In some studies, more than one measure was available for a category, and in this case, we prioritised measures as detailed in the Methods section.

Primary outcomes

Upper limb functional outcome measures

- Arm function: Action Research Arm Test (Arya 2012; Kwakkel 1999b; Ross 2009), Wolf Motor Function Test (Winstein 2016; Yen 2005), Motor Assessment Scale - arm (Blennerhassett 2004a; Langhammer 2000; Van Vliet 2005), Box and Block Test (Salbach 2004b), Functional Test of the Hemiparetic Upper Extremity (Winstein 2004), Southern Motor Group Assessment - upper limb activity (Turton 1990), Frenchay Arm Test (Baer 2007).
- Hand function: 9 Hole Peg Test (Salbach 2004b), 10 Hole Peg Test (Turton 1990), Motor Assessment Scale - hand (Blennerhassett 2004a; Langhammer 2000; Van Vliet 2005), Wolf Motor Funtion Test (functional ability) (Ross 2009), Stroke Impact Scale - hand domain (Winstein 2016).
- Sitting balance and reach: Reaching distance (Dean 1997; Dean 2007), Sitting Equilibrium Index (de Sèze 2001), Motor Assessment Scale - balanced sitting (Langhammer 2000; Van Vliet 2005), lateral reach - time to return to quiet sitting (Howe 2005).

Lower limb functional outcome measures

- Walking distance: 6 Minute Walk Test (Blennerhassett 2004b; Dean 2000; Gordon 2013; Kim 2014; Kim 2016Mudge 2009; Park 2011; Salbach 2004a; van de Port 2012).
- Walking speed: 10 Metre Walk speed (Dean 1997; Dean 2000; Dean 2007; Frimpong 2014; Kim 2012; Kim 2014; Kwakkel 1999a; Olawale 2011; Park 2011), 5 Metre Walk Speed (Lennon 2009; Salbach 2004a; van de Port 2012), 6 Metre Walk Speed (Van Vliet 2005).
- Functional ambulation: Functional Ambulation Classification (de Sèze 2001; Frimpong 2014; Kwakkel 1999a), Motor Assessment Scale - walking (Langhammer 2000; McClellan 2004; Van Vliet 2005); Walking Ability Questionnaire (Park 2011), Stroke Impact Scale - mobility domain (van de Port 2012).
- Sit-to-stand: Timed Up and Go (Baer 2007; Blennerhassett 2004b; Dean 2000; Kim 2012; Salbach 2004a), Motor Assessment Scale - sit-to-stand (Langhammer 2000; Van Vliet 2005), sit-to-stand time in seconds (Howe 2005), and number of people able to stand safely and independently on two occasions (Barreca 2004).
- Lower limb function: Sødring Motor Evaluation Scale - trunk, balance and gait subscale (Langhammer 2000), Step Test (Baer 2007; Blennerhassett 2004b; Dean 2000), Motor Assessment Scale - leg and trunk (Van Vliet 2005).
- Standing balance and reach: Upright Equilibrium Index (de Sèze 2001), Functional Reach (McClellan 2004), Berg Balance Scale (Holmgren 2010; Kim 2012; Kim 2016; Salbach 2004a; Tung 2010), Activities Based Confidence Scale (Park 2011), Timed Balance Test (van de Port 2012).

Secondary outcomes

ADL measures

The Barthel Index (Baer 2007; Gordon 2013; Holmgren 2010; Kim 2016; Kwakkel 1999; Langhammer 2000; Salbach 2004; Van Vliet 2005), the Canadian Occupational Performance Measure (Ross 2009), Functional Independence Measure (de Sèze 2001), Frenchay Activity Index (Baer 2007). Three trials used the Barthel Index scoring out of 20 (Baer 2007; de Sèze 2001; Van Vliet 2005), while the other trials used the scoring out of 100.

Global motor function

Motor Assessment Scale (Baer 2007; Langhammer 2000), Balance Master System (Tung 2010), Rivermead Gross Function subscale (Van Vliet 2005), Rivermead Mobility Index (Peurala 2009), Stroke Impact Scale - social participation subscale (van de Port 2012).

Quality of life/health status measures

Dartmouth Primary Care Cooperative Chart (COOP) (Barreca 2004), Nottingham Health Profile (NHP) (Kwakkel 1999;

Langhammer 2000), the Short Form-36 (health component) (Gordon 2013), Stroke Impact Scale (Baer 2007).

Adverse events

Number of falls (Barreca 2004; Holmgren 2010; van de Port 2012) and other serious and non-serious adverse events (e.g. arrhythmias) (van de Port 2012; Winstein 2016) were measured.

Outcomes used at follow-up

Upper limb outcome measures
We used the following outcomes for Comparisons 2.1.1 and 2.1.2: Action Research Arm Test (Arya 2012),Time to complete Jebson Taylor Hand Test (Blennerhassett 2004), Sitting Equilibrium Index (de Sèze 2001), Lateral Reach Test - time to return to quiet sitting (Howe 2005), Maximum reach distance (Dean 2007), Motor Assessment Scale - upper arm (Langhammer 2000;Van Vliet 2005), Functional test of the hemiparetic upper extremity (Winstein 2004), Wolf Motor Function Test (Winstein 2016).
Lower limb outcome measures
We used the following outcomes for Comparisons 5.1.1 and 5.1.2: Upright Equilibrium Index (de Sèze 2001), Walking speed with assistive device (Dean 2000), 10 Metre Walk Test (Dean 2007), Berg Balance Scale (Holmgren 2010 - Comparison 5.1.1), Barthel Index (Holmgren 2010 - Comparison 5.1.2), Sit-to-stand-to-sit (Howe 2005), Walking speed (Lennon 2009), Functional Reach Test (McClellan 2004), 6 Minute Walk Test (Blennerhassett 2004; Mudge 2009), Comfortable Walk Test (van de Port 2012) and Motor Assessment Scale - walking (Langhammer 2000; Van Vliet 2005).

Excluded studies

There is a large number of excluded studies described in Characteristics of excluded studies. Because of the difficulties in determining whether trial interventions included task-specific functional repetition, we have attempted to be as transparent as possible about the basis on which we excluded trials. The reasons for exclusion were:

- not repetition, or unable to determine amount of practice: five studies;
- comparison group also includes repetitive task practice: nine studies;
- alternative mechanism of action: 10 studies.

We were unable to obtain subgroup data relating to stroke patients in one study (Sherrington 2008).

Ongoing studies

There are 11 ongoing studies, where the information available is sufficient to say that the interventions are RTT. Five trials involved training for standing, balance or sit-to-stand (Hariohm 2013; Korner-Bitensky 2013; Kumaran 2010; Stuart 2009; Tanne 2008) . Six trials involved upper limb task-specific training (NCT02765152; Bosomworth 2013; NCT02235974; CTRI/2015/06/005877; Schultz 2012; Turton 2011) (Characteristics of ongoing studies).

Studies awaiting classification

Fourteen studies are awaiting classification (Baglary 2013; Bhaskar 2009; Brkic 2016; NCT02429180; Eng 2009; Ferrari 2015; Gandhi 2015; Indurkar 2013; Knox 2014; Kumar 2012; Pandian 2014; ChiCTR-ICR-15005992; Zhu 2013; Xu 2012) (Characteristics of studies awaiting classification).

Risk of bias in included studies

See Figure 2 and Figure 3.

Figure 2. 'Risk of bias' summary: review authors' judgements about each risk of bias item for each included study.

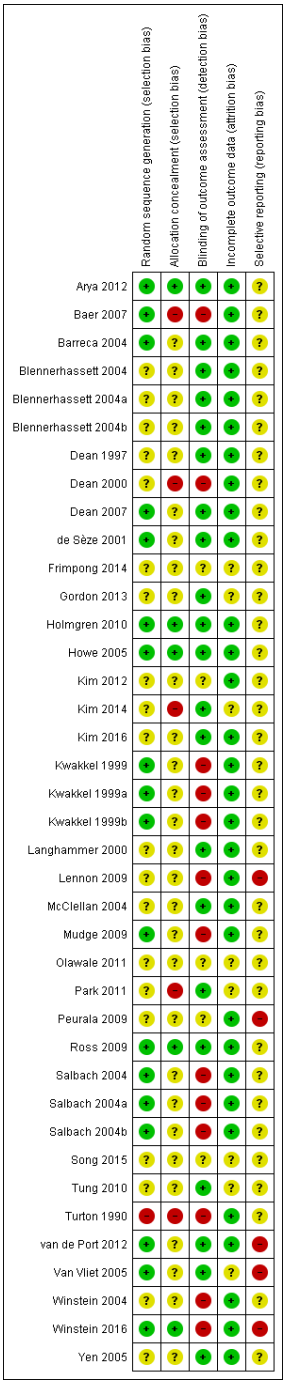
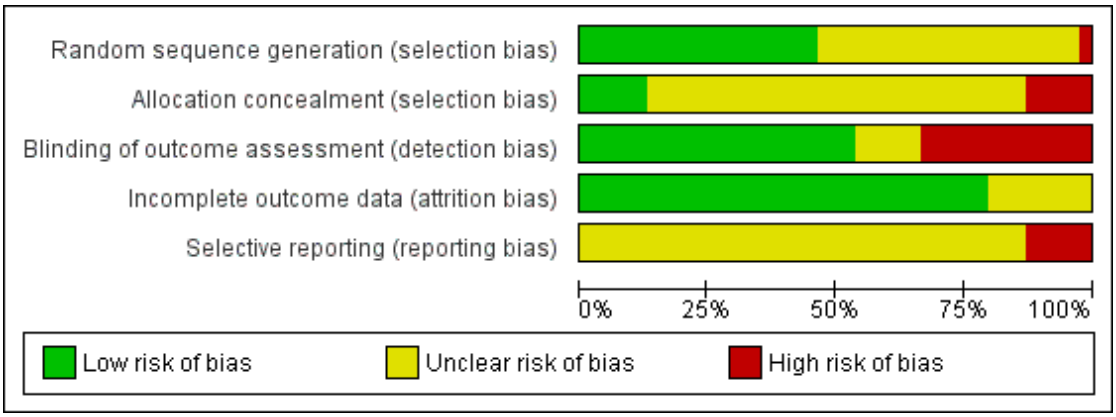


Figure 3. 'Risk of bias' graph: review authors' judgements about each risk of bias item presented as percentages across all included studies.



Allocation

Random sequence generation was adequate in 14 trials (Arya 2012; Baer 2007; Barreca 2004; Dean 2007; de Sèze 2001; Holmgren 2010; Howe 2005; Kwakkel 1999; Mudge 2009; Ross 2009; Salbach 2004; van de Port 2012; Van Vliet 2005; Winstein 2016). Allocation concealment was adequate in five trials (Arya 2012; Holmgren 2010; Howe 2005; Ross 2009; Winstein 2016).

Blinding

20 trials reported blinding of the outcome assessor (Arya 2012; Barreca 2004; Blennerhassett 2004; Dean 1997; Dean 2007; de Sèze 2001; Gordon 2013; Holmgren 2010; Howe 2005; Kim 2014;Kim 2016; Langhammer 2000; McClellan 2004; Park 2011; Ross 2009; Tung 2010; van de Port 2012; Van Vliet 2005; Winstein 2016; Yen 2005), however unblinding occurred in two trials (Baer 2007; Winstein 2016).

Incomplete outcome data

We deemed 25 trials to be at low risk of bias in relation to incomplete outcome data (Arya 2012; Baer 2007; Barreca 2004; Blennerhassett 2004; Dean 1997; Dean 2000; Dean 2007; de Sèze 2001; Holmgren 2010; Howe 2005; Kim 2012; Kim 2016; Kwakkel 1999; Langhammer 2000; Lennon 2009; McClellan 2004; Mudge 2009; Peurala 2009; Ross 2009; Salbach 2004; Turton 1990; van de Port 2012; Winstein 2004; Winstein 2016; Yen 2005).

Selective reporting

There were no study protocols available for any of the included trials to allow us to make a judgement of low risk of bias in relation to selective reporting with the exception of one recent trial (Winstein 2016) . All primary measures were not reported in five studies (Lennon 2009; Peurala 2009; van de Port 2012; Van Vliet 2005; Winstein 2016).

Other potential sources of bias

To detect systematic differences in care provided to participants in comparison groups other than the intervention under investigation, we assessed trials to determine whether groups were treated equally. In 15 studies participants in the intervention group received additional hours of therapy (Baer 2007; Frimpong 2014; Holmgren 2010; Howe 2005; Kim 2012; Kim 2014; Kim 2016; Park 2011; Peurala 2009; Ross 2009; Song 2015; Tung 2010; Turton 1990; van de Port 2012; Winstein 2004).

There is some evidence of baseline imbalance in 10 trials (de Sèze 2001; Dean 2000; Dean 2007; Kim 2012; Langhammer 2000; Lennon 2009; Tung 2010; Turton 1990; van de Port 2012; Van Vliet 2005); in van de Port 2012 analyses were adjusted for covariates at baseline.

Effects of interventions

See: **Summary of findings for the main comparison**

Primary outcomes

Results are presented for 1) upper limb, and 2) lower limb outcomes. All results are post therapy, except for Langhammer 2000, which is three months post stroke, and Van Vliet 2005, which is three months post baseline. We were not able to obtain data suitable for pooling from Baer 2007 and Song 2015.

Upper limb function: post treatment

Results are presented for 1) arm function, 2) hand function, and 3) sitting balance and reach.

Comparison 1.1: Arm function

Eleven trials recruiting 844 participants measured arm function (Arya 2012; Blennerhassett 2004a; Kwakkel 1999b; Langhammer 2000; Ross 2009; Salbach 2004b; Turton 1990; Van Vliet 2005; Winstein 2004; Winstein 2016; Yen 2005). Data were available for 88.7% (N = 749) of participants. The impact of functional training on upper limb function post therapy overall indicated a statistically significant effect favouring the treatment group: standardised mean difference (SMD) 0.25, 95% confidence interval (CI) 0.01 to 0.49 (Analysis 1.1, GRADE: low quality).

Comparison 1.2: Hand function

Eight trials recruiting 701 participants measured hand function (Arya 2012; Blennerhassett 2004a; Langhammer 2000; Ross 2009; Salbach 2004b; Turton 1990; Van Vliet 2005; Winstein 2016). Data were available for 88.3% (N = 619) of participants. The impact of functional training on hand function was statistically significant favouring the treatment group: SMD 0.25, 95% CI 0.00 to 0.51 (Analysis 1.2, GRADE: low quality).

Comparison 1.3: Sitting balance/reach

Six trials, recruiting 268 participants, measured sitting balance or functional reach (de Sèze 2001; Dean 1997; Dean 2007; Howe 2005; Langhammer 2000; Van Vliet 2005). Data were available for 82.8% (N = 222) of participants. There was some heterogeneity of treatment effects (I^2 = 48%), although not sufficient to merit the use of a random-effects approach. The impact of functional training on sitting balance and reach was statistically significant: SMD 0.28, 95% CI 0.01 to 0.55 (Analysis 1.3, GRADE: low quality).

Upper limb function: follow-up

Comparison 2.1: All outcomes

Less than six months post treatment

Three trials recruiting 158 participants measured some aspect of upper limb function for retention effects of repetitive task training (RTT) interventions under six months post treatment (Arya 2012; de Sèze 2001; Howe 2005). Data were available for 96.8% (N = 153) of participants. There was a large effect size, which was statistically significant: SMD 0.92, 95% CI 0.58 to 1.26 (Analysis 2.1).

Between six and 12 months post treatment

Six trials recruiting 505 participants measured arm function for retention effects of RTT interventions between six and 12 months post treatment (Blennerhassett 2004a; Dean 2007; Langhammer 2000; Van Vliet 2005; Winstein 2004; Winstein 2016). Data were available for 81.6% (N = 412) of participants. Results showed no effect of treatment: SMD 0.10, 95% CI -0.09 to 0.30 (Analysis 2.1).

Upper limb function: subgroup analyses

Comparison 3.1: Dosage of task practice

Trials were classified according to whether they provided zero to 20 hours of therapy (nine trials), or more than 20 hours of therapy (six trials). The difference between groups did not reach statistical significance (Chi^2 = 0.39, df = 1, P = 0.53) (Analysis 3.1).

Comparison 3.2: Time since stroke

Trials were classified according to whether they recruited within 15 days post stroke (four trials), 16 days to six months post stroke (seven trials), or more than six months post stroke (four trials). The difference between the groups did not reach statistical significance (Chi^2 = 1.16, df = 2, P = 0.56) (Analysis 3.2).

Comparison 3.3: Type of intervention

Trials were classified according to whether they were whole therapy approaches (three trials), mixed task training (eight trials), or single task training (four trials). The difference between the groups did not reach statistical significance (Chi^2 = 4.01, df = 2, P = 0.13) (Analysis 3.3).

Lower limb function: post treatment

Results are presented for 1) walking distance, 2) walking speed, 3) functional ambulation, 4) sit-to-stand, 5) lower limb function, and 6) standing balance/reach. All results are post therapy, except for Langhammer 2000, which is three months post stroke, and Van Vliet 2005, which is three months post baseline.

Comparison 4.1: Walking distance: change from baseline

Nine trials recruiting 638 participants measured walking distance (Blennerhassett 2004b; Dean 2000; Gordon 2013; Kim 2014; Kim 2016; Mudge 2009; Park 2011; Salbach 2004a; van de Port 2012). Data were available for 95.6% (N = 610) of participants. Change from baseline scores are presented. Using a random-effects model because of significant heterogeneity in treatment effects, results were statistically significant: mean difference (MD) 34.80, 95% CI 18.19 to 51.41 (Analysis 4.1, GRADE: moderate quality). In effect, participants in the experimental groups could walk on average 35 metres further in six minutes than those in the control groups.

Comparison 4.2: Walking speed

Twelve trials recruiting 748 participants measured walking speed, with data available for 91.6% (N = 685) of participants (Dean 1997; Dean 2000; Dean 2007; Frimpong 2014; Kim 2014; Kwakkel 1999a; Lennon 2009; Olawale 2011; Park 2011; Salbach 2004a; van de Port 2012; Van Vliet 2005). Results were not statistically significant: SMD 0.39, 95% CI -0.02 to 0.79 (Analysis 4.2, GRADE: low quality).

Comparison 4.3: Functional ambulation

Eight trials recruiting 592 participants measured functional ambulation, with data available for 88.7% (N = 525) of participants (de Sèze 2001; Frimpong 2014; Kwakkel 1999a; Langhammer 2000; McClellan 2004; Park 2011; van de Port 2012; Van Vliet 2005). Results indicated a statistically significant effect: SMD 0.35, 95% CI 0.04 to 0.66 (Analysis 4.3, GRADE: moderate quality).

Comparison 4.4: Sit-to-stand: post treatment/change from baseline

Seven trials recruiting a total of 397 participants included a measure of sit-to-stand, with data available for 87% (N = 346) (Barreca 2004; Blennerhassett 2004b; Dean 2000; Howe 2005; Langhammer 2000; Salbach 2004a; Van Vliet 2005). Results were significant overall: SMD 0.35, 95% CI 0.13 to 0.56 (Analysis 4.4).

Comparison 4.5: Lower limb functional measures

Five trials recruiting 473 participants included a measure of lower limb function, with data available for 88.6% (N = 419) of participants (Blennerhassett 2004b; Dean 2000; Langhammer 2000; van de Port 2012; Van Vliet 2005). Results overall showed a small but statistically significant effect size: SMD 0.29, 95% CI 0.10 to 0.48 (Analysis 4.5, GRADE: low quality).

Comparison 4.6: Standing balance/reach

Nine trials recruiting 520 participants measured standing balance or functional reach, with data available for 96.9% (N = 504) (de Sèze 2001; Holmgren 2010; Kim 2012; Kim 2016; McClellan 2004; Park 2011; Salbach 2004a; Tung 2010; van de Port 2012). Results showed a small but statistically significant effect size: SMD 0.24, 95% CI 0.07 to 0.42 (Analysis 4.6).

Lower limb function: follow-up

Comparison 5.1: all outcomes

Less than six months post treatment

Eight trials recruiting 496 participants measured some aspect of lower limb function for retention effects of RTT interventions under six months post treatment (de Sèze 2001; Dean 2000; Holmgren 2010; Howe 2005; Lennon 2009; McClellan 2004; Mudge 2009; van de Port 2012). Data were available for 95.0% (N = 471) of participants. Effects across trials were homogeneous (I^2 = 6%). Results showed a moderate effect size which was statistically significant: SMD 0.34, 95% CI 0.16 to 0.52 (Analysis 5.1).

Between six to 12 months post treatment

Six trials recruiting 318 participants measured some aspect of lower limb function for retention effects of RTT interventions between six to 12 months post treatment (Blennerhassett 2004b; Dean 2007; Holmgren 2010; Langhammer 2000; Lennon 2009; Van Vliet 2005). Data were available for 84.3% (N = 268) of participants. Results showed no treatment effect: SMD 0.06, 95% CI -0.18 to 0.31 (Analysis 5.1).

Lower limb function: subgroup analyses

Comparison 6.1: Dosage of task practice

Eight trials providing more than 20 hours of task practice showed a moderate, statistically significant effect size: SMD 0.33, 95% CI 0.16 to 0.50. There was a small, statistically significant effect from 16 trials providing 20 hours training or less: SMD 0.39, 95% CI 0.07 to 0.71. However, the difference in effects between these subgroups was not statistically significant (Chi^2 = 0.08, df = 1, P = 0.77) (Analysis 6.1).

Comparison 6.2: Time since stroke

The analysis suggests that size of the effect on lower limb function is the same whether recruitment to training is within 15 days post stroke (five trials): SMD 0.16, 95% CI -0.15 to 0.46, from 15 days to six months of stroke (nine trials): SMD 0.52, 95% CI -0.03 to 1.07, or more than six months post stroke (10 trials): SMD 0.41, 95% CI 0.21 to 0.60. There was no statistically significant difference between subgroups (Chi^2 = 2.29, df = 2, P = 0.32) (Analysis 6.2).

Comparison 6.3: Type of intervention

Results for single task (five trials): SMD 0.07, 95% CI -0.42 to 0.55, and whole therapy approaches (two trials): SMD 0.10, 95% CI -0.24 to 0.43 were not statistically significant . Mixed training (17 trials) had a moderate and statistically significant effect: SMD 0.42, 95% CI 0.17 to 0.67. There was no statistically significant difference between subgroups (Chi^2 = 3.16, df = 2, P = 0.21) (Analysis 6.3).

Secondary outcomes

Results are presented for 1) ADL function, 2) global motor function, 3) quality of life/health status, and 4) adverse events.

Comparison 7.1: Activities of daily living (ADL) function

Eleven intervention-control pairs, recruiting a total of 616 participants, used a measure of ADL with data available for 85.5% (N = 527) (de Sèze 2001; Gordon 2013; Holmgren 2010; Kim 2016; Kwakkel 1999a; Kwakkel 1999b; Langhammer 2000; Ross 2009; Salbach 2004a; Salbach 2004b; Van Vliet 2005). Kwakkel 1999 comprises the combined results for the upper and lower limb training groups compared against a splint control group, based on the assumption that effect sizes are similar for the two intervention-control pairs. The data presented for Salbach 2004 are the results for the lower limb training group compared against the upper limb training attention control group (Salbach 2004a). Overall results indicated a small effect size that was statistically significant: SMD 0.28, 95% CI 0.10 to 0.45 (Analysis 7.1).

Comparison 7.2: Global motor function

Five trials, recruiting a total of 269 participants measured global motor function (Kim 2014; Langhammer 2000; Peurala 2009; Tung 2010; Van Vliet 2005). Results were available for 82.5% (N = 222) of participants and indicated a small to moderate effect size; this was statistically significant: SMD 0.38, 95% CI 0.11 to 0.65 (Analysis 7.2, GRADE: moderate quality). There were too few trials to undertake planned subgroup analyses for global functional outcomes.

Comparison 7.3: Quality of life/health status

Four intervention-control pairs recruiting 305 participants used a measure of quality of life or health status, with data available for 86.6% (N = 264) (Barreca 2004; Gordon 2013; Kwakkel 1999; Langhammer 2000). All results are post therapy except Kwakkel 1999, which was measured at 26 weeks. There was a small effect size, which was statistically significant: SMD 0.28, 95% CI 0.04 to 0.53 (Analysis 7.3).

Adverse events

One trial of sit-to-stand training presented data for the number of falls: intervention group 3/25 (12%) versus control group 4/23 (17.4%), OR 0.65, 95% CI 0.13 to 3.27 (Barreca 2004). In one trial of an intensive lower limb exercise programme, 11 participants in total fell during the study (32%), five in the intervention group and six in the attention control group (Holmgren 2010). Fall frequency was reported as 1.35 falls per person per year. Three participants in each group (18%) fell more than once; the most falls for any single subject was six. In the FIT-Stroke trial, 29 falls were reported in the circuit training group and 26 in the usual physiotherapy group (P = 0.93) (van de Port 2012). Two serious adverse events were reported in the circuit training group: one participant fell and consulted a GP and one patient experienced arrhythmias during one session.

In one trial of an upper limb intervention there were 168 serious adverse events involving 109 participants (Winstein 2016). The most common were hospitalisation (N = 143, 25% of randomised participants) and recurrent stroke (N = 42, 9% of randomised participants). Adverse events were not presented by trial arm.

Two trials narratively reported no adverse effects (de Sèze 2001; McClellan 2004). In Salbach 2004, intervention-related reasons for withdrawal that could be interpreted as adverse events included one participant out of 47 in a mobility training group who experienced the onset of groin pain. Four participants also fell during the mobility intervention but did not suffer injury and continued to participate in the group. Two falls also occurred during evaluation. No other trials reported intervention-related reasons for withdrawal, however one study reported a withdrawal due to "disinterest" in the intervention group and one withdrawal who did not like the group sessions in the comparison group (Mudge 2009).

Sensitivity analyses

We carried out planned sensitivity analysis to investigate the following.

Studies with adequate allocation concealment (i.e. removing studies with high or unclear risk of bias for allocation concealment)

The significance of post treatment results was affected for Comparison 1.1 Arm function (removing eight studies: Blennerhassett 2004a; Kwakkel 1999b; Langhammer 2000; Salbach 2004b; Turton 1990; Van Vliet 2005; Winstein 2004; Yen 2005) (SMD 0.38, 95% CI -0.40 to 1.15), and Comparison 1.2 Hand function (removing five studies: Blennerhassett 2004a; Langhammer 2000; Salbach 2004b; Turton 1990; Van Vliet 2005) (SMD 0.38, 95% CI -0.22 to 0.98).

Sensitivity analysis was not possible for the following primary outcomes as one or no studies had adequate allocation concealment: sitting balance/reach, walking distance, walking speed, functional ambulation, sit-to-stand, lower limb functional measures and standing balance/reach.

Studies with an attention control comparison (i.e. removing studies with a usual care comparison)

The significance of post-treatment results was affected for Comparison 1.1 Arm function (removing eight studies: Arya 2012; Langhammer 2000; Ross 2009; Turton 1990; Van Vliet 2005; Winstein 2004; Winstein 2016; Yen 2005) (SMD 0.17, 95% CI -0.16 to 0.49), Comparison 1.2 Hand function (removing six studies: Arya 2012; Langhammer 2000; Ross 2009; Turton 1990; Van Vliet 2005; Winstein 2016) (SMD 0.19, 95% CI -0.17 to 0.55), Comparison 4.3 Functional ambulation (removing six studies> de Sèze 2001; Frimpong 2014; Langhammer 2000; Park 2011; van de Port 2012; Van Vliet 2005) (SMD 0.19, 95% CI -0.72 to 1.10), Comparison 4.5 Lower limb functional measures (removing three studies: Langhammer 2000; van de Port 2012; Van Vliet 2005) (SMD 0.60, 95% CI -0.05 to 1.25), and Comparison 4.6 Standing balance/reach (removing six studies: de Sèze 2001; Kim 2012; Kim 2016; Park 2011; Tung 2010; van de Port 2012) (SMD 0.21, 95% CI -0.12 to 0.54).

Results were not affected for Comparison 1.3 Sitting balance/reach, Comparison 4.1 Walking distance, Comparison 4.2 Walking speed and Comparison 4.4 Sit-to-stand.

Studies with no additional therapy time (i.e. removing studies with additional therapy time)

The significance of post-treatment results was affected for Comparison 1.3 Sitting balance/reach (removing one study, Howe 2005) (SMD 0.28, 95% CI -0.01 to 0.57), Comparison 4.3 Functional ambulation (removing three studies, Frimpong 2014; Park 2011; van de Port 2012) (SMD 0.25, 95% CI -0.03 to 0.54), Comparison 4.5 Lower limb functional measures (removing one study, van de Port 2012) (SMD 0.20, 95% CI -0.10 to 0.50) and Comparison 4.6 Standing balance/reach (removing six studies, Holmgren 2010; Kim 2012; Kim 2016; Park 2011; Tung 2010; van de Port 2012) (SMD 0.29, 95% CI -0.06 to 0.63).

Results were not affected for Comparison 1.1 Arm function, Comparison 1.2 Hand function, Comparison 4.1 Walking distance, Comparison 4.2 Walking speed and Comparison 4.4 Sit-to-stand

Studies where the intervention was delivered at an individual level (i.e. removing studies delivered at a group level)

The significance of post-treatment results was affected for Comparison 4.3 Functional ambulation (removing two studies: Frimpong 2014; van de Port 2012) (SMD 0.24, 95% CI -0.01 to 0.48) and Comparison 4.5 Lower limb functional measures (removing three studies: Blennerhassett 2004b; Dean 2000; van de Port 2012) (SMD 0.09, 95% CI -0.24 to 0.43).

Results were not affected for Comparison 4.1 Walking distance, Comparison 4.2 Walking speed and Comparison 4.6 Sit-to-stand.

DISCUSSION

Summary of main results

Upper limb function/sitting balance

There was evidence for the effectiveness of repetitive task training (RTT) on arm function (SMD 0.25, 95% CI 0.01 to 0.49; GRADE: low quality), hand function (SMD 0.25, 95% CI 0.00 to 0.51; GRADE: low quality), and sitting balance/functional reach (SMD 0.28, 95% CI 0.01 to 0.55; GRADE: low quality). There is evidence the effect was maintained up to six months post therapy (SMD 0.92, 95% CI 0.58 to 1.26), but not between six months and one year post therapy (SMD 0.10, 95% CI -0.09 to 0.30). Treatment effects were not modified by dosage of task practice, type of intervention, or time since stroke.

Results for arm and hand function are no longer significant when studies with unclear or poor allocation concealment are removed from the analysis; removing studies with a usual care comparison also changes the direction of significance. Results for sitting balance/reach are no longer significant when one study with additional therapy time is removed.

One study appears to be an outlier, with a much larger treatment effect on arm function than other studies in the comparison (Arya 2012). This may be explained by the inclusion of participants with less severe stroke (National Institute of Health Stroke Scale score < 14) and participants able to participate in "intensive exercise". The study also reported received intensity of intervention (around 55 minutes per session for the intervention group); this information was rarely reported and it is therefore uncertain whether the specified level of intervention was achieved in the majority of studies.

Lower limb function/standing balance

There was evidence for a statistically significant small to moderate impact of RTT training on walking distance (MD 34.80, 95% CI 18.19 to 51.41; GRADE: moderate quality), sit-to-stand (SMD

0.35, 95% CI 0.13 to 0.56) and functional ambulation (SMD 0.35, 95% CI 0.04 to 0.66; GRADE: moderate quality). There was also evidence of effect on lower limb functional measures (SMD 0.29, 95% CI 0.10 to 0.48; GRADE: low quality), and standing balance/reach (SMD 0.24, 95% CI 0.07 to 0.42). Results at follow-up were statistically significant at up to six months post therapy (SMD 0.34, 95% CI 0.16 to 0.52), but not up to one year post therapy (SMD 0.06, 95% CI -0.18 to 0.31). There is no evidence to suggest task training is more effective if delivered within 15 days, between 16 days and six months, or more than six months after stroke. Effects of larger versus smaller amounts of training also did not reach statistical significance (P = 0.77); type of training (whole therapy, mixed training or single task training) also did not reach statistical significance (P = 0.21), however the sample size for single task training (112) and whole therapy (138) was comparatively small.

Results for functional ambulation, lower limb functional measures, and standing balance/reach were no longer significant when studies with a usual care comparison were removed. Removing studies with additional therapy time changed results to non-significant for functional ambulation, lower limb functional measures, and standing balance/reach. Results for functional ambulation and lower limb functional measures also became non-significant when studies delivering the intervention in a group setting were removed.

One recent study appears to be an outlier, with a larger effect on walking speed and functional ambulation than other studies in these comparisons (Frimpong 2014). Possible explanations could be the small sample size (20 participants in total) and poor study quality: insufficient details were provided for all risk of bias elements. Removing this study from the analysis does not change the direction of statistical significance in either comparison.

Secondary outcomes

For the five trials using global motor function measures, there was a small effect on global motor function (SMD 0.38, 95% CI 0.11 to 0.65) (Kim 2014; Langhammer 2000; Peurala 2009; Tung 2010; Van Vliet 2005). There was a small, statistically significant effect on activities of daily living (ADL) (SMD 0.28, 95% CI 0.10 to 0.45) and perceptions of quality of life/health status (SMD 0.28, 95% CI 0.04 to 0.53). There was insufficient evidence to be certain of the risk of adverse events.

Overall completeness and applicability of evidence

The included trials were clinically diverse in focus and there are gaps in the evidence base, particularly for people who are more than six months post stroke. Only four trials evaluated the impact of RTT on upper limb function in people more than six months post stroke: three trials for 20 hours or less (Dean 1997; Mudge 2009; Salbach 2004b), and two for more than 20 hours (Ross 2009; Yen 2005). Only five trials evaluated the impact of more than 20 hours of RTT on upper limb function in people zero to six months post stroke (Arya 2012; Kwakkel 1999b; Turton 1990; Winstein 2016). More trials have focused on the impact of RTT on lower limb function, but there are also gaps in the evidence, with only six trials evaluating more than 20 hours lower limb training in people zero to six months post stroke (Holmgren 2010; Kim 2016; Kwakkel 1999a; McClellan 2004; Peurala 2009; van de Port 2012).

Although we were unable to classify participants into more disabled or less disabled participant subgroups, the Characteristics of included studies table illustrates the wide range of disability levels of the participants within the included trials. However, many of the trials had inclusion criteria specifying either minimum, or minimum and maximum levels of ability, motivation to participate, and ability to understand instruction. The evidence provided by the review therefore appears to be widely applicable, perhaps with the exception of very severely disabled people with little postural control or voluntary movement, those with very mild deficits, and those with severe communication difficulties. Seven of the 33 included studies (Howe 2005; Holmgren 2010; Kwakkel 1999; Lennon 2009; Ross 2009; van de Port 2012; Van Vliet 2005) reported stroke subtype using the Oxfordshire Community Stroke Project classification tool (Bamford 1991).

The acceptability and safety of RTT to all types of participants is unclear. While there were few adverse effects reported overall, the lack of formal reporting means this finding is inconclusive. Of the information provided about reasons for dropouts in the trials, the most frequent cause was physical illness, and only a very small proportion of those participating dropped out for physical reasons that might have been related to the intervention. There was also a small number of participants who were lost to follow-up for reasons related to compliance or treatment preference.

Information about recruitment was not often provided but, of those that did provide information, a large trial recruiting inpatients early after stroke had a relatively low number of refusals to participate (for example, Kwakkel 1999 had four out of 101 participants who did not give consent), while a trial recruiting in the community after rehabilitation had high numbers of refusal of the intervention (Salbach 2004a had 73% refusal). It may be that some forms of intervention are less acceptable, or that interventions only appeal to a subset of stroke survivors, particularly if travel is involved.

We were unable to reach any conclusions about the impact of numbers of repetitions as a measure of the intensity of practice, as this information was rarely provided. The amount of task practice is therefore a measure of the intervention sessions' duration rather than the amount of time spent doing repetitive task practice or the number of repetitions.

We were also unable to comment on the resource implications of different sites of treatment, therapist-delivered versus self-de-

livered interventions, or group versus individual delivery, as there were too few trials for comparison. However, the presence of three trials involving self-delivery in the home environment (Holmgren 2010 (last week of the intervention only); McClellan 2004; Turton 1990), and six trials involving group delivery of task-specific training (Barreca 2004; Blennerhassett 2004; Dean 2000; Kim 2012; Mudge 2009; van de Port 2012), suggest that these modes of delivery are feasible. The two studies that collected information showed generally high levels of satisfaction with the programme (Barreca 2004; Dean 2000). Attendance levels at community programmes were also very good, suggesting that these training programmes were well received by those who chose to participate.

Our review aimed to assess whether RTT alone leads to functional gains in the absence of other mechanisms of action. However, it could be argued that RTT as an intervention necessarily includes some additional mechanisms, For example, many of the trials referred to motor learning principles as the basis for the intervention. This approach involves a much more complex set of principles than just task-specific repetition, including targeting to individual needs, task variation, and particular forms of feedback. Inclusion of these trials in the review suggests reducing motor learning or movement science therapies to their lowest common denominator, but even those trials that did not claim a basis in such approaches often also included aspects of active learning, task shaping, feedback, or individualisation of treatment.

Our definition of RTT, and subsequent decisions about study inclusion, have consequences for the applicability of the evidence. We excluded trials when the repetition described appeared to be primarily for strength or endurance training, for example cycling or gait training, and when the type of training appeared divorced from the functional aim, for example backward walking training, slot machines, or computer games. By the exclusion of trials of what could be defined as 'pre-functional' types of movement, we will effectively have excluded a group of people who cannot yet participate in functional movement. The same consequence applies to the exclusion of trials with a large element of passive and active-assisted movement.

Since the publication of the original review RTT has become an established intervention tested in rehabilitation trials. The quality of reporting of RTT interventions has also greatly improved. As a consequence, it is likely that new studies included in this update will more closely resemble the inclusion criteria and definition of RTT than those included in the original review.

Quality of the evidence

Poor reporting, particularly in the earlier studies, meant the overall risk of bias was unclear for many studies: only eight out of the 33 trials had adequate allocation concealment, however 22 studies had blinded outcome assessment. Many of the trials were small, with 21 trials having less than 50 participants. The inclusion of pilot and feasibility trials (five studies) suggests many were not powered to detect a difference between intervention groups. Eleven studies not described as pilot or feasibility trials reported a power calculation; in a further 13 studies this was not reported.

Potential biases in the review process

When designing the review, we made an early decision to consider the effect of RTT on upper and lower limb function outcomes separately, as we thought that there might be a differential impact. The results of the review support this decision, although there are two disadvantages. Firstly, we are unable to give an overall effect estimate for RTT, although considering the different interventions and objectives of upper and lower limb training this may not have been a clinically meaningful figure. Secondly, subgroup analyses are smaller, and therefore less well powered than they would have been if all trials had been combined. As the number of studies reported in the subgroup analyses are small, the results should be treated with caution.

Our major focus in this review was impact on task-specific function. In practice, we excluded a large number of studies on the basis that we did not judge the outcomes to be functional, or the intervention to be task-specific. We have also included studies where our interpretation of the intervention was that repetition of functional movement was a major mechanism of action (for example, de Sèze 2001). Whether balance training is truly 'functional' is also a matter of interpretation.

Although interventions were often well described, it was sometimes difficult to estimate the relative intensity of treatment, especially within mixed interventions. Information on the number of repetitions was rarely available. This potentially means that the review is investigating the impact of functional task specificity rather more than the element of repetition. Our decision was to include trials if we could clearly identify the amount of practice.

The included trials used a wide range of outcome measures, methodologies and time intervals for follow-up making summary statistics difficult. We made strenuous efforts to obtain data suitable for pooling for each outcome, but sometimes these were not available, and the method of pooling less than optimum, such as the use of standardised mean difference for walking speed. It would have been better to use outcome changes compared with baseline, especially for analyses with smaller numbers of participants, but these were also not available across trials. We also generally used fixed-effect analyses, which some might criticise due to the presence of some clinical heterogeneity in the treatments and trials combined.

The subgroup analysis of trial design (that is, attention control versus usual care control) did reach statistical significance (P = 0.88). However, maintaining the upper and lower limb trials separately meant that further subdivision into type of comparison group was not feasible.

Agreements and disagreements with other studies or reviews

In contrast to the original review, which found no evidence of significant benefit from RTT of the upper limb, this update suggests significant benefit both on arm and hand function, with benefits sustained at short-term follow-up (up to six months post intervention). However, studies were heterogeneous (I^2 58% and 54% for arm and hand function, respectively). Repetitive task training of the lower limb found significant benefit on all primary and secondary outcome measures with the exception of walking speed. This is in line with recent reviews on physical therapy (Verbeek 2014) and interventions directed at motor recovery after stroke (Langhorne 2009).

Treatment effects of longer versus shorter amounts of training did not reach statistical significance for the upper limb, suggesting results are not moderated by the amount of practice. Upper limb findings do not support a recent review and meta-analysis of physical therapy post stroke (Verbeek 2014), suggesting high-intensity practice (specifically an additional 17 hours therapy time over 10 weeks) is necessary for functional benefit. Findings also do not support the identified dose-response relationship between amount of therapy and improved outcome for upper limb training found in Kwakkel 2004.

For the lower limb, the effect of more than 20 hours of task training was greater than that of zero to 20 hours training, but the difference between subgroups was not significant.(P = 0.77), contrary to the findings of Van der Lee 2001, where more than 20 hours was found to be preferable to up to 20 hours of training. A recent review of physical therapy approaches similarly concluded that in relation to the dose of intervention, subgroup analysis revealed a dose of 30 to 60 minutes per day delivered five to seven days per week was effective in terms of independence in ADL (Pollock 2014b). Results from subgroup analysis suggest further research into the dose-response relationship in lower limb interventions should be a priority.

There were small positive effects on global motor function, ADL and functional ambulation. Even though the amount of change is small, the clinical benefit of the change in activities of daily living is likely to be meaningful in relation to quality of life (Van Exel 2004).

In those studies that did show a benefit and provided later assessments, improvements at the end of training were evident in both upper and lower limb function up to six months post treatment but not beyond. It is unclear from this review whether this is related to characteristics of the participants, the intensity of training or the degree of improvement required before detectable change was noted.

Evidence from this review does not support the suggestion that earlier provision of treatment results in greater functional improvement. Improvement in function was possible even in the later stages of recovery (Page 2004).

In a review of physiotherapy treatments after stroke (Pollock 2014b), it is suggested that research should be conducted to determine the efficacy of clearly described individual techniques and task-specific treatments. Clear definition of individual techniques still remains a challenge but this review suggests that focusing on specific treatments is possible; there are now taxonomies for grouping such interventions (e.g. Pollock 2014a). Readers may not agree with some of our classification of studies, but the review authors compared all interventions in detail to make these difficult decisions.

The mechanisms of action responsible for any lower limb functional gain are still unclear. Many of the interventions were mixed, and while all contained repetition and functional practice, they could also include elements of endurance or strength training. However, the review of treadmill training found people after stroke who receive treadmill training with or without body weight support are not more likely to improve their ability to walk independently compared with people after stroke not receiving treadmill training, but there may be improvement in walking speed and walking endurance (Mehrholz 2014). Results of a recent review of robot-aided therapy on arm function found moderate quality evidence that robotics may be effective in improving upper limb impairment and ADL outcomes (Mehrholz 2015b). However, robotics may not be more beneficial than conventional therapy at the same dose. Given that repetition is a major mechanism of action in both treadmill and robotics, this would suggest that reflecting real-world task complexity in training is a significant factor. However, other potential mechanisms of action are also implicit in some of the trial interventions, such as self-efficacy, task-novelty, and motivation to participate in the interventions delivered in a group setting.

AUTHORS' CONCLUSIONS

Implications for practice

The results of this review provide low- or moderate-quality evidence to validate the general principle that repetitive, task-specific training for lower limbs can result in functional gain when compared against other forms of usual care or attention control. There is low-quality evidence of improvement in arm and hand function following repetitive task training (RTT) of the upper limb. Effects for both upper and lower limb appear to be sustained up to six months post treatment. Some caution is needed in interpreting the lack of evidence of adverse effects, as few trials specifically monitored these as outcomes. If task-specific training is used in clinical practice, adverse effects should be monitored.

Implications for research

Further primary research should be directed towards exploration of the amount of lower limb task training actually performed, as

opposed to the length of the therapy session, and include number of repetitions, and how to maintain functional gain after six months post treatment. It is unclear whether task training accelerates recovery or simply improves performance for a finite time interval. This review provided some evidence of a treatment effect for upper limb function, although, with the exception of two studies (Arya 2012; Winstein 2016), sample sizes were small. The conclusion of this review about evidence for efficacy of task training for arm function is therefore tentative. More intensive therapy (over 20 hours) does not appear to be more effective for either the upper or lower limb.

There were insufficient trials included in the review to evaluate the efficacy and cost-effectiveness of different intervention delivery methods for RTT, such as group training, or practice in the home environment. Further randomised controlled trials should evaluate practical ways of delivering RTT interventions. In particular, the acceptability of circuit type training interventions in community settings needs to be evaluated. Further research should also address practical ways of maintaining post-therapy functional gain beyond six months. Future trials should be powered to detect cost-effectiveness as well as clinical effect, and should include a quality of life measure as one of the outcomes.

We were unable to investigate the impact on people of different levels of pre-intervention disability, because of the wide range of baseline measures used. Analyses of this type would be facilitated by the inclusion in trials of baseline data using a common measure, such as the Barthel Index, which can be related to population norms dependent on time since stroke.

This review did not compare repetitive functional task training against other interventions not currently viewed as a component of usual care. Future updates of this review are likely to compare RTT against other interventions (for example, resistance training, constraint-induced movement therapy or robotics), or in combination with other interventions (e.g. strength training) rather than RTT against "usual care". The definition of RTT will need revisiting prior to further updates of this review in order to ensure it remains clinically meaningful and distinguishable from other interventions (for example, treadmill training, Mehrholz 2014).

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* *Indicates the major publication for the study*

CHARACTERISTICS OF STUDIES

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

Arya 2012

Methods	An assessor-blinded, multicentre randomised controlled design
Participants	India Participants were recruited from an inpatient neurology ward and occupational therapy unit of a rehabilitation institute. Date of recruitment not reported 103 participants: 51 RTT, 52 control Inclusion criteria: first episode of unilateral stroke with hemiparesis, 4 to 24 weeks post stroke, functional ambulation classification level I and above, ability to understand instructions (Hindi Mental State Examination > 24), National Institute of Health Stroke Scale score < 14, able to cope with intensive training program, Brunnstrom stage of arm recovery of 2 to 5 Exclusion criteria: perceptual deficits such as neglect and apraxia, dementia, depression, impaired vision, impaired conscious level, concomitant medical illness, cardiovascular instability (resting systolic blood pressure > 200 mmHg and resting diastolic blood pressure > 100 mmHg), shoulder subluxation, aphasia, sensory loss Mean age: RTT 51.67 years (SD 7.96), control 50.21 years (SD 7.60) 60.2% male Stroke details: first stroke, ischaemic 66.9%, haemorrhagic 33.0% Timing post stroke: RTT 11.92 weeks (SD 6.49), control 12.37 weeks (SD 6.64) Pre-intervention functional ability level: Functional ambulation classification level I and above
Interventions	RTT intervention: Meaningful Task Specific Training (MTST) is a training program for upper extremity rehabilitation of post stroke clients based on principles of motor learning, experience dependent neuroplasticity, and shaping techniques MTST mainly comprises the specific number of meaningful tasks, which are common to all the patients The tasks have to be practiced repetitively either with unilateral (the most affected extremity) or bilateral upper limb/s, depending on the task requirement It also has a component of individualised meaningful tasks, which have to be selected from a task bank for repetitive practice Sessions were delivered as one-to-one outpatient rehabilitation in day care units 1 hour per day (unclear number of times per week) for 4 weeks Comparison group: the control group was given an intervention of the same duration based on the Brunnstrom movement therapy and Bobath neurodevelopmental technique
Outcomes	Outcome measures were recorded at baseline, 4 weeks (post treatment) and 8 weeks Upper limb functional outcome measures: Fugl-Meyer assessment, Action Research Arm Test, Graded Wolf Motor Function Test, Motor Activity Log
Notes	No significant differences at baseline 1 experimental dropout due to personal reasons No adverse events reported

Arya 2012 (*Continued*)

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	A random-number generator program was used
Allocation concealment (selection bias)	Low risk	Intervention assignments were enclosed in sealed envelopes, which were opaque and sequentially numbered
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Blinded assessors were trained to administer the measures properly, and they did not participate in providing the interventions
Incomplete outcome data (attrition bias) All outcomes	Low risk	Missing data balanced across intervention groups An intention-to-treat analysis was used with the last observation carried forward for the missing data
Selective reporting (reporting bias)	Unclear risk	No study protocol

Baer 2007

Methods	Prospective, single-blind randomised controlled pilot trial
Participants	UK Participants were recruited from the community 64 participants: 20 Whole practice, 23 Part practice, 21 control Inclusion criteria: • Age over 18 • At least 12 months post stroke • Residual neurological physical deficit due to stroke • Discharged from formal Physiotherapy • Mini Mental State Examination (MMSE) score ≥ 22 • Functional Reach Test ≥15 cm • Able to understand the nature of the study and give informed consent Exclusion criteria: • Age under 18 • Pre-existing gross neuropathology - e.g. Multiple Sclerosis, Parkinson's Disease • Co-existing pathology that would prohibit independent exercise - e.g. lower limb fracture • Pre-existing disabilities with grossly limited mobility (e.g. lower limb amputation) • History of two falls within the previous six months Mean age: 72.9 ± 9.0 48.4% male

	Stroke details: 38 right CVA, 26 left CVA Timing post stroke: 30.3 ± 28.8 months Pre-intervention functional activity level: RTT WP MAS mean 26.5 (SD 8.5), RTT PP 28.1 (7.9), control 26.5 (8.9); (MAS score ≥32 designated as "mild", ≤ 31 designated "moderate to severe")
Interventions	RTT intervention: the exercises consisted of practising standing up from a chair, sitting down, stepping onto a step, stepping off a step, pronation and supination holding a bottle and reaching and grasping. All participants allocated to an exercise "arm" of the trial practised the same functional exercises but in different ways: entirety (whole practice) or component parts (part practice). The clinical research assistant encouraged participants to increase the number of repetitions of exercises practiced if assessed to be appropriate The target number of repetitions of each exercise was documented in the exercise diary and participants were requested to document the actual number undertaken Comparison group: participants did not receive any physical intervention or exercise instruction but received the same number of visits by the research assistant to counteract the possible therapist interaction effect
Outcomes	Outcome measures were recorded at baseline (2 measurements 2 weeks apart), 4 weeks (post treatment) and 72 hours and 3 months post treatment Upper limb functional outcome measure: Frenchay Arm Test Lower limb functional outcome measures: Timed Up and Go 2m, Step Test, Step-up count of 15 seconds Other outcome measures: Barthel Index, MAS, Frenchay Activity Index, Stroke Impact Scale (activity)
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Randomised blocks within 4 strata of participants were used, based on side and severity of stroke, due to the small numbers of participants
Allocation concealment (selection bias)	High risk	Method of concealment not described
Blinding of outcome assessment (detection bias) All outcomes	High risk	Outcome data collected by the principal investigator who was blind to group allocation. The outcome assessor became aware of group allocation for 3 participants
Incomplete outcome data (attrition bias) All outcomes	Low risk	At the short-term follow-up point, data were missing for 5 control, 3 RTT PP and one RTT WP participant. Reasons are given by intervention group; for 2/5 of participants in the control group reasons were

Baer 2007 (*Continued*)

		not illness related
Selective reporting (reporting bias)	Unclear risk	No study protocol

Barreca 2004

Methods	Single centre RCT
Participants	Canada 48 participants: 25 RTT, 23 control Participants were recruited from stroke rehabilitation units between 2000 and 2001 Inclusion criteria: between the ages of 18 to 90 years, medically stable, had a postural control of Stage 3 or greater as measured by the Chedoke-McMaster Stroke Assessment (CMSA), and failed the third item of the CMSA Stage 4 Postural Control Exclusion criteria: none stated Median age: RTT 67 years (IQR 56 - 72), control 70 years (IQR 64 - 78) 65% male Stroke details: not stated whether first or recurrent stroke, 73% ischaemic, 42% right hemiparesis Timing post stroke: RTT median 30 days (IQR 21 to 48), control median 31 days (IQR 18 to 50) Pre-intervention functional ability level: lack of postural control
Interventions	RTT intervention: sit-to-stand training. Group class practice in attaining standing from sitting from a variety of different heights and surfaces Training was additional to usual care, which included daily strengthening exercise, repetitive training, functional training, electrical stimulation and other exercise Sessions were 45 minutes, 3 times per week until competence or discharge (approximately 6 weeks) = 13.5 hours + practice on ward Each session aimed to involve 3 practice sets of 5 sit-to-stand manoeuvres per class Average total repetitions during training = 450 to 500 Classes had 6 to 7 participants, supervised by 2 registered practical nurses, with extra practice delivered by nurses trained on the sit-to-stand protocol in a ward setting using videotapes, written instruction and practice Comparison group: usual care and recreation therapy
Outcomes	Outcome measures were recorded at baseline and at competence or discharge (approximately 6 weeks) Balance/sit-to-stand outcome measures: ability to stand independently and safely on 2 consecutive occasions Adverse events outcome measures: number of falls QoL/health status outcome measures: satisfaction with ability to stand, Dartmouth Primary Care Cooperative Chart
Notes	No significant differences in baseline characteristics

Risk of bias

Barreca 2004 (*Continued*)

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Assigned by coin flip
Allocation concealment (selection bias)	Unclear risk	Inadequately reported
Blinding of outcome assessment (detection bias) All outcomes	Low risk	A research physiotherapist, blind to the study, tested the participants' STS movement once per week
Incomplete outcome data (attrition bias) All outcomes	Low risk	No loss to follow-up at end of treatment phase
Selective reporting (reporting bias)	Unclear risk	No study protocol

Blennerhassett 2004

Methods	Single-centre RCT
Participants	Australia 30 participants: 15 mobility group, 15 upper limb group Participants were recruited from inpatient admissions, with a primary diagnosis of stroke, to a rehabilitation centre between 2001 and 2003 Inclusion criteria: able to walk 10 metres and provide informed consent Exclusion criteria: deteriorating medical condition, independent community ambulation Mean age: mobility group 53.9 years (SD 19.8), upper limb group 56.3 years (SD 10.5) 56.6% male Stroke details: first or recurrent stroke, 73% ischaemic, 47% right hemiparesis Timing post stroke: mobility group 36 days (SD 25.1), upper limb group 50 days (SD 49.2) Pre-intervention functional ability level: Six Minute Walk Test: mobility group 183 metres (SD 85), upper limb group 181 metres (SD 85)
Interventions	RTT interventions: • Mobility group: circuit training including sit-to-stand, step-ups, obstacle course, plus stretching/strengthening exercise, and some endurance training (stationary bikes/ treadmill) • Upper limb group: reach and grasp, hand-eye co-ordination activities, stretching and strengthening exercises Sessions were during inpatient rehabilitation and additional to usual care of 5 hours per week Sessions were 60 minutes, 5 times per week for4 weeks = 20 hours Each circuit included 10 x 5-minute workstations Sessions were delivered by a physical therapist in groups of up to 4 participants Comparison group: Blennerhassett 2004a lower limb attention control Blennerhassett 2004b upper limb attention control

Blennerhassett 2004 (*Continued*)

Outcomes	Outcome measures were recorded at baseline, 4 weeks (post treatment) and 6 months after training Upper limb functional outcome measures: MAS, Jebsen Taylor Test of Hand Function Lower limb functional outcome measures: Six Minute Walk Test, Step Test Balance/sit-to-stand outcome measures: Timed Up and Go Test
Notes	No significant differences reported at baseline 3% lost to follow-up at end of treatment phase No likely intervention-related withdrawals Average attendance was approximately 80%, with no significant difference between the groups

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Inadequately reported
Allocation concealment (selection bias)	Unclear risk	Randomisation performed by a person independent from the study, drawing a pre-sealed opaque envelope that specified group allocation, unclear if sequentially numbered
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Outcome assessors blinded to group allocation
Incomplete outcome data (attrition bias) All outcomes	Low risk	One withdrawal in the upper limb group due to hip fracture from fall post discharge
Selective reporting (reporting bias)	Unclear risk	No study protocol

Blennerhassett 2004a

Methods	See Blennerhassett 2004
Participants	
Interventions	
Outcomes	
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**

Blennerhassett 2004a (*Continued*)

Random sequence generation (selection bias)	Unclear risk	See Blennerhassett 2004
Allocation concealment (selection bias)	Unclear risk	See Blennerhassett 2004
Blinding of outcome assessment (detection bias) All outcomes	Low risk	See Blennerhassett 2004
Incomplete outcome data (attrition bias) All outcomes	Low risk	See Blennerhassett 2004
Selective reporting (reporting bias)	Unclear risk	See Blennerhassett 2004

Blennerhassett 2004b

Methods	See Blennerhassett 2004
Participants	
Interventions	
Outcomes	
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	See Blennerhassett 2004
Allocation concealment (selection bias)	Unclear risk	See Blennerhassett 2004
Blinding of outcome assessment (detection bias) All outcomes	Low risk	See Blennerhassett 2004
Incomplete outcome data (attrition bias) All outcomes	Low risk	See Blennerhassett 2004
Selective reporting (reporting bias)	Unclear risk	See Blennerhassett 2004

de Sèze 2001

Methods	Single-centre pilot RCT
Participants	France 20 participants: 10 RTT, 10 control group Participants recruited from a neurorehabilitation unit in 1998 Inclusion criteria: hemiplegia caused by a single stroke occurring at least 1 month previously, static imbalance of the trunk resulting from the stroke Exclusion criteria: multiple cerebral lesions, disorders of the locomotor system, a severe visual or auditory deficit, a severe deficit of executive functions, or deterioration in the general state of health that might alter postural performances Mean age: RTT 63.5 years (SD 17), control 67.7 years (SD 15) 55% male Stroke details: first stroke, 35% ischaemic, 25% right hemiparesis Time since stroke: RTT 36.8 days (SD 25), control 27.7 days (SD 15) Pre-intervention functional ability level: lack of postural balance
Interventions	RTT intervention: postural training using the Bon Saint Côme device - a custom-moulded orthosis that holds a pointing device, used by the participant to point to targets on a vertical panel which are activated to emit light and sound signals Sessions were in addition to 1 hour of usual care and were 60 minutes (unclear whether 5 or 7 days per week), for 4 weeks = 20 to 28 hours Sessions were delivered individually by a physical therapist Comparison group: 2 hours of usual care (Bobath inspired approach and functional therapy plus a session of occupational therapy 5 days per week)
Outcomes	Outcomes were recorded at baseline, 4 weeks (post treatment), and 2 months Balance/sit-to-stand outcome measures: Sitting Equilibrium Index, Upright Equilibrium Index Lower limb functional outcome measures: Functional Ambulation Classification Impairment outcome measures: Trunk Control Test, Motricity Index, Ashworth Scale ADL outcome measures: Functional Independence Measure
Notes	Postural deficit and unilateral neglect tended to be more severe in the device group at baseline, although not significant No intervention-related reasons for withdrawal Attendance: all participants completed training

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	The participants were distributed consecutively into 2 groups of 10 each by using a randomisation table
Allocation concealment (selection bias)	Unclear risk	No details reported
Blinding of outcome assessment (detection bias) All outcomes	Low risk	The clinician who evaluated the patients did not know to which group they belonged

de Sèze 2001 (*Continued*)

Incomplete outcome data (attrition bias) All outcomes	Low risk	No withdrawals or dropouts
Selective reporting (reporting bias)	Unclear risk	No study protocol

Dean 1997

Methods	RCT
Participants	Australia 20 participants: 10 RTT, 10 control group Participants were recruited from stroke clubs around Sydney. Date of recruitment not reported Inclusion criteria: diagnosis of stroke resulting in hemiplegia at least 12 months previous, discharged from all rehabilitation services, ability to understand instructions and give informed consent, no orthopaedic problem that would interfere with seated reaching, ability to sit unsupported for 20 minutes Exclusion criteria: none stated Mean age: RTT 68.2 years (SD 8.2), control 66.9 years (SD 8.2) 70% male Stroke details: not stated whether first or recurrent stroke; 40% right-sided stroke Time since stroke: RTT 6.7 years (SD 5.8), control 5.9 years (SD 2.9) Pre-intervention functional ability level: walking speed: RTT 0.41 m/s (SD 0.25), control 0.52 m/s (SD 0.28)
Interventions	RTT intervention: training designed to improve sitting balance and involving emphasis on appropriate loading of the affected leg while practicing reaching tasks using the unaffected hand to grasp objects located beyond arm's length Intervention was after discharge from all rehabilitation programmes Sessions were 30 minutes, 5 days per week for 2 weeks = 5 hours Sessions were delivered by a physical therapist in the participant's own home Comparison group: upper extremity attention control - performance of cognitive manipulative tasks while seated at a table
Outcomes	Outcomes were recorded at baseline and at 2 weeks (post treatment) Lower limb functional outcome measures: 10 Metre Walk Speed Balance/sit-to-stand outcome measures: reaching distance, reaching speed
Notes	No significant differences reported at baseline 5% loss to follow-up at end of treatment phase No intervention-related reasons for withdrawal

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Not reported

Dean 1997 (*Continued*)

Allocation concealment (selection bias)	Unclear risk	Participants allocated by drawing a card from a box of 10 experimental and 10 control cards
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Walking speed and cognitive-manipulative tasks were evaluated by an assessor blinded to the participant's group allocation Biomechanical data collection and analysis for the seated reaching tasks and sit-to-stand were computerised, which minimised experimenter bias because group allocation was not evident to the operator
Incomplete outcome data (attrition bias) All outcomes	Low risk	1 withdrawal in control group due to medical complications
Selective reporting (reporting bias)	Unclear risk	No study protocol

Dean 2000

Methods	Pilot RCT
Participants	Canada 12 participants: 6 RTT, 6 control group Participants were recruited from a rehabilitation research group database. Date of recruitment not reported Inclusion criteria: first stroke, at least 3 months post stroke, discharged from all rehabilitation services, able to attend a rehabilitation centre 3 times per week for 4 weeks, able to walk 10 metres Exclusion criteria: any medical condition that would prevent participation Mean age: RTT 66.2 years (SD 7.7), control 62.3 years (SD 6.6) 58% male Stroke details: first stroke, 58% right hemiparesis Timing post stroke: RTT 2.3 years (SD 0.7), control 1.3 years (SD 0.9) Pre-intervention functional ability level: Walking velocity: RTT 76 cm/s (SD 44), control 76 cm/s (SD 39)
Interventions	RTT intervention: lower limb circuit training of 10 workstations including sitting reach, sit-to-stand, stepping, heel lifts, standing balance, leg strengthening, treadmill walking, obstacle walking, slope and stair walking, plus participation in walking races and relays Intervention was after discharge from all rehabilitation programmes Sessions were 60 minutes, 3 times per week for 4 weeks = 12 hours Sessions were delivered to a group of 6 participants by 2 physical therapists, in an rehabilitation centre setting Comparison group: circuit programme designed to improve function of the affected upper limb
Outcomes	Outcomes were recorded at baseline, 4 weeks (post treatment), and 2 months after completion of training Lower limb functional outcome measures: Six Minute Walk Test, 10 Metre Walk Speed (with and without assistive device), Step Test

Dean 2000 (*Continued*)

	Balance/sit-to-stand outcome measures: Timed Up and Go Test
Notes	No significant difference in walking velocity at baseline for total group, but after withdrawals, measures of walking speed and distance favoured the control group 25% loss to follow-up at end of treatment phase Two participants withdrew before training (one due to transport costs) Nine participants attended at least 9 out of 12 sessions

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Inadequately reported
Allocation concealment (selection bias)	High risk	Drawing cards from a box
Blinding of outcome assessment (detection bias) All outcomes	High risk	Independent rater blinded to participant allocation for the clinical assessments but may have been unmasked as a result of the observer inadvertently viewing 1 training session
Incomplete outcome data (attrition bias) All outcomes	Low risk	Missing outcome data balanced in numbers across groups
Selective reporting (reporting bias)	Unclear risk	No study protocol

Dean 2007

Methods	Randomised placebo-controlled trial
Participants	Australia 12 participants: 6 RTT, 6 control group Participants were recruited from a hospital rehabilitation facility between January and June 2000 Inclusion criteria: a diagnosis of first stroke resulting in hemiplegia within the previous three months; no orthopaedic problems which would interfere with the ability to perform seated reaching tasks; no visual problems which would interfere with reaching to pick up objects or reading; a score of at least 3 on Item 3 (sitting balance) of the MAS for Stroke; the ability to reach with intact arm a distance equivalent to 140% of arm's length; no major cognitive or perceptual problems identified using the short portable mental status questionnaire; no left neglect identified using the Letter Cancellation Test; the ability to give informed consent; and the ability to understand instructions. Exclusion criteria: none stated Mean age: RTT 60 years (SD 7), control 74 years (SD 12) % male not reported. Ratio of males to females: RTT 5:1, control 4:2 Stroke details: side of hemiplegia RTT 3:3, control 1:5 Timing post stroke: RTT 21 days (SD 8), control 37 days (SD 23) Pre-intervention functional activity level: not reported

Interventions	RTT intervention: sitting training protocol designed to improve sitting by reaching beyond arm's length using the unaffected hand whilst focusing on: smooth co-ordinated motion of the trunk and arm to get the hand to the object; appropriate loading of the affected foot; and preventing the use of maladaptive strategies such as widening the base of support. While reaching beyond arm's length, reach distance, direction, thigh support, seat height, and task were varied systematically. Training was progressed over the 2-week period by increasing the reach distance and the number of repetitions Sessions were delivered to individuals by the first or second author or undergraduate physiotherapy students Comparison group: sham training protocol; participants completed a series of 11 cognitive-manipulative tasks Participants were seated at a table, well supported in a chair with back and armrests, with their forearms resting on the table. The workspace was confined so that reach distance was less than 50% of arm's length which minimised perturbations to balance. Training was progressed over the 2-week period by increasing the number of repetitions and cognitive difficulty of the cognitive-manipulative tasks Both training programmes were 10 sessions of 30 minutes spread over a two week period = 5 hours
Outcomes	Outcomes were recorded at baseline, 2 weeks (post treatment) and 28 weeks Upper limb functional outcome measures: Functional Reach Test (primary outcome); standardised "reach to grasp and drink a glass of water" task; average reach movement time Lower limb functional outcome measures: 10 metre Walk Test
Notes	Potential baseline imbalance in time from stroke to admission to trial: RTT mean 21 days (SD 8), control mean 37 days (SD 23)

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Sequence generated by a person independent of the study using random number tables, blocked to ensure equal numbers of experimental and control participants
Allocation concealment (selection bias)	Unclear risk	Randomisation was concealed from the recruiter and assessor by using sealed opaque envelopes containing the allocation; not clear if envelopes sequentially numbered
Blinding of outcome assessment (detection bias) All outcomes	Low risk	"The third author remained blinded to group allocation and collected the outcomes measures post training and six months later. The collection of some outcome measures required two persons, one of whom was not blinded. To reduce bias, the blinded assessor (third author) gave all instructions and measured outcomes which were

Dean 2007 (*Continued*)

		not collected by the computer."
Incomplete outcome data (attrition bias) All outcomes	Low risk	Missing outcome data balanced across groups 1 participant in the RTT group and 2 participants in the control group lost to follow-up at 6 months
Selective reporting (reporting bias)	Unclear risk	No protocol available

Frimpong 2014

Methods	RCT
Participants	Ghana 20 participants: 10 RTT, 10 control Participants were recruited from stroke survivors referred for physiotherapy. Date of recruitment not reported Inclusion criteria: first-episode single stroke, stroke duration of < 3 months, ability to walk 10 metres independently with or without walking aid and Functional Ambulatory Category (FAC) score of 3 or more Exclusion criteria: participants with aphasia, cardiac arrhythmias or any other conditions making exercises contraindicated Mean age: RTT 57.6 ± 0.3 years, control 55.8 ± 6.7 64% male Stroke details: ischaemic stroke 66.6% (6), haemorrhagic stroke 33.3% (3) Time since stroke: RTT 2.2 months (SD 0.8), control 2.4 months (SD 0.9) Pre-intervention functional ability: 6 Minute Walk Test: RTT 249.5 metres (SD 10.7), control 253.0 (SD 12.5)
Interventions	RTT intervention: circuit training for 105 minutes, 3 times per week for 8 weeks including treadmill walking, push-ups, squatting, straight leg raise, stairs walking and cycling exercises Comparison group: conventional therapy of passive and active exercises. Participants also performed upper limb strengthening exercises, walking re-education, as well as standing and balance retraining carried out between parallel bars
Outcomes	Outcomes were recorded at baseline, week 4 and week 8 (post intervention) Lower limb functional outcome measures: 6 Minute Walk Test, 10 Metre Walk Test, Functional Ambulatory Category
Notes	No apparent baseline imbalance

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	"Subjects were randomized into two groups"

Frimpong 2014 (*Continued*)

Allocation concealment (selection bias)	Unclear risk	Method of concealment not reported
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	No mention of blinding
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Number of participants not reported in data tables
Selective reporting (reporting bias)	Unclear risk	No protocol available

Gordon 2013

Methods	RCT
Participants	Jamaica 128 participants: 64 RTT, 64 control Participants were recruited from 3 hospitals. Date of recruitment not reported Inclusion criteria: 40 years of age or older, community dwelling, 6 to 24 months after stroke, able to walk with or without assistive devices, not currently in a rehabilitation or regular exercise programme, not having any disorder that would compromise exercise training, such as unstable cardiovascular diseases, no cognitive deficits Exclusion criteria: none stated Mean age: RTT 63.4 years (SD 9.4), control 64.9 years (SD 11.1) 45.3% male Stroke details: ischaemic 71.1% (91), haemorrhagic 11.7% (15) Time since stroke: RTT 12.8 months (SD 3.6), control 11.8 months (SD 3.6) Pre-intervention functional ability level: use of walking aid at recruitment: RTT 26.6% (n = 17), control 32.8% (n = 21)
Interventions	RTT intervention: participants were supervised by trained instructors to walk briskly along a prescribed course for 15 minutes, 3 times per week, for 12 weeks initially, progressing by 5 minutes per week up to 30 minutes in their home or community = 9 to 18 hours Comparison group: light massage to the affected limbs for 25 minutes, 3 times per week for 12 weeks at home
Outcomes	Outcomes were recorded at baseline, 6 weeks and 12 weeks (post treatment) Lower limb functional outcome measures: 6 Minute Walk Test Impairment outcome measures: Motricity Index QoL/health status outcome measures: Physical and Mental Component Summary scores of the Medical Outcomes Survey 36-Item Short-Form Health Survey (SF-36) ADL outcome measures: Barthel Index, instrumental ADL dimension of the Older Americans Resources and Services Questionnaire
Notes	No significant differences between groups at baseline 2 intervention-related withdrawals (programme too difficult (n = 1) and participant not happy with group assignment (n = 1))

Gordon 2013 (*Continued*)

	No major adverse events during or immediately after the sessions

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Block randomisation used but not clear how the sequence was generated
Allocation concealment (selection bias)	Unclear risk	Not reported
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Assessment by a physical therapist blinded to group assignment
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Similar number of dropouts from intervention and control groups (7 and 5 respectively) Time of dropout not reported Reasons per group not reported
Selective reporting (reporting bias)	Unclear risk	No study protocol

Holmgren 2010

Methods	Single-blind RCT
Participants	Sweden 34 participants: 15 RTT, 19 control Participants were recruited from Umeå Stroke Unit. There were 3-monthly recruitment periods between February 2005 and June 2007 Inclusion criteria: first-ever or recurrent ischaemic or haemorrhagic stroke 3 to 6 months before enrolment and randomisation, age $\geq$ 55, the ability to walk 10 metres with or without a walking device, the ability to understand and comply with instructions in Swedish, risk of fall at the time of enrolment according to subjective clinical observations in the assessment situation performed by the experienced physiotherapists in the study Exclusion criteria: the ability to walk outdoors independently, i.e. without personal assistance or walking device, severe aphasia or severe vision or hearing impairment, a medical condition that a physician determined was inconsistent with study participation, e.g. cancer or severe congestive heart failure with expected short remaining life expectancy, recurrent stroke within 3 months before study start, living more than 100 km away from the training facilities Mean age: RTT 77.7 years (SD 7.6), control 79.2 years (SD 7.5) 62% male Stroke details: first or recurrent stroke, 97% ischaemic, 3% haemorrhagic Time since stroke: RTT 139.7 days (SD 37.3), control 126.8 days (SD 28.2) Pre-intervention functional activity level: Barthel Index: RTT 44.3 (CI 40.0 to 48.7), control 44.2 (CI 39.3 to 49.2)

Holmgren 2010 (*Continued*)

Interventions	RTT intervention: the intervention was based on the HIFE (High Intensity Functional Exercise) program, to improve the participants lower-limb strength, balance and gait ability The program includes lower-limb strength (e.g. chair stand) and balance exercises (e. g. weight shifting outside support surface), standing (e.g. knee bend) and walking (e.g. obstacle crossing course) A home visit was conducted by a physiotherapist and an occupational therapist to determine each participant's ability to perform ADLs and lifestyle activities and to experience the participants daily difficulties in their own environment Sessions were 45 minutes, 6 times per week (twice daily) for 5 weeks = 22.5 hours Comparison group: participants met once per week for a 1 hour of educational session during the 5-week period The session was led by an occupational therapist, group discussions were about communication difficulties, fatigue, depressive symptoms, mood swings, personality changes and dysphagia, all more or less hidden dysfunctions after stroke and how to cope with these difficulties There was no special focus on the risks of falling in these discussions
Outcomes	Outcomes were recorded at baseline, 5 weeks (post treatment), 3 months and 6 months Balance/sit-to-stand outcome measures: Berg Balance Scale, Falls Efficacy Scale, number of falls ADL outcome measures: Barthel Index, Frenchay Activities Index
Notes	No significant differences between groups at baseline 11 participants in total fell during study (32%), RTT (n = 5), control (n = 6)

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Minimisation software program
Allocation concealment (selection bias)	Low risk	The randomisation procedure was conducted by the 2 principal investigators who were involved neither in the assessments, nor in the RTT or control group Both investigators were blinded to allocation at the time of randomisation, which was made possible by using code numbers for each participant
Blinding of outcome assessment (detection bias) All outcomes	Low risk	All assessments were done by blinded staff, who were instructed that if they had any reason to believe that they had revealed a participant's group they should make an adverse event report. The staff in the intervention did not take part in any of the assessments
Incomplete outcome data (attrition bias) All outcomes	Low risk	Small number of dropouts, reasons provided

Holmgren 2010 (*Continued*)

Selective reporting (reporting bias)	Unclear risk	No study protocol

Howe 2005

Methods	Pilot RCT
Participants	UK 35 participants: 18 RTT, 17 control Participants recruited from admissions to an acute stroke unit between 2001 and 2002 Inclusion criteria: aged 18 and over, acute vascular stroke presenting with hemiplegia, medically stable, able to co-operate, previously independent in mobility + ADL Exclusion criteria: any history of other neurological pathology, conditions or medication affecting balance, dementia, impaired consciousness levels, concomitant medical illness or musculoskeletal condition, serious perceptual problems Mean age: RTT 71.5 years (SD 10.9), control 70.7 years (SD 7.6) 51% male Stroke details: first or recurrent stroke, 47% right hemiparesis Time since stroke: RTT 26.5 days (SD 15.7), control 23.1 days (SD 17.5) Pre-intervention functional ability level: RMI on admission: RTT 24.7 (SD 8.1), control 24.4 (SD 8.9)
Interventions	RTT intervention: usual care plus exercises aimed at improving lateral weight transference in sitting and standing; this included repetition of self-initiated goal-oriented activities in various postures 16 tasks in total, with 10 repetitions of each exercise Sessions were delivered by trained physiotherapy assistants and were 30 minutes, 3 times per week for 4 weeks = 6 hours Comparison group: usual care, no details given
Outcomes	Outcomes were recorded at baseline, 4 weeks (post treatment) and 8 weeks Balance/sit-to-stand outcome measures: sit-to-stand, stand-to-sit (time in seconds), lateral reach test (time to return to quiet sitting)
Notes	No significant differences reported at baseline 6% lost to follow-up at end of treatment phase No intervention-related reasons for withdrawal Attendance: participants completed 10.6 sessions on average

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Randomised permuted blocks
Allocation concealment (selection bias)	Low risk	The project manager held details of assignment and revealed these to the recruiting physiotherapist via telephone only when the participant was due to be allocated to a group

Howe 2005 (*Continued*)

		The code was not broken until all participants had completed the study and all analysis was complete
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Outcome assessors blind to treatment group
Incomplete outcome data (attrition bias) All outcomes	Low risk	Small number of dropouts balanced across groups with similar reasons for dropout
Selective reporting (reporting bias)	Unclear risk	No study protocol

Kim 2012

Methods	RCT
Participants	Korea 20 participants: 10 RTT, 10 control Inpatient recruitment, date of recruitment not reported Inclusion criteria: ability to walk 10 metres independently using an aid or orthotic with or without supervision or aid and a minimum score of 20 in the Korean Mini-Mental State Examination Exclusion criteria: joint contraction, pain or fracture of the musculoskeletal system, hemianopsia Mean age: RTT 52.50 years (SD 11.72), control 53.40 years (SD 12.11) % male: not reported Stroke details: not reported Time since stroke: RTT 7.70 years (SD 6.11), control 13.10 years (SD 10.62) Pre-intervention functional activity level: Timed Up and Go Test: RTT 29.84 seconds (SD 13.32), control 39.10 seconds (SD 14.97)
Interventions	RTT intervention: the training consists of 10 walking-related tasks designed to strengthen the lower extremities, and enhance the walking balance, speed and distance in a progressive manner The 10 tasks were: step-ups; balance beam; kicking a ball; stand up and walk; obstacle course; treadmill; walk and carry; speed walk; walk backwards; and stairs. Before commencing training, the participants warmed up for 5 minutes to improve their range of motion and flexibility. Each item was practiced for 5 minutes, and 1 minute of rest time was allowed between each item Sessions were in addition to conservative physical therapy and were 1 hour, 3 times per week for 4 weeks = 12 hours Comparison group: conservative physical therapy for 1 hour per day, 5 days per week for 4 weeks Conservative physical therapy consisted of joint mobilisation, muscle strengthening, and balance training
Outcomes	Outcomes were recorded at baseline and 4 weeks (post treatment) Lower limb functional outcome measures: 10 Metre Walk Speed, Balance/sit-to-stand outcome measures: Trunk Impairment Scale, Berg Balance Scale,

Kim 2012 (*Continued*)

	Timed Up & Go Test
Notes	Equivalence not reported, but baseline values for Time Since Stroke and the Timed up and Go Test appear different across groups

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Patients 'randomly allocated' but no further information provided
Allocation concealment (selection bias)	Unclear risk	Not reported
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Not reported
Incomplete outcome data (attrition bias) All outcomes	Low risk	No dropouts
Selective reporting (reporting bias)	Unclear risk	No study protocol

Kim 2014

Methods	RCT
Participants	Republic of Korea 26 participants: 13 RTT; 13 control Participants were recruited from inpatients in a rehabilitation hospital. Date of recruitment not reported Inclusion criteria: hemiparesis from a single stroke occurring at least six months before; sufficient cognition to follow simple instructions and understand the purpose of the study (Korean version of the Mini-Mental State Examination score of ≥ 24 points); gait speed < 0.8 m/s; ability to walk 10 metres independently without an assistive device; absence of a musculoskeletal condition that could potentially affect the ability to walk safely; and absence of hemispatial neglect Exclusion criteria: participation in other studies or rehabilitation programs; or severe heart disease or uncontrolled hypertension and pain Mean age: 50.45 years 50% male Stroke details: 59% right hemiparesis (no baseline data reported for 4 participants who dropped out) Time since stroke: 231.64 days Pre-intervention functional ability: 10 metre Walk Test (m/s) RTT mean 0.51 ± 0.16, control mean 0.48 ± 0.18

Kim 2014 (*Continued*)

Interventions	RTT intervention: a Community Walking Training Programme comprising various community environments, including walking near the hospital setting, walking outside of the hospital setting on uneven ground, walking outside of the hospital setting on uneven ground with obstacles, and visiting a shopping centre Comparison group: All participants took part in the same standard rehabilitation programme consisting of conventional physical and occupational therapy. Conventional physical therapy, including increased trunk stability, lower-extremity muscle strength, and gait, was performed for 30 minutes per day, 5 times a week, for 4 weeks. Occupational therapy, consisting of an upper-extremity training program for ADL, was performed for 30 minutes per day, 5 times a week, for 4 weeks
Outcomes	Outcomes were recorded at baseline and 4 weeks (post treatment) Lower limb functional outcome measures: 10 Metre Walk Test, 6 Minute Walk Test and Community Walk Assessment QoL: Stroke Impact Scale social participation domain
Notes	No apparent baseline imbalance

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	"patients were randomly assigned"
Allocation concealment (selection bias)	High risk	"sealed envelopes were prepared in advance and marked on the inside with an O or X."
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Blinded outcome assessment.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	"Two subjects each in the CWTP and control groups dropped out due to health conditions, personal reasons, or discharge." Reasons not given by intervention group
Selective reporting (reporting bias)	Unclear risk	No study protocol

Kim 2016

Methods	Randomised controlled single-blind study
Participants	Korea 20 participants: 10 RTT; 10 control Inpatient recruitment between August 2012 and October 2013 Inclusion criteria: a clinical diagnosis of a first stroke confirmed by neuroimaging (CT or MRI); a hemiparesis; a time interval between stroke and recruitment of 3 months or less; the ability to comprehend the instructions for the testing procedures; and mild

	to moderate walking deficit, as indicated by Functional Ambulation Category (FAC) between 3 and 4 Exclusion criteria: severe cognitive impairment (K-MMSE ≤ 10) or aphasia; previous stroke history; not independent 'sit-to-stand' activity (Berg Balance Scale score < 18) ; acute systemic illness or infection; a significant orthopaedic condition or pain that limited participation in exercise; and visual impairment or vestibular system deficit that caused balance impairment Mean age: 65.6 ± 9.2 years 65% male Stroke details: first stroke; ischaemic 80% (16), haemorrhage 20% (4) Time since stroke: RTT 30.1 days (SD 21.8), control 29.9 days (SD 20.3) Pre-intervention functional activity level: 6 Minute Walk Test RTT 167.5 metres (SD 121.8), control 157.5 metres (SD 64.0)
Interventions	RTT intervention: participants participated in 90-minute circuit-training classes, 5 times per week for 4 weeks. Circuit training consisted of a 5-minute warm-up period, five classes of 15 minutes duration interspersed with a 1 minute rest and a 5-minute cool-down period. There were 5 categories of complex exercises including trunk exercise and active sitting practice, sit-to-stand practice, standing and walking practice, aerobic exercise training and strengthening training Comparison group: participants in the control group received conventional individual physiotherapy for 30 minutes twice a day (total 60 minutes), 5 days a week for 4 weeks
Outcomes	Outcomes were recorded at baseline and 4 weeks (post treatment) Lower limb functional outcome measures: Fugl-Meyer lower limb score, Berg Balance Scale, 6 Minute Walk Test ADL: Korean version of the Modified Barthel Index
Notes	No apparent baseline imbalance

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	"Participants were randomly allocated"
Allocation concealment (selection bias)	Unclear risk	A sealed envelope technique was used; unclear if envelopes were opaque and sequentially numbered
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Blinded outcome assessment
Incomplete outcome data (attrition bias) All outcomes	Low risk	All participants completed the study
Selective reporting (reporting bias)	Unclear risk	No protocol available

Kwakkel 1999

Methods	Multicentre RCT
Participants	The Netherlands 101 participants: 31 leg training group, 33 arm training group, 37 control Participants recruited from 7 hospitals in the Netherlands between1994 and1997 Inclusion criteria: primary first-ever stroke in the territory of the middle cerebral artery, confirmed by CT or MRI, aged 30 to 80 years, impaired motor function of the arm and leg, inability to walk at first assessment Exclusion criteria: complicating medical history or severe deficits in communication, memory or understanding Mean age: leg training group 64.5 years (SD 9.7), arm training group 69 years (SD 9.8) , control group 64.1 years (SD 15) 43% male Stroke details: first-ever stroke,41% right hemiparesis Timing post stroke: leg training group 7.0 days (SD 2.5), arm training group 7.2 days (SD 2.8), control group 7.5 days (SD 2.9) Pre-intervention functional ability level: Barthel Index of 9 or lower
Interventions	Leg training group: sitting, standing and weight-bearing exercise, with an emphasis on achieving stability and improving gait velocity Treadmill training was used if available If treatment at disability level was not possible, strengthening exercises were used Arm training group: functional exercise to facilitate forced arm and hand activity such as leaning, punching a ball, grasping, reaching, dressing, hair-combing and moving objects If treatment at disability level not possible, strengthening exercises were used Intervention was in addition to basic rehabilitation, which consisted of 15 minutes arm rehabilitation, 15 minutes leg rehabilitation and 1.5 hours per week of ADL training by an occupational therapist Sessions were delivered individually by a physiotherapist and were 30 minutes, 5 days per week for 20 weeks = 50 hours Comparison group: immobilisation of the paretic arm and leg by means of an inflatable pressure splint Kwakkel 1999a: arm training versus splint control Kwakkel 1999b: leg training versus splint control
Outcomes	Outcomes were recorded at baseline, and weekly between weeks 1 to 10, and every 2 weeks between week 11 to 26 Final measurements were at 26 weeks Results are presented for baseline, weeks 6, 12, 20 and 26 Lower limb functional outcome measures: Functional Ambulation Classification, walking speed (comfortable and maximum) Upper limb functional outcome measures: Action Research Arm test ADL outcome measures: Barthel Index QoL/health status outcome measures: Nottingham Health Profile
Notes	No significant differences reported at baseline 12% lost to follow-up at end of treatment phase No likely intervention-related reasons for withdrawal, although 2 participants refused the splint control treatment Compliance with delivery of intended amounts of training was monitored, and achieved

Kwakkel 1999 (*Continued*)

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Restricted randomisation (permuted blocks of nine) was applied, using random number tables for each of 3 participating hospitals
Allocation concealment (selection bias)	Unclear risk	Allocation was concealed by use of sealed envelopes
Blinding of outcome assessment (detection bias) All outcomes	High risk	Assessors were blind to group allocation, Treatment assignment was unintentionally disclosed for 10 participants (1 leg training, 4 arm training, 5 control group)
Incomplete outcome data (attrition bias) All outcomes	Low risk	Number of dropouts balanced across groups, reasons do not appear to be related to the intervention
Selective reporting (reporting bias)	Unclear risk	No study protocol

Kwakkel 1999a

Methods	See Kwakkel 1999
Participants	
Interventions	
Outcomes	
Notes	

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	See Kwakkel 1999
Allocation concealment (selection bias)	Unclear risk	See Kwakkel 1999
Blinding of outcome assessment (detection bias) All outcomes	High risk	See Kwakkel 1999
Incomplete outcome data (attrition bias) All outcomes	Low risk	See Kwakkel 1999

Kwakkel 1999a (*Continued*)

Selective reporting (reporting bias)	Unclear risk	See Kwakkel 1999

Kwakkel 1999b

Methods	See Kwakkel 1999	
Participants		
Interventions		
Outcomes		
Notes		

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	See Kwakkel 1999
Allocation concealment (selection bias)	Unclear risk	See Kwakkel 1999
Blinding of outcome assessment (detection bias) All outcomes	High risk	See Kwakkel 1999
Incomplete outcome data (attrition bias) All outcomes	Low risk	See Kwakkel 1999
Selective reporting (reporting bias)	Unclear risk	See Kwakkel 1999

Langhammer 2000

Methods	Stratified, single-centre RCT
Participants	Norway 61 participants: 33 RTT, 28 control Participants were recruited from a hospital in Norway between 1996 and1997 Inclusion criteria: first-ever stroke with hemiparesis verified clinically and by CT Exclusion criteria: more than1 stroke incident, subarachnoid bleeding, tumours of the brain, other severe medical conditions in combination with stroke, 5 or more points on each of the scores on the MAS Mean age: 78 years (SD 9), range 49 to 75 years 59% male Stroke details: first stroke, 56% right hemiparesis Time since stroke: baseline measures taken within 3 days of admission

Langhammer 2000 (*Continued*)

	Pre-intervention functional ability level: Barthel Index: RTT 56 (SD 28), control 46 (SD 36)
Interventions	RTT intervention: Motor Relearning Programme as per Carr 1987 Functional task training in ordinary settings, with ordinary tasks, using the principles of maximal repetition, task and setting variation RTT intervention was instead of usual care Sessions were delivered by hospital and outpatient physiotherapists and were 40 minutes minimum per session, 5 days per week for as long as hospitalised, and continuing into the community, although receipt of physiotherapy in community settings was variable After discharge, some participants received therapy in their own homes, at rehabilitation centres, or private outpatient departments, dependent on need Comparison group: Bobath Programme
Outcomes	Outcomes were recorded at baseline, 2 weeks, 3 months, 1 year and 4 years post stroke Lower limb functional outcome measures: MAS, Sødring Motor Evaluation Scale - subscale for trunk/balance/gait Balance/sit-to-stand outcome measures: Berg Balance Scale (1 year only) Impairment outcome measures: Sødring Motor Evaluation Scale - subscales for leg function, arm function ADL outcome measures: Barthel Index QoL/health status outcome measures: Nottingham Health Profile
Notes	Baseline differences: control group slightly more dependent at entry, but no significant difference in MAS, Sødring Motor Evaluation Scale or Barthel Index

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Inadequately reported
Allocation concealment (selection bias)	Unclear risk	Not reported
Blinding of outcome assessment (detection bias) All outcomes	Low risk	The study was double-blind, and the code was sealed until the last test was performed at 3 months follow-up
Incomplete outcome data (attrition bias) All outcomes	Low risk	Number of dropouts balanced across groups and reasons provided
Selective reporting (reporting bias)	Unclear risk	No study protocol

Lennon 2009

Methods	RCT
Participants	Ireland 61 participants, 31 RTT, 30 control Participants were recruited from an inpatient stroke unit between October 2004 and July 2007 Inclusion criteria: stroke admissions within 21 days post stroke Exclusion criteria: none stated Mean age: RTT 71.55 (SD 13.31), control 72.13 (SD 9.93) 58.4% male Stroke details: first or recurrent stroke, 55.7% right hemisphere Timing post stroke: RTT 10.81 days (SD 5.22), control 10.73 (SD 5.09) Pre-intervention functional ability level: Barthel Index: RTT 10.10 (SD 3.75), control 9.93 (SD 3.66); MAS: RTT 18.32 (SD 11.59), control 19.97 (SD 10.98)
Interventions	RTT intervention: 20 minutes of conventional therapy based on Bobath principles and 20 minutes of gait-specific training administered by a research therapist 5 times per week for 4 weeks = 6.6 hours of RTT Comparison group: 40 minutes of conventional therapy based on Bobath principles administered by the stroke unit therapists
Outcomes	Outcomes were recorded at baseline, 4 weeks (post treatment) and at 3 and 6 months Lower limb functional outcome measures: MAS, walking speed, Modified RMI, Step Test ADL outcome measures: Barthel Index QoL/health status outcome measures: London Handicap Score
Notes	Baseline characteristics were similar in terms of age, gender, side of hemiplegia, time since stroke onset, stroke severity and walking speed There was insufficient contrast in treatment between the groups (i.e. therapists in the Bobath group practiced early ambulation more frequently than therapists in the RTT group) Within the RTT group, there were three times the number of Total Anterior Circulation Infarct strokes (a poor prognostic indicator for recovery of independent mobility), more participants with a previous stroke and more participants requiring the assistance of 2 people to walk

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Inadequately reported
Allocation concealment (selection bias)	Unclear risk	Stratified by age and walking ability, in blocks of 4 using sealed envelopes
Blinding of outcome assessment (detection bias)	High risk	3 physiotherapists assisted with both intervention and outcome assessment following resignation of 1 research associate

Lennon 2009 (*Continued*)

All outcomes		
Incomplete outcome data (attrition bias) All outcomes	Low risk	No dropouts
Selective reporting (reporting bias)	High risk	Findings for the London Handicap Score (measured at 6 months) not reported

McClellan 2004

Methods	RCT
Participants	Australia 26 participants: 15 RTT, 11 control Participants were recruited on discharge from physiotherapy services in 6 hospitals in 1 region. Date of recruitment not reported Inclusion criteria: stroke within the past 18 months, 45 years and older, living in the community, score > 0 and < 6 on MAS, score < 6 on Item 7 or 8 of the MAS Exclusion criteria: unable to consent, uncontrolled cardiac symptoms or other medical conditions that limited exercise, or with a pacemaker Mean age: RTT 69 years (SD 13), control 72 years (SD 9) 50% male Stroke details: unclear whether first or recurrent stroke, 50% right hemiparesis Timing post stroke: RTT median 6.5 months (IQR 5.5), control median 4.5 months (IQR 3) Pre-intervention functional ability level: all participants could walk, but with difficulty
Interventions	RTT intervention: home-based exercise programme aimed at improving mobility in standing balance and walking, based on a list of 23 activities arranged hierarchically on their challenge to balance The home programme used video self-modelling prepared on the baseline visit to the clinic to prescribe the exercise programme, telephone monitoring to encourage compliance, and 2 clinic visits for programme review Sessions were prescribed 60 minutes per day over 6 weeks = 42 hours Participants were required to keep a record of practice Comparison group: home-based exercise programme of same duration based on improving upper limb function, starting from basic movement through to functional activity, using the same self-instructional video, self- and telephone-monitoring and clinic visits as the experimental group
Outcomes	Outcomes were recorded at baseline, 6 weeks (post treatment) and 14 weeks Lower limb functional outcome measures: MAS - walking Balance/sit-to-stand outcome measures: Functional Reach Test
Notes	No baseline comparisons reported 19% lost to follow-up by end of treatment phase No likely intervention-related reasons for withdrawal Participants reported 75% compliance with prescribed exercises

McClellan 2004 (*Continued*)

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Inadequately described
Allocation concealment (selection bias)	Unclear risk	Randomisation by numbered, sealed, opaque envelopes
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Outcome measures were collected by a measurer blinded to group allocation
Incomplete outcome data (attrition bias) All outcomes	Low risk	Number of dropouts balanced across groups and reasons provided
Selective reporting (reporting bias)	Unclear risk	No study protocol

Mudge 2009

Methods	Single-blind RCT
Participants	New Zealand 58 participants: 31 RTT, 27 control Participants were recruited through the Stroke Foundation of New Zealand, stroke clubs and the local hospital stroke service between June 2007 and February 2008 Inclusion criteria: 1 or more strokes more than 6 months earlier, had been discharged from rehabilitation, and were able to walk independently (with an aid if necessary). Some residual gait difficulty was required, as defined by a score of less than 2 on at least 1 of the walking items of the physical functioning scale of the 36-Item Short Form Health Survey Exclusion criteria: progressive neurologic disease, other significant health problems that adversely affected walking ability, more than 2 falls in the previous 6 months, unstable cardiac conditions, uncontrolled hypertension, or congestive heart failure Mean age: RTT 69.8 (SD 13.12), control 69.61 (SD 12.81) 55% male Stroke details: first or recurrent stroke, 59% right hemisphere Timing post stroke: RTT 49.2 months (SD 40.9), control 69.1 months (SD 54.7) Pre-intervention functional ability level: median score on the physical functioning index of the 36-item Short Form Health Survey: RTT 19, control 17
Interventions	RTT intervention: the circuit exercise groups contained up to 9 participants and were led by 1 of the investigators, assisted by 2 physiotherapy students. There were 15 stations in the circuit, which were graded to each participant's ability and progressed as tolerated. Each station contained either a task-oriented gait or standing balance activity, or strengthening of a lower extremity muscle in a way designed to improve gait (e.g. sit-to-stand, self-sway, standing balance, step-ups, balance beam, standing hamstring curl, tandem walk, Swiss ball squats, tandem stance, calf raise, backward walk, lunges, side

Mudge 2009 (*Continued*)

	leg lifts, marching in place, obstacle course). The total exercise time was 30 minutes, although sessions lasted between 50 to 60 minutes, including stretching, sessions were 3 times per week for 4 weeks = 6 hours of RTT Comparison group: participants in the control group attended eight 90-minute sessions over 4 weeks in groups of up to 8. The control group was run by an occupational therapist and consisted of 4 social and 4 educational sessions. The duration of the control group sessions was designed to match the duration of the intervention sessions in order to control for possible effects of dosage
Outcomes	Outcomes were recorded at baseline, 4 weeks (post treatment) and 3 months Lower limb functional outcome measure: mean number of steps per day measured by the StepWatch Activity Monitor, 10 Metre Walk Speed, 6 Minute Walk Test, RMI, Physical Activity and Disability Scale ADL outcome measures: Activities-Based Confidence Scale
Notes	No apparent baseline imbalance

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Computer-generated random numbers by an individual not associated with the study
Allocation concealment (selection bias)	Unclear risk	Inadequately reported
Blinding of outcome assessment (detection bias) All outcomes	High risk	Unmasking of independent assessor occurred for 3 participants who stated or implied their group allocation
Incomplete outcome data (attrition bias) All outcomes	Low risk	Number of dropouts balanced across groups and reasons provided
Selective reporting (reporting bias)	Unclear risk	No study protocol

Olawale 2011

Methods	Prospective randomised controlled study
Participants	Africa 40 participants: 20 RTT, 20 control Participants were recruited from people referred for outpatient management at the physiotherapy department of a tertiary hospital. Date of recruitment not reported Inclusion criteria: all participants were people whose stroke occurred not less than 3 months, and not more than 24 months, before entering the study. Participants were included if they were able to walk 10 metres independently with or without a walking aid Exclusion criteria: none specifically reported but ability to walk < 10 metres excluded

	Mean age: RTT 56.8 years (SD 8.3), control 57.2 years (SD 5.9) 55% male Stroke details: 52.5% right hemisphere Timing post stroke: RTT 10.7 months (SD 6.8), control 10.3 (SD 5.9) Pre-intervention functional ability level: able to walk ≥ 10 metres
Interventions	RTT intervention: on each day of treatment/training, participants observed a pre-exercise rest period of 10 minutes during which heart rate and blood pressure measurements were made. The RTT group went through a 1-hour session of conventional physiotherapy including 25 minutes of overground walking exercise training. The overground walking exercise training involved walking over ground at a natural safe speed (i.e. walking at own pace in order to cover as much ground as possible within the training period) on a 15 x 10 metre walk course marked out on the flat floor of a remedial gymnasium. In each case, exercise would be terminated any time the participant reported symptoms of exertional intolerance, i.e. outside the target zone on Borg's rate of perceived exertion (RPE) scale. Participants took part in 3 x 25 minute sessions per week for a 12-week period = 15 hours Comparison group: the conventional physiotherapy rehabilitation consisted of 1 hour of active and passive range of motion (ROM) exercises, strength training and balance training, as applicable
Outcomes	Outcomes were recorded at baseline, 4 weeks, 8 weeks and 12 weeks (post treatment) Lower limb functional outcome measures: 10 Metre Walk Speed, 6 Minute Walk Test
Notes	Equivalence of groups at baseline was not reported 5 participants were lost to follow-up

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Inadequately reported
Allocation concealment (selection bias)	Unclear risk	Not reported
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Not reported
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Withdrawals not explained
Selective reporting (reporting bias)	Unclear risk	No study protocol

Park 2011

Methods	Randomised, single-blind, controlled pilot study
Participants	Republic of Korea 25 participants, 13 RTT, 12 control Participants were recruited from people receiving inpatient management service in a rehabilitation hospital. Date of recruitment not reported Inclusion criteria: the first stroke had occurred 6 months to five years before the study, a walking speed of 50.7 m/s, which indicates unsafe community ambulation, no auditory or visual deficits, no orthopaedic or cardiovascular conditions that may interfere with the study, no cognitive impairment (> 25 in Mini-Mental State Examination) Exclusion criteria: none stated Mean age: RTT 59.38 years (SD 8.46), control 56.92 years (SD 7.79) 48% male Stroke details: 60% ischaemic, 44% right hemiparesis Timing post stroke: RTT 28.08 months (SD 12.59), control 28.67 months (SD 17.96) Pre-intervention functional ability level: Walking Aids: no aid (n = 7), ankle foot orthosis (n = 0), cane (n = 13), quadruped cane (n = 4), ankle foot orthosis + quadruped cane (n = 1)
Interventions	RTT intervention: participants from the experimental group underwent 1-hour sessions of community-based ambulation training in addition to functional training. The community-based ambulation training programme consisted of 4-phase walking training performed in various community situations, which were differently applied according to a weekly schedule. The difficulty level of the walking training was increased every week, with different environmental demands in each session. During the 4-week training period, walking training was conducted at various locations (e.g.in the foyer of a hospital, a pavement, stairs, a ramp, a car park, a pedestrian crossing, and a shopping centre), with progressive changes in the environmental demands. These sessions were conducted 3 x per week for a 4-week period = 12 hours Comparison group: functional training based on the Bobath concept daily for an hour, according to the routine schedule of the rehabilitation unit. The functional training consisted of standing up from a sitting position, therapist-guided movement of the trunk and lower limb to simulate normal walking pattern, forward and backward stepping of affected and unaffected lower limb, and stair climbing
Outcomes	Outcomes were recorded at baseline and 4 weeks (post treatment) Lower limb functional outcome measures: 10 Metre Walk Speed, 6 Minute Walk Test, community walk test, walking ability questionnaire Balance/sit-to-stand outcome measures: Activities-Specific Balance Confidence Scale
Notes	No significant differences at baseline

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	The participants were randomly allocated to the experimental group or control group. Each participant was given an envelope

Park 2011 (*Continued*)

		containing 2 cards and was instructed to blindly draw 1 card on each occasion
Allocation concealment (selection bias)	High risk	Extent to which cards were drawn 'blindly' unclear
Blinding of outcome assessment (detection bias) All outcomes	Low risk	The person undertaking the assessment and data analysis was unaware of the group of each participant
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	1 withdrawal in each group Number of participants included in outcome analysis not given
Selective reporting (reporting bias)	Unclear risk	No study protocol

Peurala 2009

Methods	RCT
Participants	Finland 56 participants: 22 gait trainer group (not included in this review), 21 WALK group, 13 control group Participants were recruited from inpatients in an acute care hospital between June 2003 and December 2004 and between January 2005 and February 2007 Inclusion criteria: (first supratentorial stroke or no significant disturbance from an earlier stroke (Modified Ranking Scale 0-2); Functional Ambulatory Category (FAC) 0-3; voluntary movement in the leg of the affected side; Barthel Index (BI) 25 to 75 points; age 18 to 85 years; no unstable cardiovascular disease; body mass index (BMI) < 32; no severe malposition of joints; and no severe cognitive or communicative disorders Exclusion criteria: none reported Mean age (excluding dropouts): RTT 65.3 years (SD 9.9), control 69.5 years (SD 11.0) 53% male Stroke details: ischaemic stroke 26 participants, haemorrhagic stroke 8 participants; left hemiparesis 20 participants, right hemiparesis 14 participants Timing post stroke (excluding dropouts): RTT 7.8 days (SD 3.0), control 9.5 days (SD 1.9) Pre-intervention functional activity level: participants in Functional Ambulation Category 0 (not able to walk or needed two assistants to help) RTT 15/21, control 9/13
Interventions	RTT intervention (WALK group): participants practiced walking over ground with 1 or 2 physiotherapists, using their individual walking aids. Training was progressed by increasing the speed and decreasing the amount of manual guidance and reliance on walking aids Each participant spent a maximum of 1 hour a day to obtain 20 minutes actual walking time. Each participant also received additional gait-oriented physiotherapy for 55 minutes a day Comparison group: participants were transferred to a health centre after the first set

Peurala 2009 (*Continued*)

	of measurements and visited the hospital on testing days. While in the health centre, the participants normally had 1 or 2 physiotherapy sessions daily, but not at the same intensity as in the WALK group. The content of physiotherapy was determined according to individually set goals
Outcomes	Outcomes were measured at baseline, 2 weeks (not reported), 3 weeks (post treatment) and 6 months Lower limb functional outcome measures: Functional Ambulation Category (primary outcome), 10 Metre Walk Test, 6 Minute Walk Test, Modified MAS, RMA Scale and RMI
Notes	Participants were recruited in 2 phases, June 2003 to December 2004 and January 2005 to February 2007. In the first phase, there was not control group. Control group outcome data for the 10 Metre Walk Test and 6 Minute Walk Test not reported. No apparent baseline imbalance

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	"patients were randomly allocated"
Allocation concealment (selection bias)	Unclear risk	"envelopes indicating the groups were sealed separately for patients with FAC [Functional Ambulatory Category] 0 or 1 and with FAC 2 or 3."
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Participants and outcome assessors do not appear to have been blinded
Incomplete outcome data (attrition bias) All outcomes	Low risk	Proportion of dropouts similar between WALK group (1/21) and control group (3/13)
Selective reporting (reporting bias)	High risk	No study protocol. No data presented for the control group for the 10 Metre Walk Test and the 6 Minute Walk Test at baseline and post intervention

Ross 2009

Methods	RCT
Participants	Australia 35 participants, 17 RTT, 18 control Participants were recruited from a rehabilitation hospital (inpatients and outpatients). Date of recruitment not reported Inclusion criteria: acquired brain injury within the past five years, over 18 years of age and notable hand impairment (i.e. a score of less than 80% on the Action Research Arm Test)

Ross 2009 (*Continued*)

	Exclusion criteria: co-existing injury or disease affecting hand function; unable to complete six weeks of training (i.e. for geographical, medical or psycho-social reasons). Patients with cognitive or physical problems precluding cooperation with the programme were also excluded Mean age: RTT 62.2 years (SD 18.2), control 60.8 years (SD 16.7) 48.6% male Stroke details: 85.7% ischaemic, 48.72% right sided hemiplegia Timing post stroke: RTT median 2.3 months (IQR 0.7 - 4.4), control median 0.7 months (IQR 0.3 - 3.0) Pre-intervention functional ability level: Scandinavian Stroke Scale: RTT 36.2 (SD 11.7), control 39.8 (SD 8.7)
Interventions	RTT intervention: all hand training was based on the principles of task-specific motor training and included repetitive practice of tasks which were individualised to the functional goals of each participant. Training was closely supervised on a 1-to-1 basis by 1 of a small number of experienced therapists The amount of actual practice performed in each session was carefully monitored, for this purpose a stopwatch was used to record the time spent performing hand activities. The aim was to achieve at least 45 minutes of repetitious practice in each session. Sessions were 1-hour with a therapist 5 x per week for six weeks = 30 hours Comparison group: both groups continued to receive usual arm care which consisted of half an hour of motor training for the shoulder and elbow 5 x per week. A cup or splint was strapped to participants' hands to standardise inadvertent hand training Usual care for both groups also consisted of strategies such as slings, wheelchair arm troughs and positioning programmes. In addition, participants in the control group had similar hand therapy as participants in the experimental group but for only 10 minutes, 3 x per week
Outcomes	Outcomes were recorded at baseline and 6 weeks (post treatment) Upper limb functional outcome measures: Disability of Shoulder Arm and Hand Assessment, Action Research Arm Test, Summed Manual Muscle Test, Wolf Motor Function Test, long finger flexor extensibility ADL outcome measures: Canadian Occupational Performance Measure
Notes	No significant differences at baseline

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Computer-generated allocation schedule
Allocation concealment (selection bias)	Low risk	Concealed opaque consecutively numbered envelopes by a person not otherwise involved in the study. The allocation schedule and envelopes were kept off-site

Ross 2009 (*Continued*)

Blinding of outcome assessment (detection bias) All outcomes	Low risk	Participants were instructed not to discuss their intervention or group allocation with assessors. The success of blinding was verified by asking assessors each time a participant completed the trial whether they had been unblinded. Assessors were then asked for their best guess at which group each participant had been allocated to
Incomplete outcome data (attrition bias) All outcomes	Low risk	2 dropouts in the control group unrelated to the intervention
Selective reporting (reporting bias)	Unclear risk	No study protocol

Salbach 2004

Methods	Stratified, multicentre RCT
Participants	Canada 91 participants: 44 mobility group, 47 arm training group Participants were recruited from 9 hospitals and 2 rehabilitation centres in Montreal or Quebec City between May 2000 and February 2003 Inclusion criteria: first or recurrent stroke, under 1 year post stroke at recruitment, able walk 10 metres but with residual walking deficit from most recent stroke, mental competency and ability to comprehend instructions, discharged from physical rehabilitation, resident in the community Exclusion criteria: resident in permanent care facility, co-morbidity precluding participation Mean age: mobility group 71 years (SD 12), arm training group 73 years (SD 8) 61.5% male Stroke details: first or recurrent stroke, 83% ischaemic, 56% right hemiparesis Timing post stroke: mean 228 days (SD 78) Pre-intervention functional ability level: 6 Minute Walk Test: mobility group 209 metres (SD 126), arm training group 204 metres (SD 131)
Interventions	Mobility group: 10 walking-related tasks designed to strengthen the lower extremities and enhance walking balance, speed and distance in a progressive manner Arm training group: functional tasks such as manipulating cards, using a keyboard and writing while seated Intervention was after discharge from physical rehabilitation Sessions were 60 minutes, 3 x per week for 6 weeks = 18 hours Sessions were delivered individually by a physical or occupational therapist in a hospital outpatient or rehabilitation setting Comparison group: Salbach 2004a: upper extremity training; Salbach 2004b: lower extremity training
Outcomes	Outcomes were recorded at baseline, and at 6 weeks (post treatment) Limb-specific functional outcome measures: 6 Minute Walk Test, 5 metre walk at comfortable and maximum speed Balance/sit-to-stand outcome measures: Timed Up and Go Test, Berg Balance Scale,

Salbach 2004 (*Continued*)

	Activities Specific Balance Confidence Scale ADL outcome measures: Barthel Index
Notes	No comparison of groups at baseline Participants stratified into 3 groups based on comfortable walking speed 86% of participants attended 17 or more mobility sessions out of 18, 72% attended 17 or more arm training sessions 344 people were evaluated for participation but 73% refused because they could not tolerate the travel required for attendance

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Computer-generated
Allocation concealment (selection bias)	Unclear risk	Allocation maintained in sealed, opaque envelopes, prepared prior to recruitment by persons not involved in the study
Blinding of outcome assessment (detection bias) All outcomes	High risk	Assessors were blind to group allocation. Unblinding occurred for 18/42 in the mobility group and 16/43 of the upper extremity training group, but did not bias the estimated effect as evaluated by multiple linear regression model
Incomplete outcome data (attrition bias) All outcomes	Low risk	Number of dropouts balanced across groups and reasons provided
Selective reporting (reporting bias)	Unclear risk	No study protocol

Salbach 2004a

Methods	See Salbach 2004
Participants	
Interventions	
Outcomes	
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement

Salbach 2004a (*Continued*)

Random sequence generation (selection bias)	Low risk	See Salbach 2004
Allocation concealment (selection bias)	Unclear risk	See Salbach 2004
Blinding of outcome assessment (detection bias) All outcomes	High risk	See Salbach 2004
Incomplete outcome data (attrition bias) All outcomes	Low risk	See Salbach 2004
Selective reporting (reporting bias)	Unclear risk	See Salbach 2004

Salbach 2004b

Methods	See Salbach 2004
Participants	
Interventions	
Outcomes	
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	See Salbach 2004
Allocation concealment (selection bias)	Unclear risk	See Salbach 2004
Blinding of outcome assessment (detection bias) All outcomes	High risk	See Salbach 2004
Incomplete outcome data (attrition bias) All outcomes	Low risk	See Salbach 2004
Selective reporting (reporting bias)	Unclear risk	See Salbach 2004

Song 2015

Methods	RCT
Participants	Korea 20 participants: 10 RTT, 10 control (additional individual-based task-oriented circuit training arm not included in the review) Inpatient recruitment, date of recruitment not reported Inclusion criteria: people with hemiplegia who were diagnosed with stroke Exclusion criteria: not reported Mean age: RTT 62.78 years (SD 9.97), control 59.28 years (SD 5.23) % male: not reported Stroke details: not reported Time since stroke: RTT 36.67 months (SD 15.12), control 27.66 (SD 19.35) Pre-intervention functional activity level: 2 Minute Walk Test RTT 76.6 (SD 33.1), control 57.6 (SD 20.5)
Interventions	RTT intervention: task-oriented circuit training. Training tasks were sitting in a chair, walking, walking over obstacles, carrying goods, turning the goods upside down and walking fast in a circle in addition to conventional therapy. Intervention performed for 30 minutes a day, 3 x per week for 4 weeks Comparison group: conventional therapy for 30 minutes a day, 5 x per week for 4 weeks
Outcomes	Outcomes were recorded at baseline and 4 weeks (post treatment) Lower limb functional outcome measure: 2 Minute Walk Test
Notes	Inadequate specification of inclusion criteria

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	"Subjects were randomly allocated"
Allocation concealment (selection bias)	Unclear risk	Method of concealment not reported
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	No mention of blinding
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Number of participants not reported in data tables
Selective reporting (reporting bias)	Unclear risk	No protocol available

Tung 2010

Methods	Single-blind RCT
Participants	Taiwan 32 participants, 16 RTT, 16 control Participants were recruited from a rehabilitation medical centre. Date of recruitment not reported Inclusion criteria: first CVA with unilateral motor deficits, Berg Balance Scale score less than 50, ability to perform the sit-to-stand task independently, stable medical condition to allow participation in assessment and intervention, ability to understand instructions and follow commands Exclusion criteria: any medical condition that would prevent participation in the study, deep sensory deficits or hemi-neglect Mean age: RTT 51.0 years (SD 12.1), control 52.7 years (SD 14.1) 62.5% male Stroke details: 68.8% right hemiparesis Timing post stroke: RTT 26.9 months (SD 16.0), control 12.8 months (SD 12.3) Pre-intervention functional ability level: static balance weight distribution (%) affected side: RTT 44.8 (SD 9.7), control 47.5 (SD 8.8)
Interventions	RTT intervention: participants received sit-to-stand training programme for 15 minutes each time in addition to a general physical therapy programme, 3 x per week for 4 weeks = 3 hours Comparison group: general physical therapy programme (30 minutes) including balance training, gait training, strengthening exercise for lower extremities, and ADL training
Outcomes	Outcomes were recorded at baseline and 4 weeks (post treatment) Balance/sit-to-stand outcome measures: Balance Master System, the limit of stability testing, duration of sit-to-stand, Berg Balance Scale
Notes	There was no significant difference in the baseline data between the experimental and control groups except the post stroke duration (RTT 29.9 months (SD 16), control 12. 8 months (SD 12.3))

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Block randomisation used but not clear how the sequence was generated
Allocation concealment (selection bias)	Unclear risk	Not clear if sealed envelopes were sequentially numbered
Blinding of outcome assessment (detection bias) All outcomes	Low risk	All participants were evaluated by another physical therapist who was blind to the assignment
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	No details provided on the number of participants included in outcome analysis

Tung 2010 (*Continued*)

Selective reporting (reporting bias)	Unclear risk	No study protocol

Turton 1990

Methods	Single-centre, quasi-randomised trial
Participants	UK 22 participants: 12 RTT, 10 control Participants were recruited from stroke patients discharged from inpatient care at one hospital between 1986 and 1987 Inclusion criteria: some impairment of function of the affected upper limb (i.e. less than 95% performance on a peg transfer task), able to understand instructions, lives within 25 miles of hospital Exclusion criteria: none stated Age: RTT 59 years (SD 11.97), control 58 years (SD 6.86) 55% male Stroke details: unclear whether first or recurrent stroke, 56% right hemiparesis Time since stroke: RTT 24 weeks (SD 25.8), control 16 weeks (SD 6.1) Pre-intervention disability level: 12.5/20 on Southern MAS
Interventions	RTT intervention: usual outpatient care plus home-based exercise programme for the upper limb, based on motor relearning principles. Exercises included movement and task-related reach, grasp and grip Participants were visited by an occupational therapist at home, and given exercises and repetitions Participants were visited every 2 to 4 weeks for review Carers were involved if able and willing Participants were assigned 2 to 3 practice sessions per day (approximately 1 hour in total) , 7 days per week for 8 to 11 weeks = 63 hours approximately Sessions were self-managed by the participant and their carer at home, with 2 to 3 home visits by an occupational therapist for programme review Comparison group: usual outpatient care (some had therapy, but others did not)
Outcomes	Outcomes were recorded at baseline and at 8 to 11 weeks (post treatment) Upper limb functional outcome measures: sitting part of the upper limb activity assessment - Southern Motor Group Assessment, 10 Hole Peg Test
Notes	Baseline differences: difference in time since stroke: experimental group mean of 24 weeks, and usual care mean of 16 weeks 10 Hole Peg Test performance: experimental group more disabled, home therapy group had more carers living at home Self-reported rates of compliance: mean 68% (SD 25)

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**

Turton 1990 (*Continued*)

Random sequence generation (selection bias)	High risk	Assigned to home-therapy group or a control group in alternate runs of 5
Allocation concealment (selection bias)	High risk	As above
Blinding of outcome assessment (detection bias) All outcomes	High risk	Outcome assessor not blinded to treatment group
Incomplete outcome data (attrition bias) All outcomes	Low risk	No loss to follow-up at end of treatment phase
Selective reporting (reporting bias)	Unclear risk	No study protocol

van de Port 2012

Methods	Multicentre RCT
Participants	Netherlands 250 participants: 126 RTT, 124 control Participants were recruited from 9 rehabilitation centres between June 2008 and December 2010 Inclusion criteria: eligible people had to have had a verified stroke according to the WHO definition, be able to walk a minimum of 10 metres without physical assistance (Functional Ambulation Categories $\geq$ 3), be discharged home from a rehabilitation centre, need to continue physiotherapy during outpatient care to improve walking competency or physical condition, or both and be able to give informed consent and be motivated to participate in a 12 week intensive programme of physiotherapy Exclusion criteria: cognitive deficits as evaluated by the Mini Mental State Examination (< 24 points), were unable to communicate (< 4 points on the Utrechts Communicatie Onderzoek, UCO) or lived more than 30 km from the rehabilitation centre Mean age: RTT 56 years (SD 10), control 58 years (SD 10) 64.8% male Stroke details: 81.2% (n = 103) ischaemic, 47.2% (n = 118) right hemisphere Time since stroke: RTT 91 days (SD 42), control 103 days (SD 51) Pre-intervention functional ability level: Six Minute Walk Test: RTT 339 metres (SD 120), control 306 metres (SD 135)
Interventions	RTT intervention: the training included 8 different workstations, intended to improve meaningful tasks relating to walking competency such as balance control, stair walking, turning, transfers and speed walking. At each workstation, participants worked together in pairs, while 1 participant performed the task for 3 minutes, the other observed their performance. Each participant's performance (such as counts) was recorded in a training log, which was used as a feedback and motivational tool during the next sessions. Motivational music was played in the background during the entire training session. The total FIT-Stroke programme included four stages: warming up (5 minutes), circuit training (60 minutes), evaluation and a short break (10 minutes), and group game (15 minutes) . Sessions lasted 90 minutes, twice per week for 12 weeks = 36 hours

van de Port 2012 (*Continued*)

	Comparison group: same duration of usual outpatient physiotherapy, mainly one-to-one treatments tailored to the patient with a physiotherapist who had not been on the circuit training course at one of the participating rehabilitation centres Sessions designed to improve control of standing balance, physical condition, and walking competency were provided according to Dutch physiotherapy guidelines
Outcomes	Outcomes were recorded at baseline, 12 weeks (post treatment), and 24 weeks after completion of training. Lower limb functional outcome measures: Six Minute Walk Test, functional ambulation, modified stairs test, comfortable walk test, RMI, Stroke Impact Scale 3.0 mobility domain Balance/sit-to-stand outcome measures: Timed Up and Go Test, Timed balance test Impairment outcome measures: Motricity Index ADL outcome measures: Nottingham Extended ADL QoL/health status outcome measures: Stroke Impact Scale (other domains), Hospital Anxiety and Depression Scale
Notes	Significant baseline differences in favour of the circuit training group for a few secondary outcomes, all analyses were adjusted for these covariates at baseline. 29 falls were reported in the circuit training group and 26 in the usual physiotherapy group (P = 0.93). 2 serious adverse events were reported in the circuit training group: 1 participant fell and consulted a GP and 1 experienced arrhythmias during 1 session

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Online minimisation procedure
Allocation concealment (selection bias)	Unclear risk	Method of concealment not described
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Trained research assistants who were blinded to treatment allocation, measured all outcomes
Incomplete outcome data (attrition bias) All outcomes	Low risk	Reasons for withdrawals provided. An intention-to-treat analysis was used with the last observation carried forward for the missing data
Selective reporting (reporting bias)	High risk	EuroQoL not reported

Van Vliet 2005

Methods	Single-centre RCT
Participants	UK 120 participants: 60 RTT, 60 control Participants were recruited from admissions to a stroke rehabilitation ward over a period

	of 21 months. Date of recruitment not reported Inclusion criteria: diagnosis of stroke, referral to physiotherapy Exclusion criteria: more than 2 weeks post stroke, unconscious on admission, unable to toilet independently prior to stroke, living more than 25 km from hospital, unable to tolerate more than 30 minutes of physical tasks required in initial assessment Mean age: RTT 75 years (SD 9.1), control 73.3 (SD 10.4) 50% male Stroke details: unclear whether first or recurrent stroke included, 51% right hemiparesis Time since stroke: within 14 days Pre-intervention functional ability level: RMA - gross function subscale: RTT median 2 (IQR 1 to 6), control median 1 (IQR 1 to 4)
Interventions	RTT intervention: movement science-based therapy based on the principle that skill in performance is a direct function of the amount of practice. Programme involved use of everyday objects for functional training, and practice outside of delivered sessions. Intervention was instead of usual care. Participants received a median 23 minutes treatment by a physiotherapist per week day (IQR 13 to 32 minutes). Median total number of minutes of treatment was 365 (IQR 140 to 1160), equating to approximately 6 hours total training time. Treatment was delivered by physiotherapists, occupational therapists and physiotherapy assistants, in hospital, and as an outpatient after discharge. Treatment was delivered for as long as needed Comparison group: Bobath-based therapy
Outcomes	Outcomes were recorded at baseline, 4 weeks, 3 months and 6 months Lower limb functional outcome measures: RMA, MAS, Six Metre Walk Test Upper limb functional outcome measures: 10 Hole Peg Test ADL outcome measures: Barthel Index, Extended ADL
Notes	Control group had higher median scores for Rivermead gross function, and leg and trunk subscales, and for supine to side lying, supine to sitting, balanced sitting, and sit-to-stand sections of the MAS; the experimental group had higher median scores for the upper arm section of the MAS. 29% loss to follow-up at 3 months

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Computer-generated random sequence provided by an independent person
Allocation concealment (selection bias)	Unclear risk	Allocations were provided in envelopes and opened after initial assessment
Blinding of outcome assessment (detection bias) All outcomes	Low risk	The assessor was blind to group allocation. To ensure masking, assessments of inpatients occurred in a room separate from the ward and patients were brought to the assessor there whenever possible. Patients were asked not to mention their treatment or therapist to the assessor. For later examination of the success of masking, the assessor recorded a guess of the patient's group

Van Vliet 2005 (*Continued*)

		allocation at each assessment, there was poor agreement
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Number of dropouts balanced across groups, unclear if reasons provided are related to the intervention
Selective reporting (reporting bias)	High risk	Modified Ashworth Scale and Nottingham Sensory Assessment not reported

Winstein 2004

Methods	Stratified, single-centre pilot RCT
Participants	USA 43 participants: RTT 22, control 21 Participants were recruited from new admissions to a neurorehabilitation services centre. Date of recruitment not reported Inclusion criteria: aged 29 to 76, first time stroke confirmed by CT or MRI, initially from infarction in the anterior circulation, but widened early in the recruitment phase to include haemorrhagic or pontine stroke, onset of stroke from 2 to 35 days before study entry, FIM score of 40 to 80, widened to include a broader range early in recruitment phase Exclusion criteria: peripheral nerve or orthopaedic conditions that interfered with arm movements, cardiac disease that limited function, subarachnoid haemorrhage within evidence of infarction, progressive hydrocephalus, previous history of brain injury, severe aphasia, neglect, agitation or depression that could limit participation Age: RTT< 35 years (n = 2), 35 to 75 years (n = 18), control < 35 years (n = 0), 35 to 75 years (n = 19), > 75 years (n = 1) 52.5% male Stroke details: first stroke, 85% ischaemic stroke, 62% right hemiparesis Time since stroke: RTT 15.5 days (SD 6), control 15.4 days (SD 5.5) Pre-intervention disability level: 65% Orpington Score 1.6 to 4.1
Interventions	RTT intervention: usual care plus task-specific functional training based on the principles of motor relearning, focusing on systematic and repetitive practice of tasks. Tasks were randomly ordered, and progressed in difficulty Sessions were 1 hour per day, 5 days per week, for 4 weeks = 20 hours additional to usual care Sessions were delivered by a physical therapist in hospital, and in an outpatient setting when discharged Comparison group: usual care - delivered primarily by occupational therapists, which could include muscle facilitation exercises emphasising the neurodevelopmental treatment approach, neuromuscular electrical stimulation, stretching exercises, and ADL
Outcomes	Outcomes were recorded at baseline, 4 to 6 weeks (post treatment) and 9 months after stroke Upper limb functional outcome measures: Functional Test of the Hemiparetic Upper Extremity, Fugl Meyer Assessment ADL outcome measures: Functional Independence Measure

Winstein 2004 (*Continued*)

Notes	No significant differences reported at baseline 7% loss to follow-up at end of treatment phase Intervention-related reasons for withdrawal: 1 participant in the experimental group lost interest Compliance reported as near perfect, except for 1 participant in the experimental group who, after discharge, and because of travel distance, completed only 15 of the 20 hours training

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Procedure for generating random numbers not described, except for blocking
Allocation concealment (selection bias)	Unclear risk	Sealed envelopes delivered by independent person, and opened on enrolment on next eligible participant
Blinding of outcome assessment (detection bias) All outcomes	High risk	Outcome assessor not blinded to group allocation
Incomplete outcome data (attrition bias) All outcomes	Low risk	Missing data balanced in numbers across groups with similar reasons
Selective reporting (reporting bias)	Unclear risk	No study protocol

Winstein 2016

Methods	RCT
Participants	USA 361 participants: 119 structured, task-oriented upper extremity training (Accelerated Skill Acquisition Programme), 120 dose-equivalent occupational therapy (DEUCC), 122 monitoring-only occupational therapy (UCC) Participants were recruited from 7 sites, predominantly during inpatient rehabilitation, between June 2009 and March 2014 Inclusion criteria: ischaemic or haemorrhagic stroke (subdural and epidural effusions permitted) within the previous 106 days, hemiparesis (weakness) in arm or hand, some active finger extension movement by close of enrolment window, age 21+, able to communicate in English, willing to attend outpatient therapy and all study evaluations Exclusion criteria: • Neurologic symptoms or conditions: traumatic or non-vascular brain injury, subarachnoid haemorrhage, AV malformation, acute subdural or epidural haematoma; neurologic condition that may affect motor response (e.g. Parkinson's, ALS, MS); presence of ataxia per NIHSS and evidence of cerebellar or brainstem lesion; absent upper extremity sensation per NIHSS; neglect asymmetry > 3 per Mesulam

	Unstructured; a second stroke within the last 72 hours cannot be ruled out before the brief medical exam (BME) • Physical attributes affecting movement or function: total UE Fugl-Meyer score < 19 or > 58, or = 0 for finger mass extension/grasp release hand score; upper extremity pain that substantially interferes with ADLs; maximum assistance required for mobility • Passive ROM limitation of the hemiparetic upper extremity that prevents functional use of limb/hand, including any of the following: shoulder: flexion < 90°, abduction < 90°, external rotation < 45°; elbow/forearm: extension <— 20°, supination or pronation < 45° from neutral; wrist/finger: flexion or extension < 0°, MCP or IP extension < 30° • Pre-morbid status: head trauma requiring > 48 hours of hospitalisation within past 12 months; psychiatric illness requiring hospitalisation within past 24 months; arm or hand injury limiting use prior to stroke; amputation of all fingers or thumb of affected hand; pre-morbid motor impairment of the contralateral upper extremity of neurologic origin; Barthel Index < 95 • Medication, drugs and/or alcohol: active or recent drug treatment for dementia; treated with Botox in affected arm within last 3 months; toxicology screen positive for illegal substances or reported use within the past 3 years; reported alcohol use per CAGE or treatment for withdrawal since index stroke • Cognition and Participation: enrolment in a conflicting study; expected inability to participate in study due to illness, social, or geographic reasons; unable to follow a 2-step command per NIHSS; < 2 on the Mini-Cog with an abnormal Clock Draw Test (CDT) or score = 0; PHQ-9 total score between 10 and 19 without management plan or score > 19; judged medically unstable and/or unable to participate by primary physician or SPI • Other: received > 6 hours of outpatient occupational therapy (OT) since stroke (Home Health and OT Evaluation do not count toward 6 hour maximum); clinician's best judgment (multiple factors in combination): the SPI and CSC concur that the PP is NOT a candidate for randomisation; 14-106 days post stroke Mean age: ASAP 60.9 years (SD 13.7), DEUCC 59.9 years (SD 10.5), UCC 61.1 years (SD 13.1) 56.2% male Stroke details: ischaemic stroke 83.3%, right hemiparesis 46.5% Time since stroke: total 45.8 days (SD 22.4), ASAP 45.2 days (SD 20.3), DEUCC 45.0 days (SD 22.8), UCC 47.0 days (SD 23.9) Pre-intervention functional ability level: baseline upper extremity Fugl-Meyer motor score: total 41.6 (SD 9.4), ASAP 41.7 (9.5), DEUCC 41.5 (SD 9.2), UCC 41.6 (SD 9.5)
Interventions	RTT intervention: Accelerated Skill Acquisition Program (ASAP) emphasising purposeful and skilled movement execution, choices of specific tasks to be practiced, collaborative problem solving to identify and address movement needs and encouragement of self-direction in extending practice to community contexts Sessions were 1 hour, 3 times per week for 10 weeks = 30 hours Dose-equivalent usual and customary care group (DEUCC) and monitoring-only usual and customary care (UCC) received outpatient occupational therapy based on usual and customary practice. The DEUCC group received 30 hours of therapy; the UCC group did not have a specified dose

Winstein 2016 (*Continued*)

Outcomes	Outcomes measured at baseline, post intervention (10 weeks) and at 6 and 12 months Upper limb functional outcomes: log-transformed Wolf Motor Function Test (primary outcome); 12-month change in Wolf Motor Function Test time score; Stroke Impact Scale hand sub-scale score
Notes	No apparent baseline imbalance

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	A stratified block randomisation scheme within sites balanced assignment by motor severity and time from stroke onset
Allocation concealment (selection bias)	Low risk	"Once a participant provided informed consent and the baseline assessment was completed, the study site requested randomization; the data manager confirmed eligibility and the site team leader was notified of the assignment."
Blinding of outcome assessment (detection bias) All outcomes	High risk	Outcome assessors blinded; not possible to blind participants. Assessor was unblinded to allocation of 7 participants
Incomplete outcome data (attrition bias) All outcomes	Low risk	Data for all participants analysed using intention to treat. Withdrawals: ASAP: 13/119, DEUCC 11/120, UCC 22/122
Selective reporting (reporting bias)	High risk	Many more outcomes listed in the protocol than reported, e.g. Upper Extremity Fugl-Meyer

Yen 2005

Methods	Single centre RCT
Participants	Taiwan 30 participants: 13 RTT, 17 control Participants were recruited from a neurology department. Date of recruitment not reported Inclusion criteria: single stroke resulting in hemiparesis, minimum of 20 degrees of active wrist extension and 10 degrees of active finger extension, aged between 18 to 80 years, no severe aphasia or cognitive impairment Exclusion criteria: other diseases that would confound the study such as Parkinson's disease, shoulder subluxation, recurrent stroke during the training period Mean age: RTT 67.85 years (SD 11.2), control 69.53 years (SD 9.23) 46% male Stroke details: first stroke, 60% right hemiparesis Time since stroke: RTT 8.4 months (SD 8), control 6.2 months (SD 7.9) Pre-intervention functional ability level: baseline mean 3.28 seconds per item on the Wolf Motor Function Test

Yen 2005 (*Continued*)

Interventions	RTT intervention: practice of 15 to 20 tasks selected from a battery of 50 tasks, with task shaping (consisting of verbal feedback for small improvements), task selection (based on needs of individual), and performance assistance in the initial stages if unable to perform independently. Intervention was instead of usual care. Sessions were 6 hours per day; it is unclear whether there were 5 or 7 sessions per week. Treatment duration was 2 weeks = 60 to 84 hours. Sessions were delivered by a physical therapist; it is unclear whether sessions were group based or individual Comparison group: regular program of physical therapy including gait training, facilitation, balance training, or occupational therapy; it is unclear how much time the control group spent in therapy
Outcomes	Outcomes were recorded at baseline and 2 weeks (post treatment) Upper limb functional outcome measures: mean time taken to complete individual items on the Wolf Motor Function Test Results for items 8 to 15 are only presented for participants able to complete them within 2 minutes
Notes	Exclusion criteria potentially applied during training. No baseline differences reported

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Inadequately reported
Allocation concealment (selection bias)	Unclear risk	Not reported
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Assessor blinded
Incomplete outcome data (attrition bias) All outcomes	Low risk	No loss to follow-up
Selective reporting (reporting bias)	Unclear risk	No study protocol

Abbreviations used in characteristics of included studies tables
ADL: activities of daily living
CT: computed tomography
CVA: cardiovascular accident
IQR: interquartile range
MAS: Motor Assessment Scale
MRI: magnetic resonance imaging
NIHSS: National Institutes of Health Stroke Scale
RCT: randomised controlled trial
RMA: Rivermead Motor Assessment

RMI: Rivermead Mobility Index
RTT: repetitive task training
SD: standard deviation
QoL: quality of life

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

Study	Reason for exclusion
Allison 2005	Not repetitive task training
Almhdawi 2014	Compared against another RTT-type intervention
Askim 2010	Alternative mechanism of action
Banta 2013	Alternative mechanism of action
Conroy 2011	Not repetitive task training
English 2016	Alternative mechanism of action
Harijan 2013	Compared against another RTT-type intervention
Hillier 2010	Compared against another RTT-type intervention
Hubbard 2015	Compared against another RTT-type intervention
Li 2008	Alternative mechanism of action
Logan 2014	Not RTT
Lord 2008	Compared against another RTT-type intervention
Malagoni 2016	Compared against another RTT-type intervention
McCombe Waller 2014	Alternative mechanism of action
Onigbinde 2009	Alternative mechanism of action
Pang 2013	Compared against another RTT-type intervention
Rao 2013	Not RTT
Saeys 2012	Alternative mechanism of action
Sherrington 2008	Not specific to stroke patients
Shimodozono 2013	Alternative mechanism of action

(*Continued*)

Tang 2009	Alternative mechanism of action
Taub 2013	Compared against another RTT-type intervention
Verheyden 2009	Not RTT
Vloothuis 2013	Alternative mechanism of action
Wang 2011	Compared against another RTT-type intervention

RTT: repetitive task training

Characteristics of studies awaiting assessment *[ordered by study ID]*

Baglary 2013

Methods	Pre-test, post test experimental study design
Participants	Undergoing hospital rehabilitation
Interventions	Backward walking training in gait performance for people with stroke
Outcomes	Gait measures
Notes	MSc Dissertation not published

Bhaskar 2009

Methods	RCT
Participants	Stroke
Interventions	Conventional physiotherapy and hand functional activities
Outcomes	Hand function
Notes	

Brkic 2016

Methods	RCT
Participants	Recruited within 14 days of stroke
Interventions	Repetitive functional task practice upper limb
Outcomes	Arm function
Notes	Trial completed, in follow-up phase

ChiCTR-ICR-15005992

Methods	RCT
Participants	Acute ischaemic stroke
Interventions	Early and intensive rehabilitation
Outcomes	Motor function
Notes	

Eng 2009

Methods	RCT
Participants	Undergoing hospital rehabilitation
Interventions	Leg exercise programme
Outcomes	Gait speed, balance, physical activity
Notes	Trial completed, publication under review

Ferrari 2015

Methods	RCT
Participants	People with post stroke Pusher Syndrome
Interventions	Specific rehabilitation treatment
Outcomes	Sitting and standing balance
Notes	

Gandhi 2015

Methods	RCT
Participants	Within 7 days of admission (< 1- month post stroke)
Interventions	Repetition of task-specific activities (ATTEND Trial)
Outcomes	Patient-centred goals, quality of life
Notes	

Indurkar 2013

Methods	RCT
Participants	Within 1 year of a first or recurrent stroke and with residual walking deficit
Interventions	Task-orientated intervention comprising of 5 tasks
Outcomes	Balance, speed and distance
Notes	

Knox 2014

Methods	Not known
Participants	People with stroke discharged from hospital
Interventions	Outpatient-based, task-orientated training programme
Outcomes	Not known
Notes	

Kumar 2012

Methods	RCT
Participants	Stroke patients with paresis of hand
Interventions	Task-orientated training
Outcomes	Hand function
Notes	

NCT02429180

Methods	RCT
Participants	At least 1 month post discharge from hospital
Interventions	Excercise-based functional training programme
Outcomes	Mobility, balance, ability to perform 5 functional tasks, physical activity
Notes	Trial estimated completion date October 2016

Pandian 2014

Methods	RCT
Participants	People with stroke: early supported discharge
Interventions	Family-led caregiver-delivered, home-based stroke rehabilitation (ATTEND Trial)
Outcomes	Quality of life, anxiety and depression, health costs
Notes	

Xu 2012

Methods	RCT
Participants	Stroke
Interventions	Walking training
Outcomes	Lower limb function, activities of daily living
Notes	

Zhu 2013

Methods	RCT
Participants	People with stroke with upper limb dysfunction
Interventions	Rehabilitation training for optimising motor skills
Outcomes	Hand function
Notes	

RCT: randomised controlled trial

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

Bosomworth 2013

Trial name or title	Robot Assisted Training for the Upper Limb after Stroke (RATULS)
Methods	3-arm multicentre RCT
Participants	1 week to 5 years post stroke (Stratified: 0 to 3months; > 3 to 12 months; > 12 months to 5 years)
Interventions	Enhanced upper limb therapy programme
Outcomes	Upper limb function, upper limb impairment, ADL, quality of life, adverse events
Starting date	Main Trial 2015
Contact information	helen.rodgers@ncl.ac.uk
Notes	Pilot trial 2014

CTRI/2015/06/005877

Trial name or title	Short-term effect of circuit class training for improvement of upper limit in stroke patients: a randomised clinical trial
Methods	RCT
Participants	Single episode supratentorial stroke
Interventions	Task-orientated circuit class training
Outcomes	Motor function
Starting date	2014
Contact information	abraham.joshua@manipal.edu
Notes	

Hariohm 2013

Trial name or title	RCT protocol on efficacy of deep knee flexion exercises on improving activities involving deep knee flexion and quality of life in persons with stroke
Methods	Pragmatic RCT
Participants	Chronic stroke, community dwelling
Interventions	Task specific deep knee flexion activity-training
Outcomes	Deep knee flexion activity goal attainment, quality of life (social participation domain), lower limb muscle strength, fear of fall, functional ambulation status
Starting date	2013
Contact information	Hariohm@hotmail.com
Notes	Recruitment target 40 - ongoing

Korner-Bitensky 2013

Trial name or title	Randomised pilot trial of usual care versus LIFE (lifestyle intervention using functional exercise to reduce falls) in those with mild stroke
Methods	3-group parallel RCT
Participants	Individuals aged > 70 years with a first mild stroke
Interventions	Lifestyle intervention using functional exercise
Outcomes	Rate of falls (self-reported), static and dynamic balance
Starting date	2013
Contact information	lindy.clemson@sydney.edu.au
Notes	Pilot data being prepared for publication

Kumaran 2010

Trial name or title	RCT to study the effects of a task and context-based exercise program in stroke patients
Methods	RCT
Participants	> 3 months post stroke
Interventions	Task and context-based exercise program using motor relearning approach

Kumaran 2010 (*Continued*)

Outcomes	Stroke Impact Scale, Motricity Index Score, gait velocity, Berg Balance Scale, walking distance, Participation and Autonomy Questionnaire, Falls Efficacy Scale
Starting date	2011
Contact information	senthil.kumaran@manipal.edu
Notes	Trial due to complete 2015

NCT02235974

Trial name or title	Critical Periods After Stroke Study (CPASS)
Methods	4-arm RCT (Phase 2)
Participants	People with stroke within 28 days of admission
Interventions	Upper limb motor training (intensive therapy: acute, sub-acute, chronic phase)
Outcomes	Upper extremity motor improvement
Starting date	2014
Contact information	Margot.Giannetti@medstar.net
Notes	Trial estimated completion date August 2018

NCT02765152

Trial name or title	Effects of training rhythmic and discrete aiming movements on arm control and functionality after stroke
Methods	3-arm RCT
Participants	Stroke experienced more than 6 months on enrolment
Interventions	Discrete and rhythmic aiming movements (repeated)
Outcomes	Motor activity, arm function
Starting date	May 2016
Contact information	sandra.alouche@unicid.edu.br
Notes	Not yet recruiting

Schultz 2012

Trial name or title	Use of repetitive facilitative exercise program in established stroke
Methods	RCT
Participants	> 6 months post stroke
Interventions	Repetitive facilitative exercise therapy
Outcomes	Fugl-Meyer Arm Score, Motor Activity Log, Grasp strength, hand dexterity, patient satisfaction
Starting date	2012
Contact information	schultz.billie@mayo.edu
Notes	Trial due to complete 2014

Stuart 2009

Trial name or title	Adaptive Physical Activity for chronic stroke (APA-Stroke)
Methods	RCT
Participants	> 6 months post stroke
Interventions	Progressive exercise program
Outcomes	Walking speed, ambulatory activity, balance
Starting date	2009
Contact information	stuart@umbc.edu
Notes	Trial due to complete 2014

Tanne 2008

Trial name or title	Virtual reality training program for ambulatory patients with chronic gait deficits after stroke
Methods	Pilot RCT
Participants	Ambulatory patients following stroke (3 to 72 months post stroke)
Interventions	Virtual reality system
Outcomes	Ambulation, gait, functional reach
Starting date	2008

Tanne 2008 (*Continued*)

Contact information	David.Tanne@sheba.health.gov.il
Notes	

Turton 2011

Trial name or title	Home-based reach-to-grasp training for people after stroke: study protocol for a feasibility RCT
Methods	Randomised controlled feasibility trial
Participants	< 12 months post stroke
Interventions	Task-specific reach-to-grasp training
Outcomes	Arm function, arm movement in 28 everyday tasks , Stroke Impact Scale, Health and Social Questionnaire, caregiver burden
Starting date	2011
Contact information	ailie.turton@uwe.ac.uk
Notes	Trial completed, in follow-up phase

ADL: activities of daily living
RCT: randomised controlled trial

DATA AND ANALYSES

Comparison 1. Upper limb function: post treatment

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Arm function	11	749	Std. Mean Difference (IV, Random, 95% CI)	0.25 [0.01, 0.49]
2 Hand function	8	619	Std. Mean Difference (IV, Random, 95% CI)	0.25 [0.00, 0.51]
3 Sitting balance/reach	6	222	Std. Mean Difference (IV, Fixed, 95% CI)	0.28 [0.01, 0.55]

Comparison 2. Upper limb function: follow-up

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 All outcomes	9		Std. Mean Difference (IV, Fixed, 95% CI)	Subtotals only
1.1 Under 6 months post treatment	3	153	Std. Mean Difference (IV, Fixed, 95% CI)	0.92 [0.58, 1.26]
1.2 6 to 12 months post treatment	6	412	Std. Mean Difference (IV, Fixed, 95% CI)	0.10 [-0.09, 0.30]

Comparison 3. Upper limb function: subgroup analyses

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Dosage of task practice	15	833	Std. Mean Difference (IV, Random, 95% CI)	0.33 [0.11, 0.56]
1.1 0 to 20 hours	9	383	Std. Mean Difference (IV, Random, 95% CI)	0.23 [0.00, 0.46]
1.2 More than 20 hours	6	450	Std. Mean Difference (IV, Random, 95% CI)	0.38 [-0.03, 0.80]
2 Time since stroke	15	833	Std. Mean Difference (IV, Random, 95% CI)	0.33 [0.11, 0.56]
2.1 0 to 15 days	4	239	Std. Mean Difference (IV, Random, 95% CI)	0.21 [-0.04, 0.47]
2.2 16 days to 6 months	7	421	Std. Mean Difference (IV, Random, 95% CI)	0.48 [0.06, 0.91]
2.3 More than 6 months	4	173	Std. Mean Difference (IV, Random, 95% CI)	0.24 [-0.23, 0.72]
3 Type of intervention	15	833	Std. Mean Difference (IV, Random, 95% CI)	0.33 [0.11, 0.56]
3.1 Whole therapy	3	240	Std. Mean Difference (IV, Random, 95% CI)	0.51 [-0.18, 1.20]
3.2 Mixed training	8	509	Std. Mean Difference (IV, Random, 95% CI)	0.14 [-0.03, 0.32]
3.3 Single task training	4	84	Std. Mean Difference (IV, Random, 95% CI)	0.71 [0.11, 1.30]

Comparison 4. Lower limb function: post treatment

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Walking distance: change from baseline	9	610	Mean Difference (IV, Random, 95% CI)	34.80 [18.19, 51.41]
2 Walking speed	12	685	Std. Mean Difference (IV, Random, 95% CI)	0.39 [-0.02, 0.79]
3 Functional ambulation	8	525	Std. Mean Difference (IV, Random, 95% CI)	0.35 [0.04, 0.66]
4 Sit-to-stand: post treatment/change from baseline	7	346	Std. Mean Difference (Fixed, 95% CI)	0.35 [0.13, 0.56]
5 Lower limb functional measures	5	419	Std. Mean Difference (IV, Fixed, 95% CI)	0.29 [0.10, 0.48]
6 Standing balance/reach	9	504	Std. Mean Difference (IV, Fixed, 95% CI)	0.24 [0.07, 0.42]

Comparison 5. Lower limb function: follow-up

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 All outcomes	12		Std. Mean Difference (IV, Fixed, 95% CI)	Subtotals only
1.1 Under 6 months post treatment	8	471	Std. Mean Difference (IV, Fixed, 95% CI)	0.34 [0.16, 0.52]
1.2 6 to 12 months post treatment	6	268	Std. Mean Difference (IV, Fixed, 95% CI)	0.06 [-0.18, 0.31]

Comparison 6. Lower limb function: subgroup analyses

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Dosage of task practice	24	1144	Std. Mean Difference (IV, Random, 95% CI)	0.32 [0.12, 0.53]
1.1 0 to 20 hours	16	583	Std. Mean Difference (IV, Random, 95% CI)	0.39 [0.07, 0.71]
1.2 More than 20 hours	8	561	Std. Mean Difference (IV, Random, 95% CI)	0.33 [0.16, 0.50]
2 Time since stroke	24	1144	Std. Mean Difference (IV, Random, 95% CI)	0.32 [0.12, 0.53]
2.1 0 to 15 days	5	288	Std. Mean Difference (IV, Random, 95% CI)	0.16 [-0.15, 0.46]
2.2 16 days to 6 months	9	428	Std. Mean Difference (IV, Random, 95% CI)	0.52 [-0.03, 1.07]
2.3 More than 6 months	10	428	Std. Mean Difference (IV, Random, 95% CI)	0.41 [0.21, 0.60]
3 Type of intervention	24	1144	Std. Mean Difference (IV, Random, 95% CI)	0.32 [0.12, 0.53]
3.1 Whole therapy	2	138	Std. Mean Difference (IV, Random, 95% CI)	0.10 [-0.24, 0.43]
3.2 Mixed training	17	894	Std. Mean Difference (IV, Random, 95% CI)	0.42 [0.17, 0.67]
3.3 Single task training	5	112	Std. Mean Difference (IV, Random, 95% CI)	0.07 [-0.42, 0.55]

Comparison 7. Secondary outcomes

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Activities of daily living function	9	527	Std. Mean Difference (IV, Fixed, 95% CI)	0.28 [0.10, 0.45]
2 Global motor function scales	5	222	Std. Mean Difference (IV, Fixed, 95% CI)	0.38 [0.11, 0.65]
3 Quality of life/health status	4	264	Std. Mean Difference (IV, Fixed, 95% CI)	0.28 [0.04, 0.53]

Analysis 1.1. Comparison 1 Upper limb function: post treatment, Outcome 1 Arm function.

Review: Repetitive task training for improving functional ability after stroke

Comparison: 1 Upper limb function: post treatment

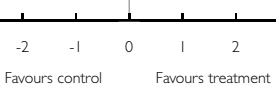
Outcome: 1 Arm function

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Weight	Std. Mean Difference IV,Random,95% CI
Arya 2012	50	22.84 (12.33)	52	11.15 (7.31)		11.1 %	1.15 [0.73, 1.57]
Blennerhassett 2004a	15	4.9 (1.9)	15	5.1 (1.5)		6.8 %	-0.11 [-0.83, 0.60]
Kwakkel 1999b	27	20 (22)	34	10 (19)		9.6 %	0.48 [-0.03, 1.00]
Langhammer 2000	29	4.7 (2)	24	4.1 (2.3)		9.1 %	0.28 [-0.27, 0.82]
Ross 2009	17	17 (21)	16	22 (25)		7.1 %	-0.21 [-0.90, 0.47]
Salbach 2004b	47	29 (17)	44	28 (19)		11.3 %	0.06 [-0.36, 0.47]
Turton 1990	12	13.83 (6)	10	12.25 (7.2)		5.5 %	0.23 [-0.61, 1.07]
Van Vliet 2005	42	3.88 (2.23)	43	3.69 (2.38)		11.1 %	0.08 [-0.34, 0.51]
Winstein 2004	20	9.58 (5.7)	20	9.47 (6.3)		8.0 %	0.02 [-0.60, 0.64]
Winstein 2016	102	1.38 (0.82)	100	1.28 (0.81)		13.8 %	0.12 [-0.15, 0.40]
Yen 2005	13	-2.57 (0.93)	17	-3.06 (1.54)		6.6 %	0.36 [-0.37, 1.09]
Total (95% CI)	**374**		**375**			**100.0 %**	**0.25 [0.01, 0.49]**

Heterogeneity: $Tau^2 = 0.09$; $Chi^2 = 24.09$, df = 10 (P = 0.01); $I^2 = 58\%$

Test for overall effect: Z = 2.01 (P = 0.045)

Test for subgroup differences: Not applicable



Analysis 1.2. Comparison 1 Upper limb function: post treatment, Outcome 2 Hand function.

Review: Repetitive task training for improving functional ability after stroke

Comparison: 1 Upper limb function: post treatment

Outcome: 2 Hand function

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Weight	Std. Mean Difference IV,Random,95% CI
Arya 2012	50	9.64 (6.92)	52	4.12 (4.04)		15.2 %	0.97 [0.56, 1.38]
Blennerhassett 2004a	15	4.7 (2.5)	15	4.9 (2.1)		8.4 %	-0.08 [-0.80, 0.63]
Langhammer 2000	29	4.6 (1.9)	24	3.9 (2.3)		11.7 %	0.33 [-0.21, 0.87]
Ross 2009	16	2.1 (1.5)	16	2.3 (1.5)		8.8 %	-0.13 [-0.82, 0.56]
Salbach 2004b	47	-9 (3)	44	-10 (4)		15.1 %	0.28 [-0.13, 0.70]
Turton 1990	12	-43.5 (20.8)	10	-41.1 (20.1)		6.7 %	-0.11 [-0.95, 0.73]
Van Vliet 2005	42	4.3 (2.41)	43	4.07 (2.56)		14.8 %	0.09 [-0.33, 0.52]
Winstein 2016	104	70.34 (26.36)	100	65.25 (24.87)		19.4 %	0.20 [-0.08, 0.47]
Total (95% CI)	**315**		**304**			**100.0 %**	**0.25 [0.00, 0.51]**

Heterogeneity: $Tau^2 = 0.07$; $Chi^2 = 15.17$, df = 7 (P = 0.03); $I^2 = 54\%$

Test for overall effect: Z = 1.96 (P = 0.050)

Test for subgroup differences: Not applicable

Analysis 1.3. Comparison 1 Upper limb function: post treatment, Outcome 3 Sitting balance/reach.

Review: Repetitive task training for improving functional ability after stroke

Comparison: 1 Upper limb function: post treatment

Outcome: 3 Sitting balance/reach

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Fixed,95% CI	Weight	Std. Mean Difference IV,Fixed,95% CI
de S ze 2001	10	3.3 (0.8)	10	3 (0.8)		9.2 %	0.36 [-0.53, 1.24]
Dean 1997	10	12 (0.95)	9	10.8 (0.9)		7.2 %	1.24 [0.23, 2.24]
Dean 2007	6	1.25 (0.07)	6	1.07 (0.13)		3.8 %	1.59 [0.22, 2.96]
Howe 2005	15	-1.9 (0.8)	18	-2.1 (0.7)		15.3 %	0.26 [-0.43, 0.95]
Langhammer 2000	29	5.4 (0.9)	24	5 (1.5)		24.4 %	0.33 [-0.22, 0.87]
Van Vliet 2005	42	4.54 (1.49)	43	4.63 (1.42)		40.0 %	-0.06 [-0.49, 0.36]
Total (95% CI)	**112**		**110**			**100.0 %**	**0.28 [0.01, 0.55]**

Heterogeneity: Chi^2 = 9.54, df = 5 (P = 0.09); I^2 =48%

Test for overall effect: Z = 2.03 (P = 0.043)

Test for subgroup differences: Not applicable

Analysis 2.1. Comparison 2 Upper limb function: follow-up, Outcome 1 All outcomes.

Review: Repetitive task training for improving functional ability after stroke

Comparison: 2 Upper limb function: follow-up

Outcome: 1 All outcomes

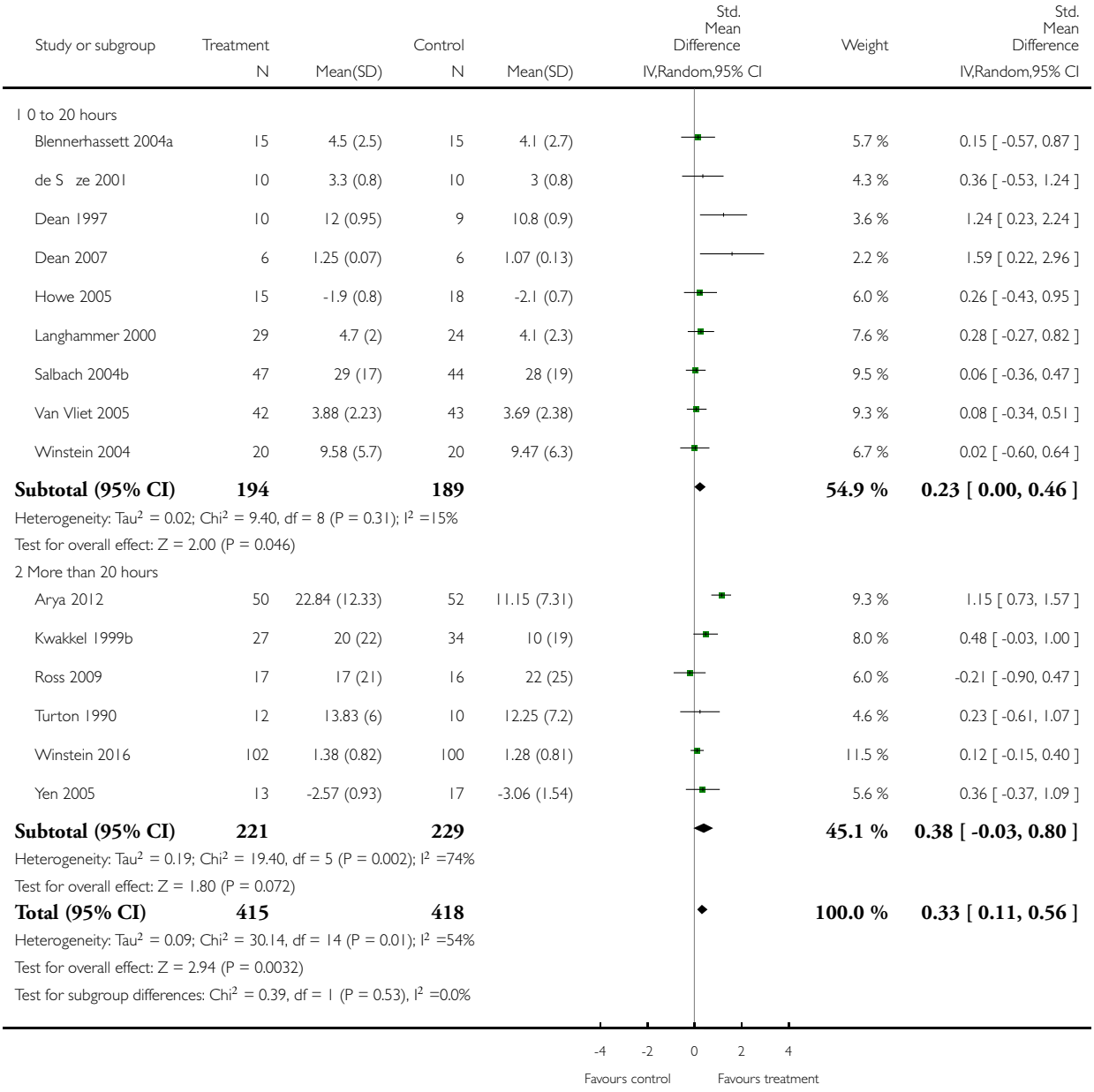
Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Fixed,95% CI	Weight	Std. Mean Difference IV,Fixed,95% CI
1 Under 6 months post treatment							
Arya 2012	50	25.5 (12.1)	52	13.46 (8.22)		63.9 %	1.16 [0.74, 1.58]
de S ze 2001	10	3.6 (0.5)	10	3.4 (0.6)		14.4 %	0.35 [-0.54, 1.23]
Howe 2005	15	2.5 (1.3)	16	1.9 (0.5)		21.7 %	0.60 [-0.12, 1.32]
Subtotal (95% CI)	**75**		**78**			**100.0 %**	**0.92 [0.58, 1.26]**
Heterogeneity: Chi^2 = 3.61, df = 2 (P = 0.16); I^2 =45%							
Test for overall effect: Z = 5.37 (P < 0.00001)							
2 6 to 12 months post treatment							
Blennerhassett 2004a	10	-23.6 (12.2)	11	-31 (33.2)		5.1 %	0.28 [-0.58, 1.14]
Dean 2007	5	1.26 (0.08)	4	1.07 (0.08)		1.1 %	2.11 [0.26, 3.96]
Langhammer 2000	27	3.9 (2.5)	27	3.5 (2.8)		13.3 %	0.15 [-0.39, 0.68]
Van Vliet 2005	42	3.45 (2.4)	45	3.77 (2.37)		21.4 %	-0.13 [-0.55, 0.29]
Winstein 2004	17	9.67 (5.8)	16	10.98 (6.2)		8.1 %	-0.21 [-0.90, 0.47]
Winstein 2016	104	1.4 (1.1)	104	1.2 (1.1)		51.1 %	0.18 [-0.09, 0.45]
Subtotal (95% CI)	**205**		**207**			**100.0 %**	**0.10 [-0.09, 0.30]**
Heterogeneity: Chi^2 = 7.06, df = 5 (P = 0.22); I^2 =29%							
Test for overall effect: Z = 1.05 (P = 0.29)							

Analysis 3.1. Comparison 3 Upper limb function: subgroup analyses, Outcome 1 Dosage of task practice.

Review: Repetitive task training for improving functional ability after stroke

Comparison: 3 Upper limb function: subgroup analyses

Outcome: 1 Dosage of task practice

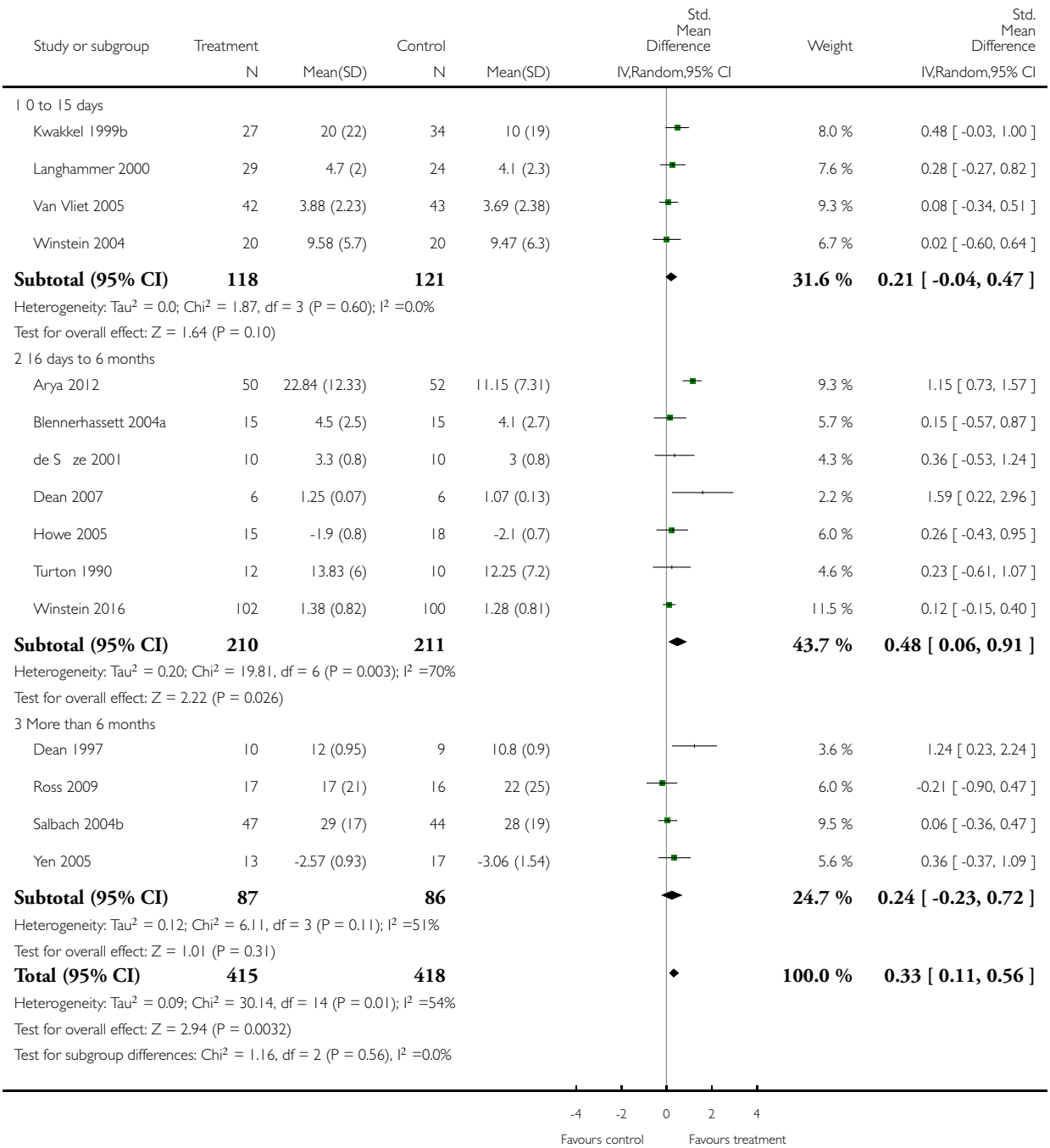


Analysis 3.2. Comparison 3 Upper limb function: subgroup analyses, Outcome 2 Time since stroke.

Review: Repetitive task training for improving functional ability after stroke

Comparison: 3 Upper limb function: subgroup analyses

Outcome: 2 Time since stroke

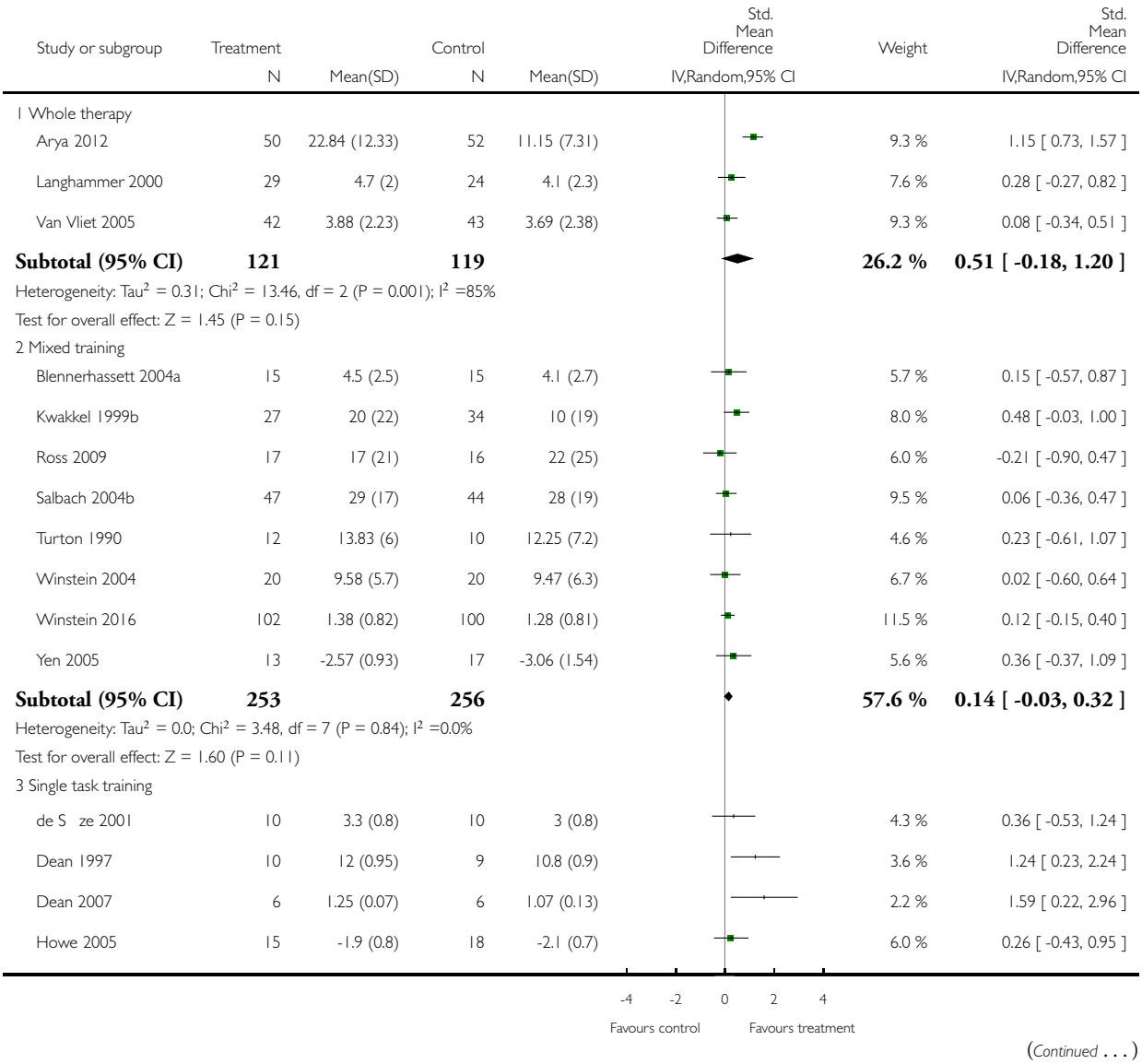


Analysis 3.3. Comparison 3 Upper limb function: subgroup analyses, Outcome 3 Type of intervention.

Review: Repetitive task training for improving functional ability after stroke

Comparison: 3 Upper limb function: subgroup analyses

Outcome: 3 Type of intervention



Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Weight	Std. Mean Difference IV,Random,95% CI
1 Whole therapy							
Arya 2012	50	22.84 (12.33)	52	11.15 (7.31)		9.3 %	1.15 [0.73, 1.57]
Langhammer 2000	29	4.7 (2)	24	4.1 (2.3)		7.6 %	0.28 [-0.27, 0.82]
Van Vliet 2005	42	3.88 (2.23)	43	3.69 (2.38)		9.3 %	0.08 [-0.34, 0.51]
Subtotal (95% CI)	**121**		**119**			**26.2 %**	**0.51 [-0.18, 1.20]**
Heterogeneity: Tau^2 = 0.31; Chi^2 = 13.46, df = 2 (P = 0.001); I^2 =85%							
Test for overall effect: Z = 1.45 (P = 0.15)							
2 Mixed training							
Blennerhassett 2004a	15	4.5 (2.5)	15	4.1 (2.7)		5.7 %	0.15 [-0.57, 0.87]
Kwakkel 1999b	27	20 (22)	34	10 (19)		8.0 %	0.48 [-0.03, 1.00]
Ross 2009	17	17 (21)	16	22 (25)		6.0 %	-0.21 [-0.90, 0.47]
Salbach 2004b	47	29 (17)	44	28 (19)		9.5 %	0.06 [-0.36, 0.47]
Turton 1990	12	13.83 (6)	10	12.25 (7.2)		4.6 %	0.23 [-0.61, 1.07]
Winstein 2004	20	9.58 (5.7)	20	9.47 (6.3)		6.7 %	0.02 [-0.60, 0.64]
Winstein 2016	102	1.38 (0.82)	100	1.28 (0.81)		11.5 %	0.12 [-0.15, 0.40]
Yen 2005	13	-2.57 (0.93)	17	-3.06 (1.54)		5.6 %	0.36 [-0.37, 1.09]
Subtotal (95% CI)	**253**		**256**			**57.6 %**	**0.14 [-0.03, 0.32]**
Heterogeneity: Tau^2 = 0.0; Chi^2 = 3.48, df = 7 (P = 0.84); I^2 =0.0%							
Test for overall effect: Z = 1.60 (P = 0.11)							
3 Single task training							
de S ze 2001	10	3.3 (0.8)	10	3 (0.8)		4.3 %	0.36 [-0.53, 1.24]
Dean 1997	10	12 (0.95)	9	10.8 (0.9)		3.6 %	1.24 [0.23, 2.24]
Dean 2007	6	1.25 (0.07)	6	1.07 (0.13)		2.2 %	1.59 [0.22, 2.96]
Howe 2005	15	-1.9 (0.8)	18	-2.1 (0.7)		6.0 %	0.26 [-0.43, 0.95]

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Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Weight	Std. Mean Difference IV,Random,95% CI
Subtotal (95% CI)	**41**		**43**			**16.1 %**	**0.71 [0.11, 1.30]**
Heterogeneity: Tau^2 = 0.13; Chi^2 = 4.75, df = 3 (P = 0.19); I^2 =37%							
Test for overall effect: Z = 2.34 (P = 0.019)							
Total (95% CI)	**415**		**418**			**100.0 %**	**0.33 [0.11, 0.56]**
Heterogeneity: Tau^2 = 0.09; Chi^2 = 30.14, df = 14 (P = 0.01); I^2 =54%							
Test for overall effect: Z = 2.94 (P = 0.0032)							
Test for subgroup differences: Chi^2 = 4.01, df = 2 (P = 0.13), I^2 =50%							

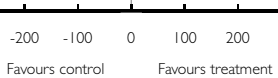
Analysis 4.1. Comparison 4 Lower limb function: post treatment, Outcome 1 Walking distance: change from baseline.

Review: Repetitive task training for improving functional ability after stroke

Comparison: 4 Lower limb function: post treatment

Outcome: 1 Walking distance: change from baseline

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Blennerhassett 2004b	15	221 (65.4)	15	107 (85.6)		6.6 %	114.00 [59.48, 168.52]
Dean 2000	5	42.03 (30.42)	4	4.76 (4.9)		14.2 %	37.27 [10.18, 64.36]
Gordon 2013	57	43.4 (101.09)	59	9.2 (106.04)		10.5 %	34.20 [-3.49, 71.89]
Kim 2014	11	65.2 (51.35)	11	17.98 (15.72)		12.5 %	47.22 [15.48, 78.96]
Kim 2016	10	93.5 (56.28)	10	118.5 (50.4)		8.1 %	-25.00 [-71.82, 21.82]
Mudge 2009	30	19 (77.96)	25	-1 (73.48)		9.8 %	20.00 [-20.10, 60.10]
Park 2011	13	67 (48.78)	12	23.75 (61.45)		8.9 %	43.25 [-0.48, 86.98]
Salbach 2004a	44	40 (72)	47	5 (66)		13.7 %	35.00 [6.56, 63.44]
van de Port 2012	125	73 (81.15)	117	48 (104.33)		15.6 %	25.00 [1.34, 48.66]



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Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Total (95% CI)	**310**		**300**			**100.0 %**	**34.80 [18.19, 51.41]**

Heterogeneity: Tau² = 313.27; Chi² = 16.29, df = 8 (P = 0.04); I² =51%

Test for overall effect: Z = 4.11 (P = 0.000040)

Test for subgroup differences: Not applicable

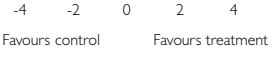
Analysis 4.2. Comparison 4 Lower limb function: post treatment, Outcome 2 Walking speed.

Review: Repetitive task training for improving functional ability after stroke

Comparison: 4 Lower limb function: post treatment

Outcome: 2 Walking speed

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Weight	Std. Mean Difference IV,Random,95% CI
Dean 1997	10	0.39 (0.2)	8	0.62 (0.34)		7.2 %	-0.81 [-1.79, 0.17]
Dean 2000	5	0.707 (0.483)	4	0.85 (0.542)		5.3 %	-0.26 [-1.58, 1.07]
Dean 2007	6	1.11 (0.49)	6	0.49 (0.32)		5.4 %	1.38 [0.07, 2.70]
Frimpong 2014	10	0.52 (0.04)	10	0.29 (0.03)		2.4 %	6.23 [3.90, 8.56]
Kim 2014	11	0.71 (0.25)	11	0.55 (0.22)		7.9 %	0.65 [-0.21, 1.52]
Kwakkel 1999a	26	0.65 (0.46)	34	0.37 (0.41)		10.2 %	0.64 [0.12, 1.16]
Lennon 2009	31	0.51 (0.26)	30	0.58 (0.2)		10.4 %	-0.30 [-0.80, 0.21]
Olawale 2011	20	20.03 (8.38)	20	24.65 (10.49)		9.5 %	-0.48 [-1.11, 0.15]
Park 2011	13	0.72 (0.24)	12	0.5 (0.23)		8.1 %	0.90 [0.07, 1.74]
Salbach 2004a	44	0.78 (0.4)	47	0.64 (0.37)		10.9 %	0.36 [-0.05, 0.78]
van de Port 2012	125	1.1 (0.3)	117	0.89 (0.36)		11.7 %	0.63 [0.38, 0.89]
Van Vliet 2005	42	2.03 (1.51)	43	1.96 (1.31)		10.9 %	0.05 [-0.38, 0.47]



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Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Weight	Std. Mean Difference IV,Random,95% CI
Total (95% CI)	**343**		**342**			**100.0 %**	**0.39 [-0.02, 0.79]**

Heterogeneity: Tau² = 0.35; Chi² = 55.98, df = 11 (P<0.00001); I² =80%

Test for overall effect: Z = 1.87 (P = 0.061)

Test for subgroup differences: Not applicable

Analysis 4.3. Comparison 4 Lower limb function: post treatment, Outcome 3 Functional ambulation.

Review: Repetitive task training for improving functional ability after stroke

Comparison: 4 Lower limb function: post treatment

Outcome: 3 Functional ambulation

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Weight	Std. Mean Difference IV,Random,95% CI
de S ze 2001	10	2.6 (1.4)	10	1.6 (1.5)		8.1 %	0.66 [-0.25, 1.57]
Frimpong 2014	10	4.6 (0.5)	10	3.4 (0.5)		5.4 %	2.30 [1.12, 3.48]
Kwakkel 1999a	25	4 (1)	34	3 (2)		14.7 %	0.60 [0.07, 1.12]
Langhammer 2000	29	4 (1.6)	24	3.8 (2)		14.4 %	0.11 [-0.43, 0.65]
McClellan 2004	12	4.3 (1.2)	9	4.7 (1)		8.5 %	-0.34 [-1.21, 0.53]
Park 2011	13	52.54 (10.47)	12	51.5 (9.31)		9.7 %	0.10 [-0.68, 0.89]
van de Port 2012	125	87.27 (12.38)	117	83.73 (13.25)		21.9 %	0.28 [0.02, 0.53]
Van Vliet 2005	42	3.7 (1.62)	43	3.39 (1.93)		17.3 %	0.17 [-0.25, 0.60]
Total (95% CI)	**266**		**259**			**100.0 %**	**0.35 [0.04, 0.66]**

Heterogeneity: Tau² = 0.10; Chi² = 15.96, df = 7 (P = 0.03); I² =56%

Test for overall effect: Z = 2.22 (P = 0.026)

Test for subgroup differences: Not applicable

Analysis 4.4. Comparison 4 Lower limb function: post treatment, Outcome 4 Sit-to-stand: post treatment/change from baseline.

Review: Repetitive task training for improving functional ability after stroke

Comparison: 4 Lower limb function: post treatment

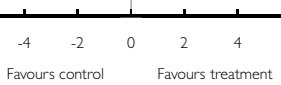
Outcome: 4 Sit-to-stand: post treatment/change from baseline

Study or subgroup	Treatment N	Control N	Std. Mean Difference (SE)	Std. Mean Difference IV,Fixed,95% CI	Weight	Std. Mean Difference IV,Fixed,95% CI
Barreca 2004	25	23	0.8715 (0.344)		10.4 %	0.87 [0.20, 1.55]
Blennerhassett 2004b	15	15	0.7 (0.3776)		8.7 %	0.70 [-0.04, 1.44]
Dean 2000	5	4	0.57 (0.6939)		2.6 %	0.57 [-0.79, 1.93]
Howe 2005	15	15	-0.25 (0.3673)		9.2 %	-0.25 [-0.97, 0.47]
Langhammer 2000	29	24	0.3 (0.2781)		16.0 %	0.30 [-0.25, 0.85]
Salbach 2004a	44	47	0.24 (0.2117)		27.6 %	0.24 [-0.17, 0.65]
Van Vliet 2005	42	43	0.35 (0.2194)		25.7 %	0.35 [-0.08, 0.78]
Total (95% CI)	**175**	**171**			**100.0 %**	**0.35 [0.13, 0.56]**

Heterogeneity: $Chi^2 = 6.23$, df = 6 (P = 0.40); $I^2 = 4\%$

Test for overall effect: Z = 3.12 (P = 0.0018)

Test for subgroup differences: Not applicable



Analysis 4.5. Comparison 4 Lower limb function: post treatment, Outcome 5 Lower limb functional measures.

Review: Repetitive task training for improving functional ability after stroke

Comparison: 4 Lower limb function: post treatment

Outcome: 5 Lower limb functional measures

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Fixed,95% CI	Weight	Std. Mean Difference IV,Fixed,95% CI
Blennerhassett 2004b	15	11.1 (5)	15	8.5 (4.6)		7.0 %	0.53 [-0.20, 1.26]
Dean 2000	5	9.8 (4)	4	5.8 (4.3)		1.9 %	0.86 [-0.56, 2.28]
Langhammer 2000	29	41 (18)	24	39 (21)		12.7 %	0.10 [-0.44, 0.64]
van de Port 2012	125	76.41 (19.18)	117	69.2 (21.2)		57.8 %	0.36 [0.10, 0.61]
Van Vliet 2005	42	5.62 (4.02)	43	5.24 (4.3)		20.6 %	0.09 [-0.34, 0.52]
Total (95% CI)	**216**		**203**			**100.0 %**	**0.29 [0.10, 0.48]**

Heterogeneity: $Chi^2 = 2.60$, df = 4 (P = 0.63); $I^2 = 0.0\%$

Test for overall effect: Z = 2.94 (P = 0.0032)

Test for subgroup differences: Not applicable

Analysis 4.6. Comparison 4 Lower limb function: post treatment, Outcome 6 Standing balance/reach.

Review: Repetitive task training for improving functional ability after stroke

Comparison: 4 Lower limb function: post treatment

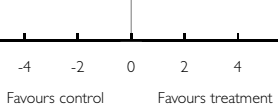
Outcome: 6 Standing balance/reach

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Fixed,95% CI	Weight	Std. Mean Difference IV,Fixed,95% CI
de S ze 2001	10	2.4 (1.6)	10	2 (0.8)		4.0 %	0.30 [-0.58, 1.19]
Holmgren 2010	14	45.2 (9.03)	19	45.5 (7.68)		6.5 %	-0.04 [-0.73, 0.66]
Kim 2012	10	50.1 (4.12)	10	44.6 (10.17)		3.8 %	0.68 [-0.23, 1.59]
Kim 2016	10	46.7 (9.4)	10	49.8 (4.6)		3.9 %	-0.40 [-1.29, 0.49]
McClellan 2004	12	21.9 (9.4)	9	17.8 (7.4)		4.0 %	0.46 [-0.42, 1.33]
Park 2011	13	54.1 (12.89)	12	43.44 (24.08)		4.8 %	0.54 [-0.26, 1.34]
Salbach 2004a	44	44 (11)	47	41 (13)		18.2 %	0.25 [-0.17, 0.66]
Tung 2010	16	48.3 (4.6)	16	49.4 (4.4)		6.4 %	-0.24 [-0.93, 0.46]
van de Port 2012	125	4.06 (1.02)	117	3.74 (1.06)		48.3 %	0.31 [0.05, 0.56]
Total (95% CI)	**254**		**250**			**100.0 %**	**0.24 [0.07, 0.42]**

Heterogeneity: Chi^2 = 6.39, df = 8 (P = 0.60); I^2 =0.0%

Test for overall effect: Z = 2.69 (P = 0.0071)

Test for subgroup differences: Not applicable



Analysis 5.1. Comparison 5 Lower limb function: follow-up, Outcome 1 All outcomes.

Review: Repetitive task training for improving functional ability after stroke

Comparison: 5 Lower limb function: follow-up

Outcome: 1 All outcomes

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Fixed,95% CI	Weight	Std. Mean Difference IV,Fixed,95% CI
1 Under 6 months post treatment							
de S ze 2001	10	3.1 (1.2)	10	2.5 (1.2)		4.2 %	0.48 [-0.41, 1.37]
Dean 2000	4	84 (46.7)	4	81.5 (47.2)		1.7 %	0.05 [-1.34, 1.43]
Holmgren 2010	14	44.1 (10.84)	19	44.4 (11.41)		7.0 %	-0.03 [-0.72, 0.66]
Howe 2005	14	-4.2 (7.3)	15	-2.9 (2.5)		6.3 %	-0.24 [-0.97, 0.50]
Lennon 2009	31	0.44 (0.37)	30	0.42 (0.35)		13.3 %	0.05 [-0.45, 0.56]
McClellan 2004	13	20.2 (9.4)	10	17.7 (8.4)		4.9 %	0.27 [-0.56, 1.10]
Mudge 2009	30	277 (125)	25	195 (104)		11.2 %	0.70 [0.15, 1.24]
van de Port 2012	125	1.1 (0.3)	117	0.94 (0.39)		51.4 %	0.46 [0.20, 0.72]
Subtotal (95% CI)	**241**		**230**			**100.0 %**	**0.34 [0.16, 0.52]**
Heterogeneity: Chi^2 = 7.48, df = 7 (P = 0.38); I^2 =6%							
Test for overall effect: Z = 3.63 (P = 0.00028)							
2 6 to 12 months post treatment							
Blennerhassett 2004b	15	416 (171)	14	313 (154)		10.5 %	0.61 [-0.13, 1.36]
Dean 2007	5	1.07 (0.39)	4	0.57 (0.38)		2.6 %	1.15 [-0.34, 2.65]
Holmgren 2010	15	19.2 (1.26)	19	18.5 (2.07)		12.6 %	0.39 [-0.30, 1.07]
Langhammer 2000	27	3.1 (2.3)	21	3 (2.3)		18.1 %	0.04 [-0.53, 0.61]
Lennon 2009	31	0.46 (0.36)	30	0.47 (0.31)		23.3 %	-0.03 [-0.53, 0.47]
Van Vliet 2005	45	3.24 (1.96)	42	3.7 (1.72)		33.0 %	-0.25 [-0.67, 0.18]
Subtotal (95% CI)	**138**		**130**			**100.0 %**	**0.06 [-0.18, 0.31]**
Heterogeneity: Chi^2 = 7.20, df = 5 (P = 0.21); I^2 =31%							
Test for overall effect: Z = 0.51 (P = 0.61)							

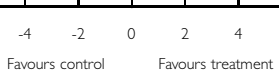
Analysis 6.1. Comparison 6 Lower limb function: subgroup analyses, Outcome 1 Dosage of task practice.

Review: Repetitive task training for improving functional ability after stroke

Comparison: 6 Lower limb function: subgroup analyses

Outcome: 1 Dosage of task practice

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Weight	Std. Mean Difference IV,Random,95% CI
1 0 to 20 hours							
Blennerhassett 2004b	15	404 (101)	15	288 (124)		3.8 %	1.00 [0.23, 1.76]
de S ze 2001	10	70.3 (24.2)	10	70.4 (21.7)		3.3 %	0.00 [-0.88, 0.87]
Dean 1997	10	33.8 (18.6)	8	29.4 (33.9)		3.0 %	0.16 [-0.77, 1.09]
Dean 2000	5	84 (46.7)	4	81.5 (47.2)		1.8 %	0.05 [-1.27, 1.36]
Dean 2007	6	1.25 (0.07)	6	1.07 (0.13)		1.7 %	1.59 [0.22, 2.96]
Frimpong 2014	10	0.52 (0.04)	10	0.29 (0.03)		0.7 %	6.23 [3.90, 8.56]
Howe 2005	15	-3.3 (3.7)	15	-2.6 (1.2)		4.1 %	-0.25 [-0.97, 0.47]
Kim 2012	10	50.1 (4.12)	10	44.6 (10.17)		3.1 %	0.68 [-0.23, 1.59]
Kim 2014	11	0.71 (0.25)	11	0.55 (0.22)		3.3 %	0.65 [-0.21, 1.52]
Langhammer 2000	29	4 (1.6)	24	3.8 (2)		5.3 %	0.11 [-0.43, 0.65]
Lennon 2009	31	0.51 (0.26)	30	0.58 (0.2)		5.6 %	-0.30 [-0.80, 0.21]
Mudge 2009	30	6666 (3966)	25	4370 (2994)		5.3 %	0.64 [0.09, 1.18]
Park 2011	13	233.23 (77.59)	12	175.58 (88.75)		3.6 %	0.67 [-0.14, 1.48]
Salbach 2004a	44	249 (136)	47	209 (132)		6.3 %	0.30 [-0.12, 0.71]
Tung 2010	16	48.3 (4.6)	16	49.4 (4.4)		4.2 %	-0.24 [-0.93, 0.46]
Van Vliet 2005	42	5.62 (4.02)	43	5.24 (4.3)		6.2 %	0.09 [-0.34, 0.52]
Subtotal (95% CI)	**297**		**286**			**61.3 %**	**0.39 [0.07, 0.71]**
Heterogeneity: Tau^2 = 0.26; Chi^2 = 46.92, df = 15 (P = 0.00004); I^2 =68%							
Test for overall effect: Z = 2.36 (P = 0.018)							
2 More than 20 hours							
Gordon 2013	57	39.1 (11.6)	59	32.5 (12.6)		6.6 %	0.54 [0.17, 0.91]
Holmgren 2010	14	45.2 (9.3)	19	45.5 (7.68)		4.3 %	-0.03 [-0.73, 0.66]
Kim 2016	10	93.5 (56.28)	10	118.5 (50.4)		3.2 %	-0.45 [-1.34, 0.44]
Kwakkel 1999a	25	4 (1)	34	3 (2)		5.4 %	0.60 [0.07, 1.12]
McClellan 2004	12	21.9 (9.4)	9	17.8 (7.4)		3.3 %	0.46 [-0.42, 1.33]



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Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Weight	Std. Mean Difference IV,Random,95% CI
Olawale 2011	20	155.27 (66.37)	20	137 (63.01)		4.7 %	0.28 [-0.35, 0.90]
Peurala 2009	20	9.8 (4.1)	10	8 (3.9)		3.8 %	0.43 [-0.33, 1.20]
van de Port 2012	125	87.27 (12.38)	117	83.73 (13.25)		7.5 %	0.28 [0.02, 0.53]
Subtotal (95% CI)	**283**		**278**			**38.7 %**	**0.33 [0.16, 0.50]**
Heterogeneity: Tau^2 = 0.0; Chi^2 = 6.59, df = 7 (P = 0.47); I^2 =0.0%							
Test for overall effect: Z = 3.88 (P = 0.00011)							
Total (95% CI)	**580**		**564**			**100.0 %**	**0.32 [0.12, 0.53]**
Heterogeneity: Tau^2 = 0.12; Chi^2 = 53.88, df = 23 (P = 0.00028); I^2 =57%							
Test for overall effect: Z = 3.16 (P = 0.0016)							
Test for subgroup differences: Chi^2 = 0.08, df = 1 (P = 0.77), I^2 =0.0%							

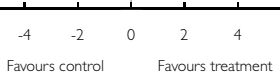
Analysis 6.2. Comparison 6 Lower limb function: subgroup analyses, Outcome 2 Time since stroke.

Review: Repetitive task training for improving functional ability after stroke

Comparison: 6 Lower limb function: subgroup analyses

Outcome: 2 Time since stroke

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Weight	Std. Mean Difference IV,Random,95% CI
1 0 to 15 days							
Kwakkel 1999a	25	4 (1)	34	3 (2)		5.4 %	0.60 [0.07, 1.12]
Langhammer 2000	29	4 (1.6)	24	3.8 (2)		5.3 %	0.11 [-0.43, 0.65]
Lennon 2009	31	0.51 (0.26)	30	0.58 (0.2)		5.6 %	-0.30 [-0.80, 0.21]
Peurala 2009	20	9.8 (4.1)	10	8 (3.9)		3.8 %	0.43 [-0.33, 1.20]
Van Vliet 2005	42	5.62 (4.02)	43	5.24 (4.3)		6.2 %	0.09 [-0.34, 0.52]
Subtotal (95% CI)	**147**		**141**			**26.2 %**	**0.16 [-0.15, 0.46]**
Heterogeneity: Tau^2 = 0.04; Chi^2 = 6.38, df = 4 (P = 0.17); I^2 =37%							
Test for overall effect: Z = 1.01 (P = 0.31)							
2 16 days to 6 months							
Blennerhassett 2004b	15	404 (101)	15	288 (124)		3.8 %	1.00 [0.23, 1.76]
de S ze 2001	10	70.3 (24.2)	10	70.4 (21.7)		3.3 %	0.00 [-0.88, 0.87]
Dean 2007	6	1.25 (0.07)	6	1.07 (0.13)		1.7 %	1.59 [0.22, 2.96]
Frimpong 2014	10	0.52 (0.04)	10	0.29 (0.03)		0.7 %	6.23 [3.90, 8.56]
Holmgren 2010	14	45.2 (9.3)	19	45.5 (7.68)		4.3 %	-0.03 [-0.73, 0.66]
Howe 2005	15	-3.3 (3.7)	15	-2.6 (1.2)		4.1 %	-0.25 [-0.97, 0.47]
Kim 2016	10	93.5 (56.28)	10	118.5 (50.4)		3.2 %	-0.45 [-1.34, 0.44]
McClellan 2004	12	21.9 (9.4)	9	17.8 (7.4)		3.3 %	0.46 [-0.42, 1.33]
van de Port 2012	125	87.27 (12.38)	117	83.73 (13.25)		7.5 %	0.28 [0.02, 0.53]
Subtotal (95% CI)	**217**		**211**			**31.8 %**	**0.52 [-0.03, 1.07]**
Heterogeneity: Tau^2 = 0.49; Chi^2 = 38.02, df = 8 (P<0.00001); I^2 =79%							
Test for overall effect: Z = 1.84 (P = 0.065)							
3 More than 6 months							
Dean 1997	10	33.8 (18.6)	8	29.4 (33.9)		3.0 %	0.16 [-0.77, 1.09]
Dean 2000	5	84 (46.7)	4	81.5 (47.2)		1.8 %	0.05 [-1.27, 1.36]
Gordon 2013	57	39.1 (11.6)	59	32.5 (12.6)		6.6 %	0.54 [0.17, 0.91]
Kim 2012	10	50.1 (4.12)	10	44.6 (10.17)		3.1 %	0.68 [-0.23, 1.59]



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Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Weight	Std. Mean Difference IV,Random,95% CI
Kim 2014	11	0.71 (0.25)	11	0.55 (0.22)		3.3 %	0.65 [-0.21, 1.52]
Mudge 2009	30	6666 (3966)	25	4370 (2994)		5.3 %	0.64 [0.09, 1.18]
Olawale 2011	20	155.27 (66.37)	20	137 (63.01)		4.7 %	0.28 [-0.35, 0.90]
Park 2011	13	233.23 (77.59)	12	175.58 (88.75)		3.6 %	0.67 [-0.14, 1.48]
Salbach 2004a	44	249 (136)	47	209 (132)		6.3 %	0.30 [-0.12, 0.71]
Tung 2010	16	48.3 (4.6)	16	49.4 (4.4)		4.2 %	-0.24 [-0.93, 0.46]
Subtotal (95% CI)	**216**		**212**			**42.0 %**	**0.41 [0.21, 0.60]**
Heterogeneity: $Tau^2 = 0.0$; $Chi^2 = 6.55$, df = 9 (P = 0.68); $I^2 = 0.0\%$							
Test for overall effect: Z = 4.14 (P = 0.000035)							
Total (95% CI)	**580**		**564**			**100.0 %**	**0.32 [0.12, 0.53]**
Heterogeneity: $Tau^2 = 0.12$; $Chi^2 = 53.88$, df = 23 (P = 0.00028); $I^2 = 57\%$							
Test for overall effect: Z = 3.16 (P = 0.0016)							
Test for subgroup differences: $Chi^2 = 2.29$, df = 2 (P = 0.32), $I^2 = 13\%$							

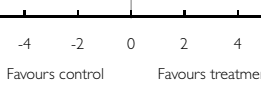
Analysis 6.3. Comparison 6 Lower limb function: subgroup analyses, Outcome 3 Type of intervention.

Review: Repetitive task training for improving functional ability after stroke

Comparison: 6 Lower limb function: subgroup analyses

Outcome: 3 Type of intervention

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Weight	Std. Mean Difference IV,Random,95% CI
1 Whole therapy							
Langhammer 2000	29	4 (1.6)	24	3.8 (2)		5.3 %	0.11 [-0.43, 0.65]
Van Vliet 2005	42	5.62 (4.02)	43	5.24 (4.3)		6.2 %	0.09 [-0.34, 0.52]
Subtotal (95% CI)	**71**		**67**			**11.5 %**	**0.10 [-0.24, 0.43]**
Heterogeneity: Tau^2 = 0.0; Chi^2 = 0.00, df = 1 (P = 0.96); I^2 =0.0%							
Test for overall effect: Z = 0.57 (P = 0.57)							
2 Mixed training							
Blennerhassett 2004b	15	404 (101)	15	288 (124)		3.8 %	1.00 [0.23, 1.76]
Dean 2000	5	84 (46.7)	4	81.5 (47.2)		1.8 %	0.05 [-1.27, 1.36]
Frimpong 2014	10	0.52 (0.04)	10	0.29 (0.03)		0.7 %	6.23 [3.90, 8.56]
Gordon 2013	57	39.1 (11.6)	59	32.5 (12.6)		6.6 %	0.54 [0.17, 0.91]
Holmgren 2010	14	45.2 (9.3)	19	45.5 (7.68)		4.3 %	-0.03 [-0.73, 0.66]
Kim 2012	10	50.1 (4.12)	10	44.6 (10.17)		3.1 %	0.68 [-0.23, 1.59]
Kim 2014	11	0.71 (0.25)	11	0.55 (0.22)		3.3 %	0.65 [-0.21, 1.52]
Kim 2016	10	93.5 (56.28)	10	118.5 (50.4)		3.2 %	-0.45 [-1.34, 0.44]
Kwakkel 1999a	25	4 (1)	34	3 (2)		5.4 %	0.60 [0.07, 1.12]
Lennon 2009	31	0.51 (0.26)	30	0.58 (0.2)		5.6 %	-0.30 [-0.80, 0.21]
McClellan 2004	12	21.9 (9.4)	9	17.8 (7.4)		3.3 %	0.46 [-0.42, 1.33]
Mudge 2009	30	6666 (3966)	25	4370 (2994)		5.3 %	0.64 [0.09, 1.18]
Olawale 2011	20	155.27 (66.37)	20	137 (63.01)		4.7 %	0.28 [-0.35, 0.90]
Park 2011	13	233.23 (77.59)	12	175.58 (88.75)		3.6 %	0.67 [-0.14, 1.48]
Peurala 2009	20	9.8 (4.1)	10	8 (3.9)		3.8 %	0.43 [-0.33, 1.20]
Salbach 2004a	44	249 (136)	47	209 (132)		6.3 %	0.30 [-0.12, 0.71]
van de Port 2012	125	87.27 (12.38)	117	83.73 (13.25)		7.5 %	0.28 [0.02, 0.53]
Subtotal (95% CI)	**452**		**442**			**72.2 %**	**0.42 [0.17, 0.67]**
Heterogeneity: Tau^2 = 0.15; Chi^2 = 43.11, df = 16 (P = 0.00027); I^2 =63%							
Test for overall effect: Z = 3.33 (P = 0.00088)							



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Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Weight	Std. Mean Difference IV,Random,95% CI
3 Single task training							
de S ze 2001	10	70.3 (24.2)	10	70.4 (21.7)		3.3 %	0.00 [-0.88, 0.87]
Dean 1997	10	33.8 (18.6)	8	29.4 (33.9)		3.0 %	0.16 [-0.77, 1.09]
Dean 2007	6	1.25 (0.07)	6	1.07 (0.13)		1.7 %	1.59 [0.22, 2.96]
Howe 2005	15	-3.3 (3.7)	15	-2.6 (1.2)		4.1 %	-0.25 [-0.97, 0.47]
Tung 2010	16	48.3 (4.6)	16	49.4 (4.4)		4.2 %	-0.24 [-0.93, 0.46]
Subtotal (95% CI)	**57**		**55**			**16.3 %**	**0.07 [-0.42, 0.55]**
Heterogeneity: $Tau^2 = 0.11$; $Chi^2 = 6.18$, df = 4 (P = 0.19); $I^2 = 35\%$							
Test for overall effect: Z = 0.27 (P = 0.79)							
Total (95% CI)	**580**		**564**			**100.0 %**	**0.32 [0.12, 0.53]**
Heterogeneity: $Tau^2 = 0.12$; $Chi^2 = 53.88$, df = 23 (P = 0.00028); $I^2 = 57\%$							
Test for overall effect: Z = 3.16 (P = 0.0016)							
Test for subgroup differences: $Chi^2 = 3.16$, df = 2 (P = 0.21), $I^2 = 37\%$							

Analysis 7.1. Comparison 7 Secondary outcomes, Outcome 1 Activities of daily living function.

Review: Repetitive task training for improving functional ability after stroke

Comparison: 7 Secondary outcomes

Outcome: 1 Activities of daily living function

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Fixed,95% CI	Weight	Std. Mean Difference IV,Fixed,95% CI
de S ze 2001	10	99.4 (10.8)	10	101.7 (14.3)		3.9 %	-0.17 [-1.05, 0.70]
Gordon 2013	57	95.9 (6.3)	59	93.3 (9.3)		22.3 %	0.32 [-0.04, 0.69]
Holmgren 2010	14	19.4 (0.9)	19	17.7 (4.15)		6.1 %	0.52 [-0.19, 1.22]
Kim 2016	10	87 (10.5)	10	85.3 (13.7)		3.9 %	0.13 [-0.74, 1.01]
Kwakkel 1999	54	16.96 (3.66)	34	14 (5)		15.4 %	0.69 [0.25, 1.14]
Langhammer 2000	29	83 (25)	24	72 (34)		10.1 %	0.37 [-0.18, 0.91]
Ross 2009	17	4.9 (1.7)	16	5.2 (2.8)		6.4 %	-0.13 [-0.81, 0.56]
Salbach 2004a	40	93.4 (18.7)	39	90.2 (12.6)		15.3 %	0.20 [-0.24, 0.64]
Van Vliet 2005	42	16.02 (3.9)	43	15.78 (4.4)		16.6 %	0.06 [-0.37, 0.48]
Total (95% CI)	**273**		**254**			**100.0 %**	**0.28 [0.10, 0.45]**

Heterogeneity: Chi^2 = 7.65, df = 8 (P = 0.47); I^2 =0.0%

Test for overall effect: Z = 3.14 (P = 0.0017)

Test for subgroup differences: Not applicable

Analysis 7.2. Comparison 7 Secondary outcomes, Outcome 2 Global motor function scales.

Review: Repetitive task training for improving functional ability after stroke

Comparison: 7 Secondary outcomes

Outcome: 2 Global motor function scales

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Fixed,95% CI	Weight	Std. Mean Difference IV,Fixed,95% CI
Kim 2014	11	54.83 (17.7)	11	42.61 (15.13)		9.6 %	0.71 [-0.15, 1.58]
Langhammer 2000	29	37 (12)	24	33 (15)		24.3 %	0.29 [-0.25, 0.84]
Peurala 2009	20	9.8 (4.1)	10	8 (3.9)		12.2 %	0.43 [-0.33, 1.20]
Tung 2010	16	-2.1 (0.7)	16	-2.5 (1.4)		14.7 %	0.35 [-0.35, 1.05]
Van Vliet 2005	42	7.85 (3.17)	43	6.69 (3.52)		39.2 %	0.34 [-0.09, 0.77]
Total (95% CI)	**118**		**104**			**100.0 %**	**0.38 [0.11, 0.65]**

Heterogeneity: Chi^2 = 0.72, df = 4 (P = 0.95); I^2 =0.0%

Test for overall effect: Z = 2.77 (P = 0.0056)

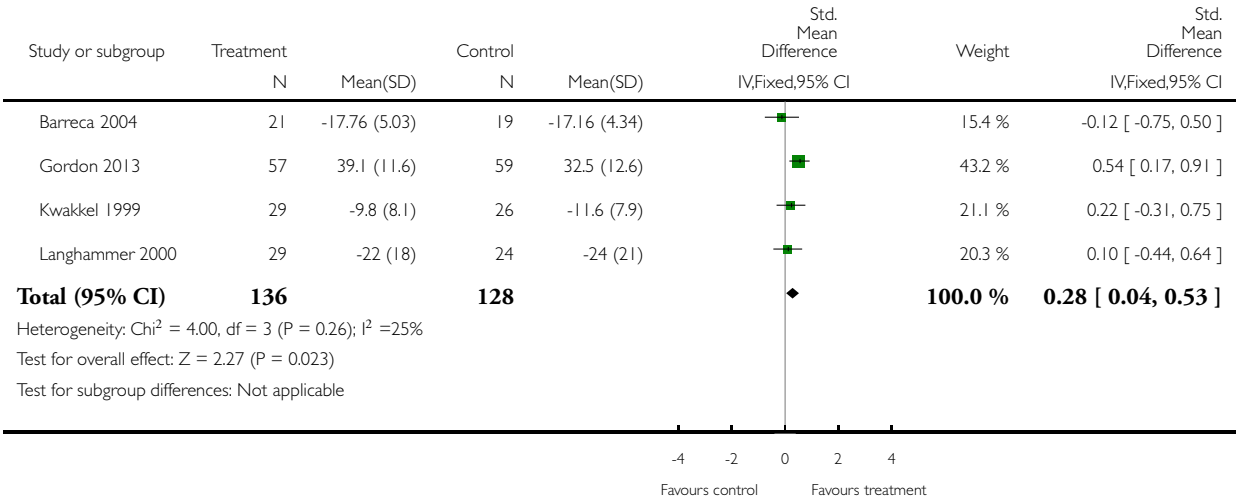
Test for subgroup differences: Not applicable

Analysis 7.3. Comparison 7 Secondary outcomes, Outcome 3 Quality of life/health status.

Review: Repetitive task training for improving functional ability after stroke

Comparison: 7 Secondary outcomes

Outcome: 3 Quality of life/health status



ADDITIONAL TABLES

Table 1. Criteria for subgroup and sensitivity analyses

STUDY	Task practice dose	Time since stroke	Type of intervention	Practice intensity	Allocation conceal	Comparison group	Therapy equivalence	Small trials
	1 = 20 hours or less 2 = more than 20 hours	1 = 1 to 14 days 2 = 15 days to 6 months 3 = more than 6 months	1 = whole therapy 2 = mixed task 3 = single task	1 = 1 to 4 weeks or less 2 = more than 4 weeks	A = adequate B = inadequate/ unclear	AC = attention control UC = usual care	EQ = equivalent therapy time ADD = additional therapy time	1 = less than 25 participants 2 = 25 or more participants
Arya 2012	Not reported	2	1	1	A	UC	EQ	2
Baer 2007	Not reported	3	2	1	B	UC	ADD	2
Barreca 2004	1	2	1	2	B	AC	ADD	2

Table 1. Criteria for subgroup and sensitivity analyses (*Continued*)

Blennerhassett 2004	1	2	2	1	B	AC	EQ	2
Dean 1997	1	3	3	1	B	AC	EQ	1
Dean 2000	1	3	2	1	B	AC	EQ	1
Dean 2007	1	2	3	1	B	AC	EQ	1
de Sèze 2001	1	2	3	1	B	UC	EQ	2
Frimpong 2014	1	2	2	2	B	UC	ADD	1
Gordon 2013	1	3	2	2	B	AC	EQ	2
Holmgren 2010	2	2	2	2	A	UC	ADD	2
Howe 2005	1	2	3	1	A	UC	ADD	2
Kim 2012	1	3	2	1	B	UC	ADD	1
Kim 2014	1	3	2	1	B	UC	ADD	2
Kim 2016	2	2	2	1	B	UC	ADD	1
Kwakkel 1999	2	1	2	2	B	AC	EQ	2
Langhammer 2000	1	1	1	1	B	UC	EQ	2
Lennon 2009	1	1	2	1	B	UC	EQ	2
McClellan 2004	2	3	2	2	B	AC	EQ	2
Mudge 2009	1	3	2	1	B	AC	EQ	2
Olawale 2011	2	3	2	2	B	UC	EQ	2
Park 2011	1	3	2	1	B	UC	ADD	2

Table 1. Criteria for subgroup and sensitivity analyses (*Continued*)

Peurala 2009	2	1	2	1	B	UC	ADD	2
Ross 2009	2	3	2	2	A	UC	ADD	2
Salbach 2004	1	3	2	2	B	AC	EQ	2
Song 2015	1	3	2	1	B	UC	ADD	1
Tung 2010	1	3	1	1	B	UC	ADD	2
Turton 1990	2	2	2	2	B	UC	ADD	1
van de Port 2012	2	2	2	2	B	UC	ADD	2
Van Vliet 2005	1	1	1	1	B	UC	EQ	2
Winstein 2004	1	1	2	1	B	UC	ADD	2
Winstein 2016	2	2	2	2	A	UC	EQ	2
Yen 2005	2	3	2	1	B	UC	EQ	2

Table 2. Outcome measures used from the included trials

Author and year	Global function	Lower limb function	Balance/sit-to-stand	Upper limb function	Hand function	ADL function	QOL, health status	Adverse events
Arya 2012				Action Research Arm Test - gross arm movement				
Barreca 2004			Number of participants able to stand				Dartmouth COOP	Falls
Blennerhassett 2004;		6 Minute Walk Test; Step Test	Timed Up & Go Test	Motor Assessment Scale - arm	Motor Assessment Scale - hand			

Table 2. Outcome measures used from the included trials (*Continued*)

Blennerhassett 2004a; Blennerhassett 2004b								
Dean 1997		10 Metre Walk Speed	Reaching distance					
Dean 2000		6 Minute Walk Test; 10 Metre Walk Speed; Step Test	Timed Up & Go Test					
Dean 2007		10 Metre Walk Test	Reaching distance					
de Sèze 2001		Functional Ambulation Classification	Sitting and Standing Equilibrium Index			Functional Independence Measure		
Frimpong 2014		10 Metre Walk Test Functional Ambulatory Category						
Gordon 2013		6 Minute Walk Test				Barthel Index	SF-36 physical health component	
Holmgren 2010			Berg Balance Scale			Barthel Index		
Howe 2005			Lateral reach - time, sit-to-stand - time					
Kim 2012		10 Metre Walk Speed	Berg Balance Scale; Timed Up & Go Test					
Kim 2014	Stroke Impact Scale -	10 Metre Walk Test						

Table 2. Outcome measures used from the included trials (*Continued*)

	social participation subscale	6 Minute Walk Test						
Kim 2016		6 Minute Walk Test	Berg Balance Scale			Korean version of Modified Barthel Index		
Kwakkel 1999; Kwakkel 1999a; Kwakkel 1999b		Functional Ambulation Classification; Walking speed		Action Research Arm Test		Barthel Index	Nottingham Health Profile	
Langhammer 2000	Motor Assessment Scale	Motor Assessment Scale - walking; Sødring Motor Evaluation Scale - trunk, balance and gait	Motor Assessment Scale - balanced sitting, Motor Assessment Scale - sit-to-stand	Motor Assessment Scale - arm	Motor Assessment Scale - hand	Barthel Index	Nottingham Health Profile	
Lennon 2009		5 Metre Walk Speed						
McClellan 2004		Motor Assessment Scale - walking	Functional Reach Test					
Mudge 2009		6 Minute Walk Test						
Olawale 2011		10 Metre Walk Speed						
Park 2011		10 Metre Walk Speed; 6 Minute Walk Test; Walking ability questionnaire	Activities-Specific Balance Confidence Scale					

Table 2. Outcome measures used from the included trials (*Continued*)

Peurala 2009	Rivermead Mobility Index							
Ross 2009					Wolf Motor Function Test (functional score)	Canadian Occupational Performace Measure		
Salbach 2004; Salbach 2004a; Salbach 2004b		6 Minute Walk Test; 5 Metre Walk Speed	Timed Up and Go Test; Berg Balance Scale	Box & Block Test	9 Hole Peg Test	Barthel Index		
Tung 2010			Berg Balance Scale					
Turton 1990				Southern Motor Group's Motor Assessment - upper extremity	10 Hole Peg Test			
van de Port 2012		6 Minute Walk Test; 5 Metre Walk Speed; Stroke Impact Scale - mobility domain	Timed Balance Test					
Van Vliet 2005	Rivermead Motor Assessment - gross function	Rivermead Motor Assessment - leg and trunk; 6 Minute Walk Test; Motor Assessment Scale - walking, Motor Assessment	Motor Assessment Scale - balanced sitting, Motor Assessment Scale - sit-to-stand	Motor Assessment Scale - arm	Motor Assessment Scale - hand	Barthel Index		

Table 2. Outcome measures used from the included trials (*Continued*)

		Scale - leg and truck						
Winstein 2004				Functional Test of the Hemiparetic Upper Extremity				
Winstein 2016				Log Wolf Motor Function Test	Stroke Impact Scale - hand function			
Yen 2005				Wolf Motor Function Test				

APPENDICES

Appendix 1. Cochrane Central Register of Controlled Trials (CENTRAL) search strategy

#1 MeSH descriptor: [Cerebrovascular Disorders] explode all trees
#2 MeSH descriptor: [Basal Ganglia Cerebrovascular Disease] explode all trees
#3 MeSH descriptor: [Brain Ischemia] explode all trees
#4 MeSH descriptor: [Carotid Artery Diseases] explode all trees
#5 MeSH descriptor: [Intracranial Arterial Diseases] explode all trees
#6 MeSH descriptor: [Intracranial Arteriovenous Malformations] explode all trees
#7 MeSH descriptor: [Intracranial Embolism and Thrombosis] explode all trees
#8 MeSH descriptor: [Intracranial Hemorrhages] explode all trees
#9 MeSH descriptor: [Stroke] this term only
#10 MeSH descriptor: [Brain Infarction] explode all trees
#11 (stroke$ or cva or poststroke or post-stroke or cerebrovasc$ or cerebral vascular):ti,ab,kw (Word variations have been searched)
#12 (cerebral or cerebellar or brain$ or vertebrobasilar):ti,ab,kw (Word variations have been searched)
#13 (infarct$ or isch?emi$ or thrombo$ or emboli$ or apoplexy):ti,ab,kw (Word variations have been searched)
#14 MeSH descriptor: [Hemiplegia] explode all trees
#15 MeSH descriptor: [Paresis] explode all trees
#16 (hempar$ or hemipleg$ or paresis or paretic or brain injur$):ti,ab,kw (Word variations have been searched)
#17 MeSH descriptor: [Gait Disorders, Neurologic] explode all trees
#18 #1 or #2 or #3 or #4 or #5 or #6 or #7 or #8 or #9 or #10 or #11 or #14 or #15 or #16 or #17 or (#12 and #13)
#19 MeSH descriptor: [Rehabilitation] explode all trees
#20 MeSH descriptor: [Activities of Daily Living] explode all trees
#21 MeSH descriptor: [Exercise Therapy] explode all trees
#22 MeSH descriptor: [Occupational Therapy] 2 tree(s) exploded
#23 MeSH descriptor: [Physical Therapy Modalities] explode all trees

#24 MeSH descriptor: [Exercise Movement Techniques] this term only
#25 MeSH descriptor: [Psychomotor Performance] explode all trees
#26 MeSH descriptor: [Movement] this term only
#27 MeSH descriptor: [Gait] explode all trees
#28 MeSH descriptor: [Range of Motion, Articular] this term only
#29 MeSH descriptor: [Task Performance and Analysis] 3 tree(s) exploded
#30 MeSH descriptor: [Recovery of Function] this term only
#31 functional:ti,ab,kw (Word variations have been searched)
#32 (task$ or movement):ti,ab,kw (Word variations have been searched)
#33 (motor or movement$ or task$ or skill$ or performance):ti,ab,kw (Word variations have been searched)
#34 (repetit$ or repeat$ or train$ or re?train$ or learn$ or re?learn$ or practice$ or practis$ or rehears$ or rehers$):ti,ab,kw (Word variations have been searched)
#35 (motor or movement$ or task$ or skill$ or performance):ti,ab,kw (Word variations have been searched)
#36 (schedule$ or intervention or therap$ or program$ or regim$ or protocol$):ti,ab,kw (Word variations have been searched)
#37 #19 or #20 or #21 or #22 or #23 or #24 or #25 or #26 or #27 or #28 or #29 or #32 or (#30 and #31) or (#33 and #34) or (#35 and #36)
#38 #18 and #37

Appendix 2. MEDLINE (Ovid) search strategy

1. cerebrovascular disorders/ or exp basal ganglia cerebrovascular disease/ or exp brain ischemia/ or exp carotid artery diseases/ or exp intracranial arterial diseases/ or exp intracranial arteriovenous malformations/ or exp "intracranial embolism and thrombosis"/ or exp intracranial hemorrhages/ or stroke/ or exp brain infarction/
2. brain injuries/ or brain injury, chronic/
3. (stroke$ or cva or poststroke or post-stroke or cerebrovasc$ or cerebral vascular).tw.
4. ((cerebral or cerebellar or brain$ or vertebrobasilar) adj5 (infarct$ or isch?emi$ or thrombo$ or emboli$ or apoplexy)).tw.
5. ((cerebral or brain or subarachnoid) adj5 (haemorrhage or hemorrhage or haematoma or hematoma or bleed$)).tw.
6. exp hemiplegia/ or exp paresis/
7. (hempar$ or hemipleg$ or paresis or paretic or brain injur$).tw.
8. Gait Disorders, Neurologic/
9. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8
10. rehabilitation/ or "activities of daily living"/ or exercise therapy/ or occupational therapy/
11. Physical Therapy Modalities/
12. Exercise Movement Techniques/
13. exp Psychomotor Performance/
14. movement/ or gait/ or exp locomotion/ or exp motor activity/
15. "Range of Motion, Articular"/ or "Task Performance and Analysis"/ or "Practice (Psychology)"/
16. "Recovery of Function"/
17. ((motor or movement$ or task$ or skill$ or performance) adj5 (repetit$ or repeat$ or train$ or re?train$ or learn$ or re?learn$ or practice$ or practis$ or rehears$ or rehers$)).tw.
18. ((motor or movement$ or task$ or skill$ or performance) adj5 (schedule$ or intervention or therap$ or program$ or regim$ or protocol$)).tw.
19. (functional adj5 (task$ or movement)).tw.
20. or/10-19
21. Randomized Controlled Trials as Topic/
22. random allocation/
23. Controlled Clinical Trials as Topic/
24. control groups/
25. clinical trials as topic/
26. double-blind method/
27. single-blind method/
28. Placebos/

29. placebo effect/
30. cross-over studies/
31. Research Design/
32. randomized controlled trial.pt.
33. controlled clinical trial.pt.
34. clinical trial.pt.
35. (random$ or RCT or RCTs).tw.
36. (controlled adj5 (trial$ or stud$)).tw.
37. (clinical$ adj5 trial$).tw.
38. ((control or treatment or experiment$ or intervention) adj5 (group$ or subject$ or patient$)).tw.
39. (quasi-random$ or quasi random$ or pseudo-random$ or pseudo random$).tw.
40. ((control or experiment$ or conservative) adj5 (treatment or therapy or procedure or manage$)).tw.
41. ((singl$ or doubl$ or tripl$ or trebl$) adj5 (blind$ or mask$)).tw.
42. (cross-over or cross over or crossover).tw.
43. (placebo$ or sham).tw.
44. trial.ti.
45. (assign$ or allocat$).tw.
46. or/21-45
47. 9 and 20 and 46

Appendix 3. Embase (Ovid) search strategy

1. cerebrovascular disease/ or brain disease/ or exp basal ganglion hemorrhage/ or exp brain hemangioma/ or exp brain hematoma/ or exp brain hemorrhage/ or exp brain infarction/ or exp brain ischemia/ or exp carotid artery disease/ or exp cerebral artery disease/ or exp cerebrovascular accident/ or exp cerebrovascular malformation/ or exp intracranial aneurysm/ or exp occlusive cerebrovascular disease/ or exp vertebrobasilar insufficiency/
2. stroke patient/ or stroke unit/
3. (stroke$ or poststroke or post-stroke or apoplex$ or cerebral vasc$ or cerebrovasc$ or cva or SAH).tw.
4. ((brain or cerebell$ or cerebr$ or hemisphere$ or intracran$ or intracerebral) adj5 (isch?emi$ or infarct$ or thrombo$ or emboli$ or occlus$ or hypoxi$)).tw.
5. ((brain$ or cerebr$ or cerebell$ or intracerebral or intracran$ or basal gangli$ or hemisphere$ or subarachnoid) adj5 (h?emorrhag$ or h$ematoma$ or bleed$)).tw.
6. exp hemiplegia/ or exp paresis/
7. (hempar$ or hemipleg$ or paresis or paretic).tw.
8. or/1-7
9. physiotherapy/ or occupational therapy/ or rehabilitation/ or exp kinesiotherapy/
10. exercise/ or functional training/
11. grip strength/ or hand strength/
12. task performance/ or psychomotor performance/
13. "physical activity, capacity and performance"/ or exp motor activity/ or motor performance/ or exp physical performance/
14. ((motor or movement$ or task$ or skill$ or performance) adj5 (repetit$ or repeat$ or train$ or re?train$ or learn$ or re?learn$ or practice$ or practis$ or rehears$ or rehers$)).tw.
15. ((motor or movement$ or task$ or skill$ or performance) adj5 (schedule$ or intervention or therap$ or program$ or regim$ or protocol$)).tw.
16. (functional adj5 (task$ or movement)).tw.
17. or/9-16
18. Randomized Controlled Trial/ or "randomized controlled trial (topic)"/
19. Randomization/
20. Controlled clinical trial/ or "controlled clinical trial (topic)"/
21. control group/ or controlled study/
22. clinical trial/ or "clinical trial (topic)"/ or phase 1 clinical trial/ or phase 2 clinical trial/ or phase 3 clinical trial/ or phase 4 clinical trial/

23. Crossover Procedure/
24. Double Blind Procedure/
25. Single Blind Procedure/ or triple blind procedure/
26. placebo/ or placebo effect/
27. (random$ or RCT or RCTs).tw.
28. (controlled adj5 (trial$ or stud$)).tw.
29. (clinical$ adj5 trial$).tw.
30. ((control or treatment or experiment$ or intervention) adj5 (group$ or subject$ or patient$)).tw.
31. (quasi-random$ or quasi random$ or pseudo-random$ or pseudo random$).tw.
32. ((control or experiment$ or conservative) adj5 (treatment or therapy or procedure or manage$)).tw.
33. ((singl$ or doubl$ or tripl$ or trebl$) adj5 (blind$ or mask$)).tw.
34. (cross-over or cross over or crossover).tw.
35. (placebo$ or sham).tw.
36. trial.ti.
37. (assign$ or allocat$).tw.
38. controls.tw.
39. or/18-38

Appendix 4. CINAHL (EBSCO) search strategy

S39 S15 AND S29 AND S38
S38 S30 OR S31 OR S32 OR S33 OR S34 OR S35 OR S36 OR S37
S37 (MH "Quantitative Studies")
S36 (MH "Placebos")
S35 (MH "Random Assignment")
S34 TX randomi* control* trial* OR TX random* allocat* OR TX placebo* OR TX allocat* random*
S33 TX ((singl* n1 blind*) or (singl* n1 mask*)) or TX ((doubl* n1 blind*) or (doubl* n1 mask*)) or TX ((tripl* n1 blind*) or (tripl* n1 mask*)) or TX ((trebl* n1 blind*) or (trebl* n1 mask*))
S32 TX clinic* n1 trial*
S31 PT Clinical trial
S30 (MH "Clinical Trials+")
S29 S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28 123,562
S28 (MH "Gait Disorders, Neurologic+")
S27 (MH "Hemiplegia")
S26 hempar* or hemipleg* or paresis or paretic or brain injur*
S25 ((cerebral or cerebellar or brain* or vertebrobasilar) n2 (infarct* or isch?emi* or thrombo* or emboli* or apoplexy))
S24 stroke* or cva or poststroke or post-stroke or cerebrovasc* or cerebral vascular
S23 ((cerebral or brain or subarachnoid) n2 (haemorrhage or hemorrhage or haematoma or hematoma or bleed*)).
S22 (MH "Brain Injuries+")
S21 (MH "Cerebrovascular Circulation") OR (MH "Basal Ganglia Cerebrovascular Disease+")
S20 (MH "Hypoxia-Ischemia, Brain+") OR (MH "Cerebral Ischemia+")
S19 (MH "Intracranial Hemorrhage+")
S18 (MH "Basal Ganglia Hemorrhage")
S17 (MH "Stroke+") OR (MH "Stroke Units") OR (MH "Stroke Patients")
S16 (MH "Cerebrovascular Disorders+")
S15 S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 263,000
S14 (MH "Range of Motion")
S13 (MH "Grip Strength")
S12 (MH "Muscle Contraction+")
S11 (MH "Locomotion+") OR (MH "Movement+") OR (MH "Gait Disorders, Neurologic+")
S10 (MH "Movement+")
S9 (MH "Movement+") OR (MH "Body Positions+")

S8 (MH “Psychomotor Performance+”)
S7 (MH “Physical Activity”)
S6 (MH “Physical Performance”)
S5 (MH “Motor Activity+”)
S4 (MH “Task Performance and Analysis+”) OR (MH “Psychomotor Performance+”)
S3 (MH “Exercise+”) OR (MH “Resistance Training”) OR (MH “Therapeutic Exercise+”) OR (MH “Warm-Up Exercise”) OR (MH “Recovery, Exercise”) OR (MH “Upper Extremity Exercises+”) OR (MH “Aerobic Exercises+”)
S2 (MH “Occupational Therapy+”)
S1 (MH “Physical Therapy+”)

Appendix 5. AMED search strategy

1. cerebrovascular disorders/ or cerebral hemorrhage/ or cerebral infarction/ or cerebral ischemia/ or cerebrovascular accident/ or stroke/
2. (stroke or poststroke or post-stroke or cerebrovasc$ or brain vasc$ or cerebral vasc$ or cva$ or apoplex$ or SAH).tw.
3. ((brain$ or cerebr$ or cerebell$ or intracran$ or intracerebral) adj5 (isch?emi$ or infarct$ or thrombo$ or emboli$ or occlus$)).tw.
4. ((brain$ or cerebr$ or cerebell$ or intracerebral or intracranial or subarachnoid) adj5 (haemorrhage$ or hemorrhage$ or haematoma$ or hematoma$ or bleed$)).tw.
5. hemiplegia/
6. (hemipleg$ or hemipar$ or paresis or paretic).tw.
7. 1 or 2 or 3 or 4 or 5 or 6
8. Rehabilitation/ or rehabilitation techniques/ or exp rehabilitation modalities/ or exp physical therapy modalities/
9. occupational therapy modalities/ or occupational therapy techniques/ or “Activities of daily living”/
10. exercise/ or exp Exercise movement techniques/
11. exp Psychomotor Performance/
12. “Range of motion”/
13. ((motor or movement$ or task$ or skill$ or performance) adj5 (repetit$ or repeat$ or train$ or re?train$ or learn$ or re?learn$ or practice$ or practis$ or rehears$ or rehers$)).tw.
14. ((motor or movement$ or task$ or skill$ or performance) adj5 (schedule$ or intervention or therap$ or program$ or regim$ or protocol$)).tw.
15. (functional adj5 (task$ or movement)).tw.
16. 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15
17. clinical trials/ or randomized controlled trials/ or random allocation/
18. double blind method/ or single blind method/
19. placebos/
20. (random$ or RCT or RCTs).tw.
21. (controlled adj5 (trial$ or stud$)).tw.
22. (clinical$ adj5 trial$).tw.
23. ((control or treatment or experiment$ or intervention) adj5 (group$ or subject$ or patient$)).tw.
24. (quasi-random$ or quasi random$ or pseudo-random$ or pseudo random$).tw.
25. ((control or experiment$ or conservative) adj5 (treatment or therapy or procedure or manage$)).tw.
26. ((singl$ or doubl$ or tripl$ or trebl$) adj5 (blind$ or mask$)).tw.
27. (cross-over or cross over or crossover).tw.
28. (placebo$ or sham).tw.
29. trial.ti.
30. (assign$ or allocat$).tw.
31. controls.tw.
32. 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31
33. 7 and 16 and 32

Appendix 6. SPORTSDiscus search strategy

S19S7 AND S11 AND S18
S18S12 OR S13 OR S14 OR S15 OR S16 OR S17
S17SU (random* or trial or crossover or cross-over or placebo* or control* or factorial or sham or counterbalance* or multiple baseline* or ABAB design) or KW (random* or trial or crossover or cross-over or placebo* or control* or factorial or sham or counterbalance* or multiple baseline* or ABAB design)
S16TI (assign* or allocate* or counterbalance* or multiple baseline* or ABAB design) or AB (assign* or allocate* or counterbalance* or multiple baseline* or ABAB design
S15(TI (clin* or intervention* or compar* or experiment* or preventive or therapeutic) or AB (clin* or intervention* or compar* or experiment* or preventive or therapeutic)) and (TI trial* or AB trial*)
S14TI (crossover or cross-over or placebo* or control* or factorial or sham) or AB (crossover or cross-over or placebo* or control* or factorial or sham)
S13(TI (singl* or doubl* or tripl* or trebl*) or AB (singl* or doubl* or tripl* or trebl*)) and (TI (blind* or mask*) or AB (blind* or mask*))
S12TI (random* or RCT or RCTs) or AB (random* or RCT or RCTs)
S11S8 OR S9 OR S10
S10(TI (exercise or rehab* or physical therap or physio* or occupation* or motor or psychomotor) or AB (exercise or rehab* or physical therap or physio* or occupation* or motor or psychomotor))
S9DE "OCCUPATIONAL therapy" OR DE "PHYSICAL therapy" OR DE "ACTIVITIES of daily living training" OR DE "OCCUPATIONAL therapists"
S8(DE "EXERCISE therapy" OR DE "EXERCISE" OR DE "THERAPEUTICS" OR DE "OCCUPATIONAL therapy" OR DE "PHYSICAL therapy" OR DE "REHABILITATION")
S7S1 OR S2 OR S3 OR S4 OR S5 OR S6
S6TI (hemipleg* or hemipar* or paresis or paretic) or AB (hemipleg* or hemipar* or paresis or paretic)
S5DE "HEMIPLEGIA" OR DE "HEMIPLEGICS" OR DE "GAIT disorders"
S4(TI (brain* or cerebr* or cerebell* or intracerebral or intracranial or subarachnoid) or AB (brain* or cerebr* or cerebell* or intracerebral or intracranial or subarachnoid)) and (TI (haemorrhage* or hemorrhage* or haematoma* or hematoma* or bleed*) or AB (haemorrhage* or hemorrhage* or haematoma* or hematoma* or bleed*))
S3(TI (brain* or cerebr* or cerebell* or intracran* or intracerebral) or AB (brain* or cerebr* or cerebell* or intracran* or intracerebral)) and (TI (ischemi* or ischaemi* or infarct* or thrombo* or emboli* or occlus*) or AB (ischemi* or ischaemi* or infarct* or thrombo* or emboli* or occlus*))
S2TI (stroke or poststroke or post-stroke or cerebrovasc* or brain vasc* or cerebral vasc or cva or apoplex or SAH) or AB (stroke or poststroke or post-stroke or cerebrovasc* or brain vasc* or cerebral vasc or cva or apoplex or SAH)
S1DE "CEREBROVASCULAR disease" OR DE "BRAIN -- Hemorrhage" OR DE "CEREBRAL embolism & thrombosis" OR DE "STROKE" OR DE "BRAIN -- Wounds & injuries" OR DE "BRAIN damage" OR DE "CEREBROVASCULAR disease -- Patients"

S20S7 AND S11 AND S18
S19S7 AND S11 AND S18
S18S12 OR S13 OR S14 OR S15 OR S16 OR S17
S17SU (random* or trial or crossover or cross-over or placebo* or control* or factorial or sham or counterbalance* or multiple baseline* or ABAB design) or KW (random* or trial or crossover or cross-over or placebo* or control* or factorial or sham or counterbalance* or multiple baseline* or ABAB design)
S16TI (assign* or allocate* or counterbalance* or multiple baseline* or ABAB design) or AB (assign* or allocate* or counterbalance* or multiple baseline* or ABAB design
S15(TI (clin* or intervention* or compar* or experiment* or preventive or therapeutic) or AB (clin* or intervention* or compar* or experiment* or preventive or therapeutic)) and (TI trial* or AB trial*)
S14TI (crossover or cross-over or placebo* or control* or factorial or sham) or AB (crossover or cross-over or placebo* or control* or factorial or sham)
S13(TI (singl* or doubl* or tripl* or trebl*) or AB (singl* or doubl* or tripl* or trebl*)) and (TI (blind* or mask*) or AB (blind* or mask*))
S12TI (random* or RCT or RCTs) or AB (random* or RCT or RCTs)
S11S8 OR S9 OR S10

S10(TI (exercise or rehab* or physical therap or physio* or occupation* or motor or psychomotor) or AB (exercise or rehab* or physical therap or physio* or occupation* or motor or psychomotor))
S9DE "OCCUPATIONAL therapy" OR DE "PHYSICAL therapy" OR DE "ACTIVITIES of daily living training" OR DE "OCCUPATIONAL therapists"
S8(DE "EXERCISE therapy" OR DE "EXERCISE" OR DE "THERAPEUTICS" OR DE "OCCUPATIONAL therapy" OR DE "PHYSICAL therapy" OR DE "REHABILITATION")
S7S1 OR S2 OR S3 OR S4 OR S5 OR S6
S6TI (hemipleg* or hemipar* or paresis or paretic) or AB (hemipleg* or hemipar* or paresis or paretic)
S5DE "HEMIPLEGIA" OR DE "HEMIPLEGICS" OR DE "GAIT disorders"
S4(TI (brain* or cerebr* or cerebell* or intracerebral or intracranial or subarachnoid) or AB (brain* or cerebr* or cerebell* or intracerebral or intracranial or subarachnoid)) and (TI (haemorrhage* or hemorrhage* or haematoma* or hematoma* or bleed*) or AB (haemorrhage* or hemorrhage* or haematoma* or hematoma* or bleed*))
S3(TI (brain* or cerebr* or cerebell* or intracran* or intracerebral) or AB (brain* or cerebr* or cerebell* or intracran* or intracerebral)) and (TI (ischemi* or ischaemi* or infarct* or thrombo* or emboli* or occlus*) or AB (ischemi* or ischaemi* or infarct* or thrombo* or emboli* or occlus*))

Appendix 7. ClinicalTrials.gov search strategy

stroke rehabilitation
stroke
rehabilitation therapy
adult, Senior

Appendix 8. World Health Organization (WHO) International Clinical Trials Registry search strategy

cerebrovascular accident
functional recovery
intervention program
occupational therapy
physiatry
physical therapy
recovery of function
rehab

WHAT'S NEW

Last assessed as up-to-date: 22 September 2016.

Date	Event	Description
22 September 2016	New citation required and conclusions have changed	The conclusions of the review have changed since the original review was published in 2007; there is now low-quality evidence for the effectiveness of repetitive task training on upper limb function

(*Continued*)

22 September 2016	New search has been performed	We updated selected searches to March 2016. We have added 19 new studies with 1355 participants, bringing the total number of included studies to 33, involving a total of 2014 participants. We have revised the review throughout and included an assessment of the quality of the evidence (presented in a 'Summary of findings' table)

CONTRIBUTIONS OF AUTHORS

Beverley French co-ordinated the review process. Beverley French, Lois Thomas, Jacqueline Coupe, Naoimh McMahon, Louise Connell, Michael Leathley, and Joanna Harrison undertook data filtration, extraction, appraisal and analysis. Jacqueline Coupe was responsible for the administration of the review process. Chris Sutton provided statistical expertise. Caroline Watkins undertook critical reading of outputs.

DECLARATIONS OF INTEREST

Beverley French: none known.

Lois H Thomas: none known.

Jacqueline Coupe: none known.

Naoimh E McMahon: none known.

Louise Connell: none known.

Joanna Harrison: none known.

Christopher J Sutton: none known.

Svetlana Tishkovskaya: none known.

Caroline L Watkins: none known.

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£5000

External sources

- Department of Health Research and Development Health Technology Assessment Programme, UK.

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

As all the studies in the original review were identified from the Cochrane Stroke Trials Register, we limited searching for this update to the Cochrane Stroke Trials Register and key electronic databases (MEDLINE, Embase, CIHAHL, SPORTSDiscus, AMED, the Cochrane Central Register of Controlled Trials, ClinicalTrials.gov and the World Health Organization International Clinical Trials Registry Platform).

INDEX TERMS

Medical Subject Headings (MeSH)

*Activities of Daily Living; *Physical Therapy Modalities; *Recovery of Function; Extremities; Motor Activity; Randomized Controlled Trials as Topic; Stroke Rehabilitation [*methods]; Task Performance and Analysis; Walking

MeSH check words

Adult; Humans