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Repetitive task training for improving functional ability after stroke.

Cochrane Database of Systematic Reviews 2016, Issue 10. Art. No.: CD006073.

DOI: 10.1002/14651858.CD006073.pub3.

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[Intervention Review]

Repetitive task training for improving functional ability after stroke

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Editorial group: Cochrane Stroke Group.

Publication status and date: Edited (conclusions changed), published in Issue 10, 2016.

Review content assessed as up-to-date: 19 October 2016.

Citation: French B, Thomas LH, Coupe J, McMahon NE, Connell L, Harrison J, Sutton CJ, Tishkovskaya S, Watkins CL. Repetitive task training for improving functional ability after stroke. *Cochrane Database of Systematic Reviews* 2016, Issue 10. Art. No.: CD006073. DOI: 10.1002/14651858.CD006073.pub3.

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ABSTRACT

Background

Repetitive task training (RTT) involves the repetitive 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 (March 2016); the Cochrane Central Register of Controlled Trials (CENTRAL) (The Cochrane Library 2016 Issue 5: searched June 2016); MEDLINE (1 October 2006 to 24 June 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 authors independently screened abstracts, extracted data and appraised trials. Quality of evidence within each study and outcome group was determined using the Cochrane 'Risk of bias' tool and GRADE (Grades of Recommendation, Assessment, Development and Evaluation) criteria. Follow-up outcome data was not assessed using GRADE. We contacted trial authors for additional information.

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

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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 repetitive task training improves arm function (standardised mean difference (SMD) 0.25, 95% CI 0.01 to 0.49), hand function (SMD 0.25, 95% CI 0.00 to 0.51), and lower limb functional measures (SMD 0.29, 95% CI 0.10 to 0.48). There is moderate quality evidence that repetitive task training improves walking distance (MD 34.80, 95% CI 18.19 to 51.41) and functional ambulation (SMD 0.35, 95% CI 0.04 to 0.66). Significant differences were found between groups for both upper (SMD 0.92, 95% CI 0.58 to 1.26) and lower (SMD 0.34, 95% CI 0.16 to 0.52) limb outcomes up to six months post-treatment, but not after 6 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 repetitive task training 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 repetitive task training 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 to 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 to 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: patients with stroke Settings: hospital, clinic or home Intervention: repetitive task training (RTT) Comparison: usual care, attention control or no treatment						
Outcomes	Illustrative comparisons and 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				
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 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 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 group 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-analysis; allocation concealment unclear in 7/8 tri-

					als and high risk in 1/8 trials)
Lower limb functional measures	<p>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</p> <p>SD units, measured using different instruments; higher scores mean better function</p>	SMD 0.29, 95% CI 0.10 to 0.48	5 studies 419 participants	⊕⊕○○ low	<p>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)</p> <p>Downgraded by one level for publication bias; 4 out of 5 are small studies (less than 50 participants)</p>
Global motor function scales	<p>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</p> <p>SD units, measured using different instruments; higher scores mean better function</p>	SMD 0.38, 95% CI 0.11 to 0.65	5 studies 226 participants	⊕⊕⊕○ moderate	<p>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)</p>
Adverse events	<p>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</p> <p>Holmgren 2010: 11 subjects in total fell during study (32%), five in the intervention group and six in the attention control group</p> <p>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</p> <p>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</p>				

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

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; Verbeek 2011; Wade 1987; Wandel 2000; Kwah 2013); 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 (Kwakkel 2004) has shown that more intensive therapy may at least improve the rate of activities of daily living (ADL) recovery, particularly if a direct functional approach is adopted (Kwakkel 1999; Van der Ploeg 2001). More recently, a review of the evidence for physical therapy post-stroke (Verbeek 2014) 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. 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 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 Corbett 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

The primary objective of the review was to determine if RTT improves functional ability in adults after stroke in:

- upper limb function/reach;
- lower limb function/balance.

The secondary objectives were as follows.

- To determine the effect of RTT on secondary outcome measures of:
 - ADL function;
 - global motor function;
 - quality of life/health status measures;
 - adverse events.

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 intervention;
- type of intervention.

METHODS

Criteria for considering studies for this review

Types of studies

We included randomised 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](#)) in the review. 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 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 repeated 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 multi-joint 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, measures of functional motor ability used in the primary trials were prioritised 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, Sødning 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

- 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, Sørdring 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, outcome measures at three months post treatment were chosen as primary, because this was considered 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, data were reported for the primary outcome if a primary outcome was specified and data were available; otherwise, data for available outcomes were included 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.

Electronic searches

We searched the Cochrane Stroke Group Trials Register; this was searched by the Review Group Managing Editor in March 2016. In addition we searched the following electronic databases: the Cochrane Central Register of Controlled Trials (CENTRAL, (The Cochrane Library 2016, Issue 5; searched 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](#)); 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 and subsequently conducted data extraction and review of the methodological quality of the eligible trials. Disagreements were resolved by discussion, and referral to a third review author as necessary.

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. Disagreements were resolved by discussion, and referral to a third author (LT) as necessary. The review authors contacted authors by email to gain any missing information necessary for the review.

Assessment of risk of bias in included studies

Two review authors (LT and NM) used The Cochrane Collaboration's 'Risk of bias' tool ([Higgins 2011](#)) to independently assess the methodological quality of the included studies. 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 (CI). If similar outcomes were measured using different outcome scales, we combined results using standardised mean difference

(SMD) and 95% CI. 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 squared test to explore differences between subgroups.

One outcome (Comparison 04.04: Sit to stand: post treatment/change from baseline) 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 (Van Vliet 2005; Langhammer 2000); 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, the SMD and corresponding standard error were calculated in the Cochrane Review Manager software, RevMan 5.3 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 to an approximate SMD scale.

Unit of analysis issues

Studies with multiple treatment groups

Two trials (Blennerhassett 2004; Salbach 2004) compared upper versus lower limb training, so are included as four intervention-control pairs. Blennerhassett 2004a refers to 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 it was 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 (Kwakkel 1999) compared upper and lower limb training groups against the same control group. To avoid the control group being included twice, and to use a limb-specific rather than a global or ADL measure, the lower limb training versus splint control comparison was selected 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. Trials reporting change scores with standard deviations are presented in separate analyses.

Assessment of heterogeneity

The degree of heterogeneity among the trials was assessed by 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-squared 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 and fixed-effect meta-analysis with 95% CI using RevMan 5.3 (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, 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, in-

directness 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). Follow-up outcomes were not assessed 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 number of weeks, by 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 (a) whole therapy approaches, where rehabilitation in total was directed by a motor relearning or movement science approach, (b) mixed functional task training, where therapy included a mixed combination of functional tasks, and (c) 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, most pre-functional trials were excluded 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 partic-

ipants and unsuitable measures and data for this purpose. Therefore, we have not presented these planned subgroup analyses.

Outcomes for subgroup analyses were prioritised by the 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, lower limb outcomes were prioritised in the following order: (1) walking speed, (2) walking distance, (3) functional ambulation, and (4) lower limb functional measures; and upper limb outcomes were prioritised to (1) arm function, and (2) hand function. Case report (Barteca 2004) is omitted from the subgroup and sensitivity analyses because it used a dichotomous outcome.

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 insufficient numbers of trials.

RESULTS

Description of studies

Results of the search

We identified 66,028 records from the database searches. After deduplication 55,011 records were screened and 54,100 excluded 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. Studies where there was uncertainty whether or not they met the inclusion criteria but which were subsequently excluded are presented in the [Characteristics of excluded studies](#) table. In total, 19 new studies were identified and added to the 14 studies previously included in the 2007 review. A total of 33 studies are now included in the review. Twelve studies were categorised as on-going and 13 studies as awaiting assessment ([Characteristics of studies awaiting classification](#)).

Figure I. 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 2002; Olawale 2011; Peurala 2009; Winstein 2004; Winstein 2016) there were three arms. Only the data for the intervention-control pair of repetitive task training versus control were included in the review.

Design

Of the 33 included trials, 32 are randomised controlled trials (Arya 2012; Baer 2002; 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 identified as not 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 2002; 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 2002; 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 2002; 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 ten 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 ten 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 2002; 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 ten 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 twelve 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 2002; Dean 1997; Dean 2000; Kim 2012; Mudge 2009; Park 2011; Ross 2009; Song 2015; Tung 2010).

Interventions

Upper limb repetitive task training 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 seventeen 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 repetitive task training interventions for both the upper and lower limbs (Blennerhassett 2004; Kwakkel 1999; Salbach 2004). Four trials investigated repetitive task training interventions that focused specifically on sitting balance (Dean 1997; Dean 2000), 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 eleven 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 (Gordon 2013; Holmgren 2010) delivered the intervention in community settings and four trials delivered the intervention solely in the patients' home environments (Baer 2002; 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 fifteen 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 (Baer 2002) the number of hours was not reported. As only four of the included trials (Arya 2012; Mudge 2009; Peurala 2009; Ross 2009) reported the duration of the RTT component of the task training sessions, 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 nineteen of the trials (Arya 2012; Baer 2002; 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 4 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 repetitive task training interventions were delivered by trained therapists in all but four of the included trials. In three trials (Baer 2002; McClellan 2004; Turton 1990) trained staff input was restricted to prescription and review of self-administered homework exercise programmes. 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 repetitive task training group received additional practice in fourteen trials (Baer 2002; 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 detailed in the 'Methods of the review' section.

Primary outcomes

Upper limb functional outcome measures

- Arm function: Action Research Arm Test (Arya 2012; Kwakkel 1999b; Ross 2009), Wolf Motor Function Test (Yen 2005; Winstein 2016), 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 2002).
- 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 Function 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 2016; Mudge 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: Tired Up and Go (Baer 2002; 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 2002; 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 2002; 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 2002). Three trials used the Barthel Index scoring out of 20 (Baer 2002; de Sèze 2001; Van Vliet 2005), while the other trials used the scoring out of 100.

Global motor function

Motor Assessment Scale (Baer 2002; 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 2002).

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 Jebsen 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 test (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 trials were excluded. The reasons for exclusion were:

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

We were unable to obtain sub-group data relating to stroke patients in one study (Shephard 2005).

Ongoing studies

There are eleven ongoing studies, where the information available is sufficient to say that the interventions are RTT. Five trials involve training for standing, balance or sit to stand (Hariohm 2013; Kernerovskiy 2013; Kumaran 2010; Stuart 2009; Tanne 2008)

Seven trials involve upper limb task-specific training (Alouche 2016; Bosomworth 2013; Dromerick 2014; Oza 2015; Schultz 2012; Turton 2011).

Studies awaiting assessment

Fourteen studies (Baglary 2013; Bhaskar 2009; Brkic 2016; Dean 2015; Eng 2009; Ferrari 2015; Gandhi 2015; Indurkar 2013; Knox 2014; Kumar 2012; Pandian 2014; Tong 2015; Zhu 2013; Xu 2012) are awaiting assessment.

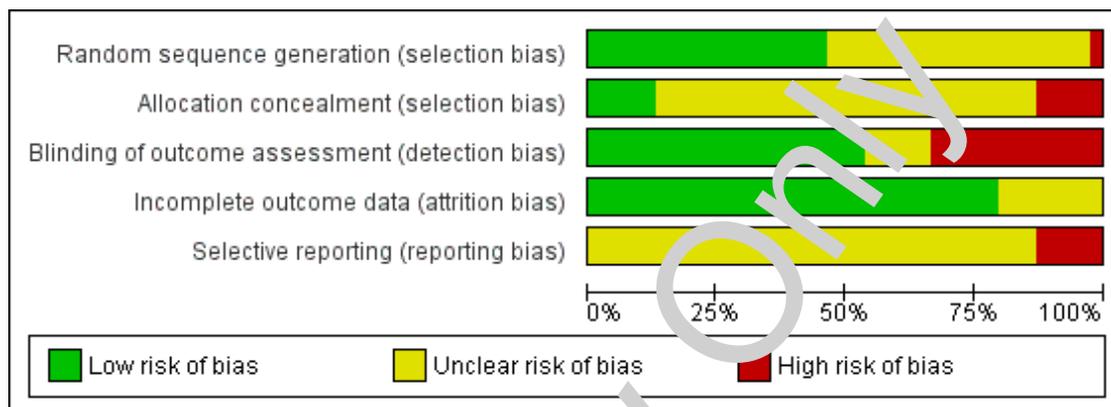
Risk of bias in included studies

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.

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)
Arya 2012	●	●	●	●	?
Baer 2002	●	●	●	●	?
Barreca 2004	●	?	●	●	?
Blennerhassett 2004	?	?	●	●	?
Blennerhassett 2004a	?	?	●	●	?
Blennerhassett 2004b	?	?	●	●	?
Dean 1997	?	?	●	●	?
Dean 2000	?	●	●	●	?
Dean 2007	●	●	●	●	?
de Sáze 2001	●	?	●	●	?
Frimpong 2014	?	?	?	?	?
Gordon 2004	?	?	●	?	?
Holmgren 2010	●	●	●	●	?
Howell 2007	●	●	●	●	?
Kim 2012	?	?	?	?	?
Kim 2014	?	●	●	?	?
Kim 2016	?	?	●	●	?
Kwakkel 1999	●	●	●	●	?
Kwakkel 1999a	●	?	●	●	?
Kwakkel 1999b	●	?	●	●	?
Loughammer 2000	?	?	●	●	?
Lennon 2009	?	?	●	●	●
McClellan 2004	?	?	●	●	?
Mudge 2009	●	?	●	●	?
Olawale 2011	?	?	?	?	?
Park 2011	?	●	●	?	?
Peurala 2009	?	?	?	●	●
Ross 2009	●	●	●	●	?
Salbach 2004	●	?	●	●	?
Salbach 2004a	●	?	●	●	?
Salbach 2004b	●	?	●	●	?
Song 2015	?	?	?	?	?
Tung 2010	?	?	●	?	?
Turton 1990	●	●	●	●	?
van de Port 2012	●	?	●	●	●
Van Vliet 2005	●	?	●	?	●
Winstein 2004	?	?	●	●	?
Winstein 2016	●	●	●	●	●
Yen 2005	?	?	●	●	?

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 2002; 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; Lennon 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 2002; 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 2002; 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, trials were assessed to determine whether groups were treated equally. In 15 studies participants in the intervention group received additional hours of therapy (Baer 2002; 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 one trial (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 2002](#) 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 01.01: Arm function

Eleven trials ([Arya 2012](#); [Blennerhassett 2004a](#); [Kwakkel 1999b](#); [Langhammer 2000](#); [Ross 2009](#); [Salbach 2004b](#); [Turton 1990](#); [Van Vliet 2005](#); [Winstein 2004](#); [Winstein 2016](#); [Yen 2005](#)) recruiting 844 participants measured arm function. 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: SMD 0.25, 95% CI 0.01 to 0.49 ([Analysis 1.1](#), GRADE: low quality).

Comparison 01.02: Hand function

Eight trials ([Arya 2012](#); [Blennerhassett 2004a](#); [Langhammer 2000](#); [Ross 2009](#); [Salbach 2004b](#); [Turton 1990](#); [Van Vliet 2005](#); [Winstein 2016](#)) recruiting 701 participants measured hand function. 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 01.03: Sitting balance/reach

Six trials ([de Sèze 2001](#); [Dean 1997](#); [Dean 2007](#); [Howe 2005](#); [Langhammer 2000](#); [Van Vliet 2005](#)), recruiting 268 participants measured sitting balance or functional reach. 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 0.26, 95% CI 0.01 to 0.55 ([Analysis 1.3](#), GRADE: low quality).

Upper limb function: follow up

Comparison 02.01: All outcomes

(1) Under six months post treatment

Three trials ([Arya 2012](#); [de Sèze 2001](#); [Howe 2005](#)) recruiting 158 participants measured some aspect of upper limb function for retention effects of RTT interventions under six months post treatment. 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](#)).

(2) Between six and 12 months post treatment

Six trials ([Blennerhassett 2004a](#); [Dean 2007](#); [Langhammer 2000](#); [Van Vliet 2005](#); [Winstein 2004](#); [Winstein 2016](#)) recruiting 505 participants measured arm function for retention effects of RTT interventions between six and 12 months post treatment. 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 03.01: Dosage of task practice

Trials were classified according to whether they provided 0 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 squared = 0.39, df = 1, P = 0.53). ([Analysis 3.1](#)).

Comparison 03.02: Time since stroke

Trials were classified according to whether they recruited within 15 days post stroke (four trials), 16 days to 6 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 squared = 1.16, df = 2, P = 0.56)([Analysis 3.2](#)).

Comparison 03.03: 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 squared = 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 04.01: Walking distance: change from baseline

Nine trials (Blennerhassett 2004b; Dean 2000; Gordon 2013; Kim 2014; Kim 2016; Mudge 2009; Park 2011; Salbach 2004a; van de Port 2012) recruiting 638 participants measured walking distance. 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: 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 04.02: Walking speed

Twelve trials (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) recruiting 748 participants measured walking speed, with data available for 91.6% (N = 685) of participants. Results were not statistically significant: SMD 0.39, 95% CI -0.02 to 0.79 (Analysis 4.2, GRADE: low quality).

Comparison 04.03: Functional ambulation

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

Comparison 04.04: Sit-to-stand: post treatment/change from baseline

Seven trials (Barreca 2004; Blennerhassett 2004b; Dean 2000; Howe 2005; Langhammer 2000; Salbach 2004a; Van Vliet 2005) recruiting a total of 697 participants included a measure of sit-to-stand, with data available for 87% (N = 346). Results were significant overall: SMD 0.37, 95% CI 0.13 to 0.56 (Analysis 4.4).

Comparison 04.05: Lower limb functional measures

Five trials (Blennerhassett 2004b; Dean 2000; Langhammer 2000; van de Port 2012; Van Vliet 2005) recruiting 473 participants included a measure of lower limb function, with data available for 88.6% (N = 419) of participants. 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 04.06: Standing balance/reach

Nine trials (de Sèze 2001; Holmgren 2010; Kim 2012; Kim 2016; McClellan 2004; Park 2011; Salbach 2004a; Tung 2010; van de Port 2012) recruiting 520 participants measured standing balance or functional reach, with data available for 96.9% (N = 504). 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 05.01: All outcomes

(1) Under six months post treatment

Eight trials (de Sèze 2001; Dean 2000; Holmgren 2010; Howe 2005; Lennon 2009; McClellan 2004; Mudge 2009; van de Port 2012) recruiting 496 participants measured some aspect of lower limb function for retention effects of RTT interventions under six months post treatment. 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).

(2) Between six to 12 months post treatment

Six trials (Blennerhassett 2004b; Dean 2007; Holmgren 2010; Langhammer 2000; Lennon 2009; Van Vliet 2005) recruiting 318 participants measured some aspect of lower limb function for retention effects of RTT interventions between six to 12 months post treatment. Data were available for 85.9% (N = 273) 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 06.01: 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 squared = 0.08, df = 1, P = 0.77) (Analysis 6.1).

Comparison 06.02: 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 (ten trials): SMD 0.41, 95% CI 0.21 to 0.60. There was no statistically significant difference between subgroups (chi squared = 2.29, df = 2, P = 0.32) (Analysis 6.2).

Comparison 06.03: 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 squared = 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 (3) adverse events.

Comparison 07.01: ADL function

Eleven intervention-control pairs (de Sèze 2007; Gordon 2013; Holmgren 2010; Kim 2016; Kwakkel 1999; Kwakkel 1999b; Langhammer 2000; Ross 2009; Salbach 2004; Salbach 2004b; Van Vliet 2005), recruiting a total of 615 participants, used a measure of activities of daily living, with data available for 85.5% (N = 527). 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 07.02: Global motor function

Five trials (Kim 2014; Langhammer 2000; Peurala 2009; Tung 2010; Van Vliet 2005), recruiting a total of 269 participants measured global motor function. 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). There were too few trials to undertake planned subgroup analyses for global functional outcomes.

Comparison 07.03: Quality of life/health status

Four intervention-control pairs (Barreca 2004; Gordon 2013; Kwakkel 1999; Langhammer 2000) recruiting 305 participants used a measure of quality of life or health status, with data available for 86.6% (N = 264). 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 (Barreca 2004) presented data for the number of falls in the intervention group 3/25 (12%) versus control group 4/33 (17.4%), OR 0.65, 95% CI 0.13 to 3.27. In one trial of an intensive lower limb exercise programme (Holmgren 2010) 11 subjects in total fell during study (32%), five in the intervention group and six in the attention control group. Fall frequency was reported as 1.35 falls per person per year. Three subjects in each group (18%) fell more than once; the most falls for any single session were six. In the FIT-Stroke trial (van de Port 2012), 29 falls were reported in the circuit training group and 26 in the usual physical therapy 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.

In one trial of an upper limb intervention (Winstein 2016) there were 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.

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 (Mudge 2009) reported a withdrawal due to "disinterest" in the intervention group and one withdrawal who did not like the group sessions in the comparison group.

Sensitivity analyses

We carried out planned sensitivity analysis to investigate including 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 -0.44 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 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). 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 ([Arya 2012](#)) appears to be an outlier, with a much larger treatment effect on arm function than other studies in the comparison. This may be explained 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 (Standardised effect 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 are no longer significant when studies with a usual care comparison are removed. Removing studies with additional therapy time changes 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 become non-significant when studies delivering the intervention in a group setting are removed. One recent study (Frimpong 2014) appears to be an outlier, with a larger effect on walking speed and functional ambulation than other studies in these comparisons. Possible explanation 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 (Kim 2014; Larsson 2000; Peurala 2009; Tung 2010; Van Vliet 2005) using global motor function measures, there was a small effect on global motor function (SMD 0.38, 95% CI 0.11 to 0.65). There was a small, statistically significant effect on activities of daily living (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 0.52). 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 have 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 have 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 here 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 trials out of the 33 included studies reported stroke sub-type using the Oxfordshire Community Stroke Project classification tool (Bamford 1991) (Howe 2005; Holmgren 2010; Kwakkel 1999; Larsson 2000; Ross 2009; van de Port 2012; Van Vliet 2005).

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 drop outs 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 were 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-delivered 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 which 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' type 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 repetitive task training has become an established intervention tested in rehabilitation trials. The quality of reporting of repetitive task training 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 the review was being designed, a early decision was made 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 could 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 to 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 repetitive task training 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 0 to 20 hours training, but the difference between sub-groups 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 (Pollock 2014a) 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 activities of daily living. 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, activities of daily living 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 Ert 2004).

In those studies that did show a benefit and provided later assessments, improvement 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

2014a) 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 focussing on specific treatments is possible; there are now taxonomies for grouping such interventions (e.g. Pollock 2014). Readers may not agree with some of our classification of studies, but the review group 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 (Mehrholz 2014) 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. Results of a recent review of robotic-assisted therapy on arm function (Mehrholz 2015b) found moderate quality evidence that robotics may be effective in improving upper limb impairment and ADL outcomes. 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 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 an outcome. 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 repetitive task training, such as group training, or practice in the home environment. Further randomised controlled trials should evaluate practical ways of delivering repetitive task training 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 repetitive task training 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 PRTT against “usual care”. The definition of repetitive task training 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).

ACKNOWLEDGEMENTS

We acknowledge the support of Hazel Fraser from the Cochrane Stroke Group for her help in the review process. We also thank all of the trial authors who kindly replied to our requests for information. We thank the authors of the original review: Anne Foster, Peter Langhorne, Christopher Price, and Andrew Walker. Finally, we would like to thank the following for their helpful comments on the first draft of the review: Alex Pollock, Joshua Cheyne, Valentina Assi, Jan Mehrholz, Ailie Turton, Brian Stafford and Matiram Pun.

REFERENCES

References to studies included in this review

Arya 2012 *{published data only}*

Arya KN, Verma R, Garg RK, Sharma VP, Agarwal M, Aggarwal GG. Meaningful task-specific training (MTST) for stroke rehabilitation: a randomized controlled trial. *Topics in Stroke Rehabilitation* 2012;**19**(3):193–211. [3215726]

Baer 2002 *{unpublished data only}*

Baer G. An investigation into a home-based mobility rehabilitation program for late-stage stroke. A pilot randomised trial. *Physiotherapy* 2007;**93**(Supp 1):S546. [3215728]

Barreca 2004 *{published and unpublished data}*

Barreca S, Sigouin CS, Lambert C, Ansley B. Effects of extra training on the ability of stroke survivors to perform an independent sit-to stand: a randomized controlled trial. *Journal of Geriatric Physical Therapy* 2004;**27**(2):59–64. [3215728; MEDLINE: 200422110]

Blennerhassett 2004 *{published and unpublished data}*

Blennerhassett J, Dite W. Additional task-related practice improves mobility and upper limb function early after

stroke: a randomised controlled trial. *Australian Journal of Physiotherapy* 2004;**50**(4):219–24. [3215730; MEDLINE: 15574110]

Blennerhassett 2004a *{published and unpublished data}*

Blennerhassett J, Dite W. Additional task-related practice improves mobility and upper limb function early after stroke: a randomised controlled trial. *Australian Journal of Physiotherapy* 2004;**50**(4):219–24. [3215732; MEDLINE: 15574110]

Blennerhassett 2004b *{published and unpublished data}*

Blennerhassett J, Dite W. Additional task-related practice improves mobility and upper limb function early after stroke: a randomised controlled trial. *Australian Journal of Physiotherapy* 2004;**50**(4):219–24. [3215734; MEDLINE: 15574110]

Dean 1997 *{published and unpublished data}*

Dean CM, Shepherd RB. Task-related training improves performance of seated reaching tasks after stroke. *Stroke* 1997;**28**:722–8. [3215736; MEDLINE: 9099186]

Dean 2000 *{published and unpublished data}*

Dean CM, Richards CL, Malouin F. Task-related circuit

- training improves performance of locomotor tasks in chronic stroke: a randomized, controlled pilot trial. *Archives of Physical Medicine and Rehabilitation* 2000;**81**:409–17. [3215738; MEDLINE: 10768528]
- Dean 2007** *{published data only}*
Dean CM, Channon EF, Hall JM. Sitting training early after stroke improves sitting ability and quality and carries over to standing up but not to walking: a randomised controlled trial. *Australian Journal of Physiotherapy* 2007;**53**: 97–102. [3215740]
- de Sèze 2001** *{published data only}*
de Sèze M, Wiart L, Bon-Saint-Côme A, Debelleix X, de Sèze M, Joseph P, et al. Rehabilitation of postural disturbances of hemiplegic patients by using trunk control retraining during exploratory exercises. *Archives of Physical and Medical Rehabilitation* 2001;**82**:793–800. [3215742; MEDLINE: 11387585]
- Frimpong 2014** *{published data only}*
Frimpong E, Olawale OA, Antwi DA, Antwi-Boasiako C, Dzudzor B. Task-oriented circuit training improves ambulatory functions in acute stroke: a randomized controlled trial. *Journal of Medicine and Medical Sciences* 2014;**5**(8):169–175.
- Gordon 2013** *{published data only}*
Gordon CD, Wilks R, McCaw-Binns A. Effect of aerobic exercise (walking) training on functional status and health-related quality of life in chronic stroke survivors. *Stroke* 2013;**44**:1179–1181. [3215744]
- Holmgren 2010** *{published data only}*
Holmgren E, Gosman-Hedstrom G, Lindstrom B, Wester P. What is the benefit of a high-intensive exercise program on health-related quality of life and depression after stroke? A randomized controlled trial. *Advances in Physiotherapy* 2010;**12**:125–133. [3215746]
Holmgren E, Lindstrom B, Gosman-Hedstrom G, Nyberg L, Wester P. What is the benefit of high intensive exercise program? A randomized controlled trial. *Advances in Physiotherapy* 2010;**12**:115–124. [3215747]
- Howe 2005** *{published data only}*
Howe TE, Taylor J, Finn P, Jones H. Lateral weight transference exercises following acute stroke: a preliminary study of clinical effectiveness. *Clinical Rehabilitation* 2005;**19**:45–53. [3215748; MEDLINE: 15704508]
- Kim 2012** *{published data only}*
Kim, BH, Lee SM, Bae YH, Yu JH, Kim TH. The effect of a task-oriented training on trunk control ability, balance and gait of stroke patients. *Journal of Physical Therapy Science* 2012;**24**:519–522. [3215751]
- Kim 2014** *{published data only}*
Kim M, Cho K, Lee W. Community Walking Training Program improves walking function and social participation in chronic stroke patients. *Tohoku Journal of Experimental Medicine* 2014;**234**:281–286. [3215753]
- Kim 2016** *{published data only}*
Kim SM, Han EY, Kim BR, Hyun CW. Clinical application of circuit training for subacute stroke patients: a preliminary study. *Journal of Physical Therapy Science* 2016;**28**:169–174.
- Kwakkel 1999** *{published and unpublished data}*
Kwakkel G, Wagenaar RC, Twisk JWR, Langhorst GJ, Koetsier JC. Intensity of leg and arm training after primary middle-cerebral-artery stroke: a randomised trial. *Lancet* 1999;**354**:191–6. [3215755; MEDLINE: 10421300]
- Kwakkel 1999a** *{published and unpublished data}*
Kwakkel G, Wagenaar RC, Twisk JWR, Langhorst GJ, Koetsier JC. Intensity of leg and arm training after primary middle-cerebral-artery stroke: a randomised trial. *Lancet* 1999;**354**:191–6. [3215757; MEDLINE: 10421300]
- Kwakkel 1999b** *{published and unpublished data}*
Kwakkel G, Wagenaar RC, Twisk JWR, Langhorst GJ, Koetsier JC. Intensity of leg and arm training after primary middle-cerebral-artery stroke: a randomised trial. *Lancet* 1999;**354**:191–6. [3215759; MEDLINE: 10421300]
- Langhammer 2000** *{published and unpublished data}*
Langhammer B, Stanghelle JK. Bobath or Motor Relearning Programme? A comparison of two different approaches of physiotherapy in stroke rehabilitation: a randomized controlled study. *Clinical Rehabilitation* 2000;**14**:361–9. [3215761; MEDLINE: 10945420]
Langhammer B, Stanghelle JK. Bobath or Motor Relearning Programme? A follow-up one and four years post stroke. *Clinical Rehabilitation* 2003;**17**:731–4. [3215762; MEDLINE: 14606738]
- Lennon 2009** *{unpublished data only}*
Lennon S. Gait-specific training within Bobath therapy in acute stroke: a randomised controlled trial [Unpublished research report]. 2009. [3215764]
- McClellan 2004** *{published data only}*
McClellan R, Ada L. A six week, resource-efficient mobility program after discharge from rehabilitation improves standing in people affected by stroke: placebo-controlled, randomised trial. *Australian Journal of Physiotherapy* 2004;**50**:163–7. [3215766; MEDLINE: 15482247]
- Mudge 2009** *{published data only}*
Mudge S, Barber A, Stott S. Circuit-based rehabilitation improves gait endurance but not usual walking activity in chronic stroke: a randomized controlled trial. *Archives of Physical Medicine and Rehabilitation* 2009;**90**:1989–96. [3215768]
- Olawale 2011** *{published data only}*
Olawale OA, Jaja SI, Anigbogu CN, Appiah-Kubi KO, Jones-Okai D. Exercise training improves walking function in an African group of stroke survivors: a randomized controlled trial. *Clinical Rehabilitation* 2011;**25**:442–50. [3215770]
- Park 2011** *{published data only}*
Park HJ, Oh DW, Kim SY, Choi JD. Effectiveness of community-based ambulation training for walking function of post-stroke hemiparesis: a randomized controlled pilot trial. *Clinical Rehabilitation* 2011;**25**:451–59. [3215772]

Peurala 2009 *{published data only}*

Peurala SH, Airaksinen O, Huuskonen P, Jäkälä P, Juhakoski M, Sandell K, Tarkka IM, Sivenius J. Effects of intensive therapy using gait trainer or floor walking exercises early after stroke. *Journal of Rehabilitation Medicine* 2009;**41**: 166–173. [3215774]

Ross 2009 *{published data only}*

Ross LF, Harvey LA, Lannin NA. Do people with acquired brain impairment benefit from additional therapy specifically directed at the hand? A randomized controlled trial. *Clinical Rehabilitation* 2009;**23**:492–503. [3215776]

Salbach 2004 *{published and unpublished data}*

Higgins J, Salbach NM, Wood-Dauphinee S, Richards CL, Côté R, Mayo NE. The effect of a task oriented intervention on arm function in people with stroke: a randomized controlled trial. *Clinical Rehabilitation* 2006;**20**:296–310. [3215778]

Salbach NM, Mayo NE, Robichaud-Ekstrand S, Hanley JA, Richards CL, Wood-Dauphinee S. The effect of a task-oriented walking intervention on improving balance self-efficacy poststroke: a randomized, controlled trial. *Journal of the American Geriatric Society* 2005;**53**:576–82. [3215779]

* Salbach NM, Mayo NE, Wood-Dauphinee S, Hanley JA, Richards CL, Côte R. A task-orientated intervention enhances walking distance and speed in the first year post stroke: a randomized controlled trial. *Clinical Rehabilitation*. 2004;**18**:509–19. [3215780]

Salbach 2004a *{published and unpublished data}*

Salbach NM, Mayo NE, Robichaud-Ekstrand S, Hanley JA, Richards CL, Wood-Dauphinee S. The effect of a task-oriented walking intervention on improving balance and self-efficacy poststroke: a randomized, controlled trial. *Journal of the American Geriatric Society* 2005;**53**:576–82. [3215782; MEDLINE: 15817000]

* Salbach NM, Mayo NE, Wood-Dauphinee S, Hanley JA, Richards CL, Côte R. A task-orientated intervention enhances walking distance and speed in the first year post stroke: a randomized controlled trial. *Clinical Rehabilitation* 2004;**18**:509–19. [3215783; MEDLINE: 15293485]

Salbach 2004b *{published and unpublished data}*

Higgins J, Salbach NM, Wood-Dauphinee S, Richards CL, Côté R, Mayo NE. The effect of a task oriented intervention on arm function in people with stroke: a randomized controlled trial. *Clinical Rehabilitation* 2006;**20**:296–310. [3215785; MEDLINE: 16719028]

Song 2015 *{published data only}*

Song HS, Lee JY, Park SD. Effect of the class and individual applications of task-oriented circuit training on gait ability in patients with chronic stroke. *Journal of Physical Therapy Science* 2015;**27**:187–189.

Tung 2010 *{published data only}*

Tung FL, Yang YR, Lee CC, Wang RY. Balance outcomes after additional sit-to-stand training in subjects with stroke: a randomized controlled trial. *Clinical Rehabilitation* 2010;**24**:533–42. [3215787]

Turton 1990 *{published data only}*

Turton A, Fraser C. The use of home therapy programmes for improving recovery of the upper limb following stroke. *British Journal of Occupational Therapy* 1990;**53**(11): 457–62. [3215789; MEDLINE: 1993165745]

van de Port 2012 *{published data only}*

van de Port IGL, Wevers LEG, Lindeman E, Kwakkel G. Effects of circuit training as an alternative to usual physiotherapy after stroke. A randomized controlled trial. *British Medical Journal* 2012;**344**:e26. [3215791]

Van Vliet 2005 *{published and unpublished data}*

Van Vliet P, Lincoln NB, Robinson E. Comparison of the content of two physiotherapy approaches for stroke. *Clinical Rehabilitation* 2001;**15**:398–414. [3215793]

* Van Vliet PM, Lincoln NB, Foxall A. Comparison of Bobath based and movement science based treatment for stroke: a randomized controlled trial. *Journal of Neurology, Neurosurgery and Psychiatry* 2005;**76**:503–8. [3215794; MEDLINE: 15774435]

Winstein 2004 *{published and unpublished data}*

Winstein CJ, Rose DK, Tan SM, Lewthwaite R, Chui HC, Azen SP. A randomized controlled comparison of upper extremity rehabilitation strategies in acute stroke: a pilot study of immediate and long-term outcomes. *Archives of Physical Medicine and Rehabilitation* 2004;**85**:620–8. [3215796; MEDLINE: 15083439]

Winstein 2016 *{published and unpublished data}*

Winstein CJ, Wolf SL, Dromerick A, Blanton S, Nelsen MA, Lane CJ, et al. Interdisciplinary comprehensive arm rehabilitation evaluation (ICARE): a randomized controlled trial. Proceedings of the International Stroke Conference 2013. 6-8 February 2013; Honolulu, Hawaii, USA. (Abst. CT P17).. 2013. [3215798]

Winstein CJ, Wolf SL, Dromerick AW, Lane CJ, Nelson MA, Lewthwaite R, Blanton S, Scott C, Reiss A, Yong Cen S, Holley R, Azen SP for the ICARE Investigative Team. Interdisciplinary Comprehensive Arm Rehabilitation Evaluation (ICARE): a randomized controlled trial protocol. *BMC Neurology* 2013;**13**(5). [3215799]

* Winstein CJ, Wolf SL, Dromerick AW, Lane CJ, Nelson MA, Lewthwaite R, Yong Cen S, Azen SP, for the Interdisciplinary Comprehensive Arm Rehabilitation Evaluation (ICARE) Investigative Team. Effect of a task-oriented rehabilitation program on upper extremity recovery following motor stroke. The ICARE randomized clinical trial. *Journal of the American Medical Association* 2016;**315**(6):571–581. [3215800]

Yen 2005 *{published data only}*

Yen JG, Wang RY, Chen HH, Hong CT. Effectiveness of modified constraint-induced movement therapy on upper limb function in stroke subjects. *Acta Neurologica Taiwanica* 2005;**14**(1):16–20. [3215802; MEDLINE: 15835284]

References to studies excluded from this review

Allison 2005 *{published data only}*

Allison R, Dennett R. Pilot randomized controlled trial to assess the impact of additional supported standing practice

- on functional ability post stroke. *Clinical Rehabilitation* 2007;**21**:614–19. [3215804]
- Almhdawi 2014** *{published data only}*
Almhdawi KA, Mathiowetz V, White M. Multidisciplinary Clinical Rehabilitation Effects of occupational therapy task-oriented approach in upper extremity poststroke rehabilitation. *International Journal of Stroke* 2014;**9**:217 (suppl). [4142191]
- Askim 2004** *{published data only}*
Askim T, Morkved S, Engen A, Roos K, Aas T, Indredavik B. Effects of a Community-Based Intensive Motor Training Program Combined With Early Supported Discharge After Treatment in a Comprehensive Stroke Unit. A Randomized, Controlled Trial. *Stroke* 2010;**41**:1697–703. [3215806]
- Banta 2013** *{published data only}*
Banta MW, Wilks M, Pidcoe PE, Sima A, Devers A. Novel, high-tech walking recovery program improves motor recovery. *Stroke* 2013;**44** (Abst.WMP86) International Stroke Conference; 2013 Feb 6-8; Honolulu. 2013. [3215810]
- Bever 2006** *{published data only}*
Conroy SS, Whitall J, Dipietro L, Jones-Lush LM, Zhan M, Finley MA. Effect of Gravity on Robot-Assisted Motor Training After Chronic Stroke: A Randomized Trial. *Archives of Physical Medicine and Rehabilitation* 2011;**92**:1754–61. [3215812]
- English 2016** *{published data only}*
English C, Healy GN, Olds T, Parfitt G, Borkoles E, Coates A, et al. Reducing Sitting Time after Stroke: A Phase II Safety and Feasibility Randomized Controlled Trial. *Archives of Physical Medicine and Rehabilitation* 2016;**97**:273–80. [4142193]
- Harijan 2013** *{unpublished data only}*
Harijan K. *Effect of Square Stepping Exercise on Gait Performance in Post Stroke [Master's dissertation]*. Rajiv Gandhi University of Health Sciences. 2013. [3215814]
- Hillier 2010** *{published data only}*
Hillier S, English C, Crotty M, Snel L, Bernhardt J, Esterman A. Circuit class or seven-day therapy for increasing intensity of rehabilitation after stroke: protocol of the CIRCIT trial. *International Journal of Stroke* 2011;**6**:560–5. [3215816]
- Hubbard 2010** *{published data only}*
Hubbard JJ, Carter LM, Budd WT, Levi CR, McElduff P, Hudson S, et al. A Randomized Controlled Trial of the Effect of Early Upper-Limb Training on Stroke Recovery and Brain Activation. *Neurorehabilitation and Neural Repair* 2015;**29**:70–83. [3215818]
- Li 2008** *{published data only}*
Li Z, Zhao J, Taub E. Recovery effect of constraint-induced movement therapy on upper extremity activity of stroke patients with hemiparesis. *Journal of Jilin University (Medicine Edition)* 2005;**34**:511–14. [3215820]
- Logan 2014** *{published data only}*
Logan PA, Armstrong S, Avery TJ, Barer D, Barton GR, Darby J, et al. Rehabilitation aimed at improving outdoor mobility for people after stroke: a multicentre randomised controlled study (the Getting out of the House Study). *Health Technology Assessment* 2014;**18**:vii–113. [4142195]
- Lord 2008** *{published data only}*
Lord S, McPherson KM, McNaughton HK, Rochester L, Weatherall M. How feasible is the attainment of community ambulation after stroke? A pilot randomized controlled trial to evaluate community-based physiotherapy in subacute stroke. *Clinical Rehabilitation* 2008;**22**:215–25. [3215822]
- Malagoni 2016** *{published data only}*
Malagoni AM, Cavallaro S, Ferraresi G, Grassi G, Felisatti M, Lamberti N, et al. Effect of a “test-in-train out” walking program versus supervised standard rehabilitation in chronic stroke: a randomised feasibility and pilot randomized study. *European Journal of Physical and Rehabilitation Medicine* 2016; Feb 17. [Epub ahead of print]. [4142197]
- McCombe-Waller 2014** *{published data only}*
McCombe-Waller S, Whitall J, Glickman L. Feasibility of bilateral arm training in the subacute setting. *Neurorehabilitation and Neural Repair* 2014;**28**: NP7 (Abst. Poster 17) American Society of Neuroradiology; 2013 Nov 3–8; San Diego. 2014. [3215824]
- Onigbinde 2009** *{published data only}*
Onigbinde AT, Awotidebe T, Awosika H. Effect of 6 weeks wobble board exercises on static and dynamic balance of stroke survivors. *Technology and health care : official journal of the European Society for Engineering and Medicine* 2009;**17**:387–92. [4142199]
- Pang 2013** *{published data only}*
Pang MYC. Whole body vibration in chronic stroke. <https://clinicaltrials.gov/ct2/show/NCT01822704> (accessed 30 November 2005). [3215826]
- Rao 2013** *{published data only}*
Rao T. A community applied research of traditional Chinese medicine rehabilitation scheme on balance dysfunction after stroke. <http://www.chictr.org.cn/showprojen.aspx?proj=5919> (accessed 14 December 2015). [3215828]
- Saeyns 2012** *{published data only}*
Saeyns W, Vereeck L, Truijten S, Lafosse C, Wuyts FP, Van De Heyning P. Randomized controlled trial of truncal exercises early after stroke to improve balance and mobility. *Neurorehabilitation and Neural Repair* 2012;**26**(3):231–38. [4142201]
- Sherrington 2005** *{published data only}*
Sherrington C, Pamphlett PI, Jacka JA, Olivetti LM, Nugent JA, Hall JM, et al. Group exercise can improve participants' mobility in an outpatient rehabilitation setting: a randomized controlled trial. *Clinical Rehabilitation* 2008;**22**:493–502. [3215830]
- Shimodozono 2013** *{published data only}*
Shimodozono M, Noma T, Nomoto Y, Hisamatsu N, Kamada K, Miyata R, et al. Benefits of a repetitive facilitative exercise program for the upper paretic extremity after subacute stroke: a randomized controlled trial. *Neurorehabilitation and Neural Repair* 2013;**27**:296–305. [3215832]

Tang 2009 *{published data only}*

Tang W, Yang B. Influence of sensory function training on motor function of cerebral apoplexy patients complicated with hemiplegia. *Chinese Nursing Research* 2009;**23**: 1905–6. [3215834]

Taub 2013 *{published data only}*

Taub E, Uswatte G, Mark VW, Morris DM, Barman J, Bowman MH, et al. Method for enhancing real-world use of a more affected arm in chronic stroke. Transfer package of constraint-induced movement therapy. *Stroke* 2013;**44**: 1383–8. [3215836]

Verheyden 2009 *{published data only}*

Verheyden G, Vereeck L, Truijien S, Troch M, LaFosse C, Saeys W, et al. Additional Exercises Improve Trunk Performance after Stroke: A Pilot Randomized Controlled Trial. *Neurorehabilitation and Neural Repair* 2009;**23**: 281–86. [4142203]

Vloothuis 2013 *{published data only}*

Vloothuis JDM. CAREgiver participation to improve intensity of training after stroke, a pilot study of a new intervention. <http://www.trialregister.nl/trialreg/admin/rctview.asp?TC=3739> (accessed 02 December 2014). [3215838]

Wang 2011 *{published data only}*

Wang Q, Zhao J, Zhu Q, Li J, Meng P. Comparison of conventional therapy, intensive therapy and modified constraint-induced movement therapy to improve upper extremity function after stroke. *Journal of rehabilitation medicine* 2011;**43**:619–25. [4142205]

References to studies awaiting assessment

Baglary 2013 *{published data only}*

Baglary S. *Effects of backward walking training in stroke patients (MSc dissertation)*. Bangalore, India: Rajiv Gandhi University, 2013. [4142207]

Bhaskar 2009 *{published data only}*

Bhaskar. Efficacy of modified hand function activities in rehabilitation of stroke patients. *Indian Journal of Physiotherapy and Occupational Therapy* 2009;**3**:16–19.

Brkic 2016 *{published and unpublished data}*

Brkic L, Shaw L, Van Wijck F, Price C, Watkins C, Forster A, et al. Repetitive arm functional tasks after stroke (RAFTAS) study. Proceedings of the 8th UK Stroke Forum Conference. 3-5 December 2013; Harrogate, UK. 2013: 58-59 (Abst. OG). [3215844]
Brkic L, Shaw L, van Wijck F, Francis R, Price C, Forster A, Lauder P, Watkins C, Rodgers H. Repetitive arm functional tasks after stroke (RAFTAS): a pilot randomised controlled trial. *Pilot and Feasibility Studies* 2016;**2**:50.

Dean 2015 *{published data only}*

NCT02429180. Rehabilitation Training after Stroke (ReTrain). <https://clinicaltrials.gov/ct2/show/NCT02429180> (accessed 22 June 2016).

Eng 2009 *{unpublished data only}*

Eng J. The Effect of an Inpatient Home-work Exercise Program on Leg Function After Stroke. clinicaltrials.gov/

[ct2/show/NCT00908479](http://clinicaltrials.gov/ct2/show/NCT00908479) (accessed 02 December 2014). [3215840]

Ferrari 2015 *{published data only}*

Ferrari FF, Gandolfi MLG, Picelli AP, La Marchina EL, Tosoni RT, Geroini GC, et al. Effects of a specific rehabilitation treatment on post-stroke pusher syndrome recovery - a randomized controlled trial. *Cerebrovascular Diseases* 2015;**39**((Suppl 2)):112. [4142209]

Gandhi 2015 *{published data only}*

Gandhi D, Pandian J, Lincoy R, Alim M, Maulik P, Murthy GVS, et al. Family-led rehabilitation after stroke in India: The ATTEND trial. *International Journal of Stroke* 2015;**10**:174. [4142211]

Indurkar 2013 *{published data only}*

Indurkar I, Iyer S. Study the Effect of Task Orientated Intervention on Walking Distance, Speed and Balance Efficiency in Post-stroke Patients. *Indian Journal of Physiotherapy and Occupational Therapy* 2013;**7**:67–72.

Knox 2014 *{published data only}*

Knox M, Stewart A, Richards C. Does a little go a long way? Efficient rehabilitation of persons with stroke in the public healthcare sector in RSA. Does a little go a long way? Efficient rehabilitation of persons with stroke in the public healthcare sector in RSA. Proceedings of the Stroke and Hypertension Congress; 2014 Aug 22-24; Durban, south Africa. 2014. [4142213]

Kumar 2012 *{published data only}*

Kumar C, Goyal R. The Effect of Task Orientated Training on Hand Functions in Stroke Patients- A Randomized Control Trial. *Indian Journal of Physiotherapy and Occupational Therapy* 2012;**6**:87–91.

Pandian 2014 *{published data only}*

Pandian JD, Felix c, Alim M, Gandhi DBC. On-going clinical trials the attend trial-family-led rehabilitation after stroke in india: A modified version of early supported discharge with a caregiver delivered home based poststroke rehabilitation. *International Journal of Stroke* 2014;**9**: 252–253. [4142215]

Tong 2015 *{published data only}*

ChiCTR-ICR-15005992. Early and Intensive Rehabilitation after Stroke. <http://apps.who.int/trialsearch/Trial2.aspx?TrialID=ChiCTR-ICR-15005992> (accessed 22 June 2016).

Xu 2012 *{published data only}*

Xu W, Su Y, Liu X, Li K, Wang H, Su Y, et al. Influence of early walking training to stroke hemiplegic patients' lower limb motor function. *Heart* 2012;**98**:E158. [4142217]

Zhu 2013 *{published data only}*

Zhu L, Song WQ, Zhang R, Liu, L. Effect of rehabilitation training for optimizing motor skills on upper limb function recovery after stroke 10(1): 22-25.. *Chinese Journal of Cerebrovascular Diseases* 2013;**10**:22–25. [4142219]

References to ongoing studies

Alouche 2016 *{published data only}*

NCT02765152. Effects of Training Rhythmic and Discrete Aiming Movements on the Upper Limb Control and Functionality After Stroke: Randomized Controlled Trial. <https://clinicaltrials.gov/ct2/show/NCT02765152> (accessed 22 June 2016).

Bosomworth 2013 *{unpublished data only}*

Bosomworth H. RATULS: Robot Assisted Training for the Upper Limb after Stroke UKCRN ID 15309. <http://public.ukcrn.org.uk/Search/StudyDetail.aspx?StudyID=15309> (accessed 03 December 2014). [3215842]

Dromerick 2014 *{published data only}*

NCT02235974. Critical Periods After Stroke Study (CPASS). <https://clinicaltrials.gov/ct2/show/NCT02235974> (accessed 30 June 2016).

Hariohm 2013 *{unpublished data only}*

Hariohm K, Prakash V, Vasanthan R, Daran JKD, Samuel RJ. An RCT protocol on efficacy of deep knee flexion exercises on improving activities involving deep knee flexion and quality of life in persons with stroke. *Cerebrovascular Diseases* 2013;**36** Suppl 1:15. [3215846]

Korner-Bitensky 2013 *{unpublished data only}*

Korner-Bitensky N, Clemson L. Randomized pilot trial of usual care versus LIFE (lifestyle intervention using functional exercise to reduce falls) in those with mild stroke. International Stroke Conference Poster Abstracts: Stroke. 2013; Vol. 44: Abstract TP319. [3215848]

Kumaran 2010 *{unpublished data only}*

Kumaran S. Effectiveness and feasibility of a task and context based exercise program in stroke patients: a randomized controlled trial.. <http://www.ctrinfo.nic.in/Clinicaltrials/pmaindet2.php?trialid=1486> CTRI/2010/091/000278 (accessed 15 November 2013). [3215850]

Oza 2015 *{published data only}*

CTRI/2015/06/005877. Short term effect of circuit class training for improvement of upper limb in stroke patients: a Randomized Clinical Trial. <http://apps.who.int/trialsearch/Trial2.aspx?TrialID=CTRI/2015/06/005877> (accessed 22 June 2016).

Schultz 2012 *{unpublished data only}*

Schultz B. Use of repetitive facilitative exercise program in established stroke. *Clinicaltrials.gov* NCT01574599 (accessed 09 January 2014). [3215852]

Stuart 2009 *{unpublished data only}*

Adaptive Physical Activity for Chronic Stroke (APA-Stroke). Ongoing study 2009.

Tanne 2008 *{published data only}*

Tanne D. Virtual Reality Training Program for Ambulatory Patients With Chronic Gait Deficits After Stroke. <https://clinicaltrials.gov/ct2/show/NCT00600379> (accessed 20 November 2013). [4142221]

Turton 2011 *{unpublished data only}*

Turton A. Home based reach to grasp training after stroke. <http://public.ukcrn.org.uk/Search/StudyDetail.aspx?StudyID=9226> (accessed 26 November 2013). [3215855]

Additional references**Au-Yeung 2009**

Au-Yeung SS, Hui-Chan CW. Predicting recovery of dextrous hand function in acute stroke. *Disability and Rehabilitation* 2009;**31**:394–401.

Bamford 1991

Bamford J, Sandercock P, Dennis M, Burn J, Warlow C. Classification and natural history of clinically identifiable subtypes of cerebral infarction. *Lancet* 1991;**337**(8756): 1521–26.

Butefisch 1995

Butefisch C, Hübner-Weinert M, Denzler P, Mauritz KH. Repetitive training of isolated movements improves the outcome of motor rehabilitation of the centrally paretic hand. *Journal of the Neurological Sciences* 1995;**130**(1): 59–64. [MEDLINE: 212]

Carr 1987

Carr J, Shepherd R. *A Motor Relearning Programme for Stroke*. Oxford: Butterworth Heinemann, 1987. [MEDLINE: 251]

Cubetto 2015

Cubetto D, Sirtori V, Castellini G, Moja L, Gatti R, et al. Constraint-induced movement therapy for upper extremities in people with stroke. *Cochrane Database of Systematic Reviews* 2015; **Issue 10**. Art. No.: **CD004433**. DOI: **10.1002/14651858.CD004433.pub3**..

Dallas 2008

Dallas MI, Rone-Adams S, Echternach JL, Brass LM, Bravata DM. Dependence in prestroke mobility predicts adverse outcomes among patients with acute ischemic stroke. *Stroke* 2008;**39**:2298–2303.

Dobkin 2004

Dobkin BH. Strategies for stroke rehabilitation. *Lancet Neurology* 2004;**3**(9):528–36. [MEDLINE: 122]

Feigin 1996

Feigin L, Sharon B, Czaczkes B, Rosin AJ. Sitting equilibrium 2 weeks after a stroke can predict the walking ability after 6 months. *Gerontology* 1996;**42**:348–353.

Feigin 2014

Feigin VL, Forouzanfar MH, Krishnamurthi R, Mensah GA, Connor M, Bennett DA, Moran AE, Sacco RL, Anderson L, Truelsen T, O'Donnell M, Venketasubramanian N, Barker-Collo S, Lawes CMM, Wang W, Shinohara Y, Witt E, Ezzati M, Naghavi M, Murray C, on behalf of the Global Burden of Diseases, Injuries, and Risk Factors Study 2010 (GBD 2010) and the GBD Stroke Experts Group. Global and regional burden of stroke during 1990–2010: findings from the Global Burden of Disease Study 2010. *Lancet*. 2014;**383**(9913):245–54.

Guyatt 2008

Guyatt GH, Oxman AD, Vist G, Kunz R, Falck-Ytter Y, for the GRADE Working Group. Rating quality of evidence and strength of recommendations GRADE: an emerging consensus on rating quality of evidence and strength of recommendations. *BMJ* 2008;**336**:924–6.

Heller 1987

Heller A, Wade DT, Wood VA, Sunderland A, Hewer RL, Ward E. Arm function after stroke: measurement and recovery over the first three months. *Journal of Neurology, Neurosurgery and Psychiatry* 1987;**50**(6):714–9. [MEDLINE: 258]

Higgins 2011

Higgins JPT, Altman DG, Gøtzsche PC, Jüni P, Moher D, Oxman AD, et al. The Cochrane Collaboration's tool for assessing risk of bias in randomised trials. *British Medical Journal* 2011;**343**:d5928.

Intercollegiate Stroke Working Party 2012

Intercollegiate Stroke Working Party. *National clinical guideline for stroke (4th edition)*. London: Royal College of Physicians, 2012.

Kwah 2013

Kwah LK, Harvey LA, Diong J, Herbert RD. Models containing age and NIHSS predict recovery of ambulation and upper limb function six months after stroke: an observational study. *Journal of Physiotherapy* 2013;**59**(3): 189–197.

Kwakkel 2004

Kwakkel G, van Peppen R, Wagenaar RC, Dauphinee SW, Richards C, Ashburn A, et al. Effects of augmented exercise therapy time after stroke - a meta-analysis. *Stroke* 2004;**35**(11):2529–36. [MEDLINE: 117]

Langhorne 2009

Langhorne P, Coupar F, Pollock A. Motor recovery after stroke: a systematic review. *Lancet Neurology* 2009;**8**: 741–754.

Lawrence 2001

Lawrence ES, Coshall C, Dundas R, Stewart J, Russell G, Howard R, et al. Estimates of the prevalence of acute stroke impairments and disability in a multi-ethnic population. *Stroke* 2001;**32**(6):1279–84. [MEDLINE: 254]

Lord 2004

Lord S, McPherson K, McNaughton L, Rochester L, Weatherall M. Community ambulation after stroke: how important and obtainable is it and what measures appear predictive?. *Archives of Physical Medicine and Rehabilitation* 2004;**85**:234–9. [MEDLINE: 181]

Mehrholz 2012

Mehrholz J, Pohl M, Platz T, Kugler J, Elsner B. Treadmill training and body weight support for walking after stroke. *Cochrane Database of Systematic Reviews* 2014, Issue 1. [DOI: 10.1002/14651858.CD002840.pub3]

Mehrholz 2015b

Mehrholz J, Pohl M, Platz T, Kugler J, Elsner B. Electromechanical and robot-assisted arm training for improving activities of daily living, arm function, and arm muscle strength after stroke. *Cochrane Database of Systematic Reviews* 2015; **Issue 11**. Art. No.: **CD006876**. DOI: 10.1002/14651858.CD006876.pub4..

Nakayama 1994

Nakayama H, Jorgensen HS, Raaschou HO, Olsen TS. Recovery of upper extremity function in stroke patients: the Copenhagen study. *Archives of Physical Medicine and Rehabilitation* 1994;**75**:852–7. [MEDLINE: 24]

Nijland 2010

Nijland RHM, van Wegen EE, Harmeling-van der Wel BC, Kwakkel G, on behalf of the EPOS Investigators. Presence of finger extension and shoulder abduction within 72 hours after stroke predicts functional recovery. Early Prediction of Functional Outcome After Stroke: the EPOS Cohort Study. *Stroke* 2010;**41**:745–750.

Nuyens 2002

Nuyens GE, De Weert J, Spaepen AJ Jr, Kiekens C, Feys HM. Reduction of spastic hypertonia during repeated passive knee movements in stroke patients. *Archives of Physical Medicine and Rehabilitation* 2002;**83**(7):930–5. [MEDLINE: 121]

Page 2004

Page SJ, Gater DR, Bach-Y-Rita P. Reconsidering the recovery plateau in stroke rehabilitation. *Archives of Physical Medicine & Rehabilitation* 2004;**85**(8):1377–81. [MEDLINE: 15295770]

Pollock 2014

Pollock A, Farmer SE, Brady MC, Langhorne P, Mead GE, Mehrholz J, et al. Interventions for improving upper limb function after stroke. *Cochrane Database of Systematic Reviews* 2014, Issue 11. [DOI: 10.1002/14651858.CD010820.pub2]

Pollock 2014a

Pollock A, Baer G, Campbell P, Choo PL, Forster A, Morris J, Pomeroy VM, Langhorne P. Physical rehabilitation approaches for the recovery of function and mobility following stroke. *Cochrane Database of Systematic Reviews* 2014, Issue Issue 4. Art. No.: CD001920. DOI: 10.1002/14651858.CD001920.pub3.

Schmidt 2014

Schmidt RA, Lee TD. *Motor Learning and Performance. 5th Edition*. Champaign, IL: Human Kinetics, 2014.

Sunderland 1989

Sunderland A, Tinson D, Bradley L, Hewer RL. Arm function after stroke. An evaluation of grip strength as a measure of recovery and a prognostic indicator. *Journal of Neurology, Neurosurgery and Psychiatry* 1989;**52**(11): 1267–72. [MEDLINE: 256]

Van der Lee 2001

Van der Lee JH, Snels IA, Beckerman H, Lankhorst GJ, Wagenaar RC, Bouter LM. Exercise therapy for arm function in stroke patients: a systematic review of randomized controlled trials. *Clinical Rehabilitation* 2001; **15**(1):20–31. [MEDLINE: 162]

Van Exel 2004

Van Exel NJA, Reimer SO, Koopmanschap MA. Assessment of post-stroke quality of life in cost-effectiveness studies:

the usefulness of the Barthel Index and the EuroQol-5D. *Quality of Life Research* 2004;**13**(2):427–33.

Van Peppen 2004

Van Peppen RPS, Kwakkel G, Wood-Dauphinee S, Hendriks HJM, van der Wees PJ, Dekker J. The impact of physical therapy on functional outcomes after stroke: what's the evidence?. *Clinical Rehabilitation* 2004;**18**(8):833–62. [MEDLINE: 35]

Verbeek 2011

Verbeek JM, Van Wegen EE, Harmeling-Van der Wel BC, Kwakkel G. Is accurate prediction of gait in nonambulatory stroke patients possible within 72 hours poststroke?: The EPOS Study. *Neurorehabilitation and Neural Repair* 2011; **25**:268–274.

Verbeek 2014

Verbeek JM, van Wegen E, van Peppen R, van der Wees PJ, Hendriks E, Rietberg M, Kwakkel G. What is the evidence for physical therapy poststroke? A systematic review and meta-analysis. *PLOS ONE* 2014;**9**(2):e87987.

Wade 1983

Wade DT, Langton-Hewer R, Wood VA, Skilbeck CE, Ismail HM. The hemiplegic arm after stroke: measurement and recovery. *Journal of Neurology, Neurosurgery & Psychiatry* 1983;**46**(6):521–4. [MEDLINE: 257]

Wade 1987

Wade DT, Langton-Hewer R. Functional abilities after stroke: measurement, natural history and prognosis. *Journal*

of Neurology Neurosurgery and Psychiatry 1987;**50**:177–82. [MEDLINE: 298]

Wandel 2000

Wandel A, Jorgensen HS, Nakayama H, Raaschou HO, Olsen TS. Prediction of walking function in stroke patients with initial lower extremity paralysis: the Copenhagen Stroke Study. *Archives of Physical Medicine and Rehabilitation* 2000;**81**:736–738.

WHO 1989

World Health Organization. Task Force on Stroke and other cerebrovascular disease. Recommendations on stroke prevention, diagnosis, and therapy: report of the WHO Task Force on Stroke and other cerebrovascular disorders. *Stroke* 1989;**20**:107–5. [MEDLINE: 299]

Wolfe 2000

Wolfe CD. The impact of stroke. *British Medical Bulletin* 2000;**58**(2):275–85.

References to other published versions of this review

French 2006

French B, Forster A, Langhorne P, Leathley MJ, McAdam J, Price CIM, et al. Repetitive task training for improving functional ability after stroke. *Cochrane Database of Systematic Reviews* 2006, Issue 3. [DOI: 10.1002/14651858.CD006073]

* Indicates the major publication for the study

CHARACTERISTICS OF STUDIES

Characteristics of included studies [ordered by study ID]

Arya 2012

Methods	An assessor-blinded, multi-centre randomised controlled trial
Participants	<p>India</p> <p>Participants were recruited from an inpatient neurology ward and occupational therapy unit of a rehabilitation institute. Details of recruitment not reported</p> <p>103 participants: 51 RTT, 52 control</p> <p>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</p> <p>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 > 200mmHg and resting diastolic blood pressure > 100mmHg), shoulder subluxation, aphasia, sensory loss</p> <p>Mean age: RTT 51.07 years (SD 7.96), control 50.21 years (SD 7.60)</p> <p>60.2% male</p> <p>Stroke details: ischaemic stroke, ischaemic 66.9%, haemorrhagic 33.0%</p> <p>Timing post stroke: RTT 11.92 weeks (SD 6.49), control 12.37 weeks (SD 6.64)</p> <p>Pre-intervention functional ability level:</p> <p>Functional ambulation classification level I and above</p>
Interventions	<p>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</p> <p>MTST mainly comprises the specific number of meaningful tasks, which are common to all the patients</p> <p>The tasks have to be practiced repetitively either with unilateral (the most affected extremity) or bilateral upper limb/s, depending on the task requirement</p> <p>It also has a component of individualized meaningful tasks, which have to be selected from a task bank for repetitive practice</p> <p>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</p> <p>Comparison group: The control group was given an intervention of the same duration based on the Brunnstrom movement therapy and Bobath neurodevelopmental technique</p>
Outcomes	<p>Outcome measures were recorded at baseline, 4 weeks (post treatment) and eight weeks</p> <p>Upper limb functional outcome measures: Fugl-Meyer assessment, Action Research Arm Test, Graded Wolf Motor Function Test, Motor Activity Log</p>
Notes	<p>No significant differences at baseline</p> <p>One experimental drop out due to personal reasons</p> <p>No adverse events reported</p>

<i>Risk of bias</i>		
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 2002

Methods	Prospective, single blind randomised controlled pilot trial
Participants	<p>UK</p> <p>Participants were recruited from the community</p> <p>64 participants: 20 Whole practice, 23 Part practice, 21 control</p> <p>Inclusion criteria:</p> <ol style="list-style-type: none"> 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 c.m. Able to understand the nature of the study and give informed consent <p>Exclusion criteria:</p> <ol style="list-style-type: none"> 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 <p>Mean age: 72.9 ± 9.0</p> <p>48.4% male</p>

	Stroke details: 38 right CVA, 26 left CVA Timing post-stroke: 30.3 ± 28.8 months Pre-intervention functional activity level: RTT WP Motor Assessment Scale 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 exercise 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 intervention effect.	
Outcomes	Outcome measures were recorded at baseline (two measurements two 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 75 seconds Other outcome measures: Barthel Index, Motor Assessment Scale, 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 four strata of patients were used, based on side and severity of stroke, due to the small numbers of patients
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 three 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 2002 (Continued)

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

Barreca 2004

Methods	Single centre randomised controlled trial
Participants	<p>Canada</p> <p>48 participants: 25 RTT, 23 control</p> <p>Participants were recruited from stroke rehabilitation units between 2000 and 2001</p> <p>Inclusion criteria: between the ages of 18 to 80 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</p> <p>Exclusion criteria: none stated</p> <p>Median age: RTT 67 years (IQR 56 - 72), control 70 years (IQR 64 - 78)</p> <p>65% male</p> <p>Stroke details: not stated whether first or recurrent stroke, 73% ischaemic, 42% right hemiparesis</p> <p>Timing post stroke: RTT median 30 days (IQR 21 - 48), control median 31 days (IQR 18 to 50)</p> <p>Pre-intervention functional ability level: lack of postural control</p>
Interventions	<p>RTT intervention: Sit-to-stand training. Group class practice in attaining standing from sitting from a variety of different heights and surfaces</p> <p>Training was additional to usual care, which included daily strengthening exercise, repetitive training, functional training, electrical stimulation and other exercise</p> <p>Sessions were 45 minutes, 3 times per week until competence or discharge (approx. 6 weeks) = 13.5 hours + practice on ward</p> <p>Each session aimed to involve 3 practice sets of 5 sit-to-stand manoeuvres per class</p> <p>Average total repetitions during training = 450 to 500</p> <p>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</p> <p>Comparison group: Usual care and recreation therapy</p>
Outcomes	<p>Outcome measures were recorded at baseline and at competence or discharge (approx. 6 weeks)</p> <p>Balance/sit-to-stand outcome measures: ability to stand independently and safely on 2 consecutive occasions</p> <p>Adverse events outcome measures: number of falls</p> <p>QoL/health status outcome measures: satisfaction with ability to stand, Dartmouth Primary Care Cooperative Chart</p>
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 randomised controlled trial
Participants	<p>Australia</p> <p>30 participants: 15 mobility group, 15 upper limb group</p> <p>Participants were recruited from inpatient admissions, with a primary diagnosis of stroke, to a rehabilitation centre between 2001 and 2003</p> <p>Inclusion criteria: able to walk 10 metres and provide informed consent</p> <p>Exclusion criteria: deteriorating medical condition, independent community ambulation</p> <p>Mean age: mobility group 53.9 years (SD 19.8), upper limb group 56.3 years (SD 10.5)</p> <p>56.6% male</p> <p>Stroke details: first or recurrent stroke, 73% ischaemic, 47% righthemiparesis</p> <p>Timing post stroke: mobility group 36 days (SD 25.1), upper limb group 50 days (SD 49.2)</p> <p>Pre-intervention functional ability level: Six Minute Walk Test: mobility group 183 metres (SD 85), upper limb group 181 metres (SD 85)</p>
Interventions	<p>RTT interventions:</p> <p>Mobility group: circuit training including sit to stand, step ups, obstacle course, plus stretching/strengthening exercise, and some endurance training (stationary bikes/treadmill)</p> <p>Upper limb group: reach and grasp, hand-eye co-ordination activities, stretching and strengthening exercises</p> <p>Sessions were during inpatient rehabilitation and additional to usual care of 5 hours per week</p> <p>Sessions were 60 minutes, 5 times per week for 4 weeks = 20 hours</p> <p>Each circuit included 10 five minute workstations</p> <p>Sessions were delivered by a physical therapist in groups of up to 4 participants</p> <p>Comparison group: Blennerhassett 2004a lower limb attention control Blennerhassett 2004b upper limb attention control</p>

Blennerhassett 2004 (Continued)

Outcomes	Outcome measures were recorded at baseline, 4 weeks (post treatment) and 6 months after training Upper limb functional outcome measures: Motor Assessment Scale, 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	

Blennerhassett 2004a (Continued)

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

Blennerhassett 2004b

Methods	See Blennerhassett 2004	
Participants		
Interventions		
Outcomes		
Notes		
<i>Risk of bias</i>		
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

Methods	Single centre pilot randomised controlled trial	
Participants	<p>France</p> <p>20 participants: 10 RTT, 10 control group</p> <p>Participants recruited from a neurorehabilitation unit in 1998</p> <p>Inclusion criteria: hemiplegia caused by a single stroke occurring at least 1 month previously, static imbalance of the trunk resulting from the stroke</p> <p>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</p> <p>Mean age: RTT 63.5 years (SD 11), control 67.7 years (SD 15)</p> <p>55% male</p> <p>Stroke details: first stroke, 35% ischaemic, 25% right hemiparesis</p> <p>Time since stroke: RTT 36.8 days (SD 25), control 27.7 days (SD 15)</p> <p>Pre-intervention functional ability level: lack of postural balance</p>	
Interventions	<p>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 were activated to emit light and sound signals</p> <p>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</p> <p>Sessions were delivered individually by a physical therapist</p> <p>Comparison group: two hours of usual care (Bobath inspired approach and functional therapy plus a session of occupational therapy 5 days per week)</p>	
Outcomes	<p>Outcomes were recorded at baseline, 4 weeks (post treatment), and 2 months</p> <p>Balance/sit-to-stand outcome measures: Sitting Equilibrium Index, Upright Equilibrium Index</p> <p>Lower limb functional outcome measures: Functional Ambulation Classification</p> <p>Impairment outcome measures: Trunk Control Test, Motricity Index, Ashworth Scale</p> <p>ADL outcome measures: Functional Independence Measure</p>	
Notes	<p>Postural deficit and unilateral neglect tended to be more severe in the device group at baseline, although not significant</p> <p>No intervention-related reasons for withdrawal</p> <p>Attendance: all participants completed training</p>	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	The patients were distributed consecutively into 2 groups of 10 each by using a randomization table
Allocation concealment (selection bias)	Unclear risk	No details reported

de Sèze 2001 (Continued)

Blinding of outcome assessment (detection bias) All outcomes	Low risk	The clinician who evaluated the patients did not know to which group they belonged
Incomplete outcome data (attrition bias) All outcomes	Low risk	No withdrawals or drop outs
Selective reporting (reporting bias)	Unclear risk	No study protocol

Dean 1997

Methods	Randomised controlled trial
Participants	<p>Australia</p> <p>20 participants: 10 RTT, 10 control group</p> <p>Participants were recruited from stroke clubs around Sydney. Date of recruitment not reported</p> <p>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</p> <p>Exclusion criteria: none stated</p> <p>Mean age: RTT 66.2 years (SD 8.2), control 66.9 years (SD 8.2)</p> <p>70% male</p> <p>Stroke details: not stated whether first or recurrent stroke; 40% right-sided stroke</p> <p>Time since stroke: RTT 6.7 years (SD 5.8), control 5.9 years (SD 2.9)</p> <p>Pre-intervention functional ability level: Walking speed: RTT 0.41 m/s (SD 0.25), control 0.35 m/s (SD 0.28)</p>
Interventions	<p>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</p> <p>Intervention was after discharge from all rehabilitation programmes</p> <p>Sessions were 30 minutes, 5 days per week for 2 weeks = 5 hours</p> <p>Sessions were delivered by a physical therapist in the participant's own home</p> <p>Comparison group: upper extremity attention control - performance of cognitive manipulative tasks while seated at a table</p>
Outcome	<p>Outcomes were recorded at baseline and at 2 weeks (post treatment)</p> <p>Lower limb functional outcome measures: 10 Metre Walk Speed</p> <p>Balance/sit-to-stand outcome measures: reaching distance, reaching speed</p>
Notes	<p>No significant differences reported at baseline</p> <p>5% loss to follow up at end of treatment phase</p> <p>No intervention-related reasons for withdrawal</p>

Risk of bias

Dean 1997 (Continued)

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not reported
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 subject's group allocation Biomechanical data collection and analysis for the seated reaching tasks and sit-to-stand were computerized, which minimized experimenter bias because group allocation was not evident to the operator
Incomplete outcome data (attrition bias) All outcomes	Low risk	One withdrawal in control group due to medical complications
Selective reporting (reporting bias)	Unclear risk	No study protocol

Dean 2000

Methods	Pilot randomized controlled trial
Participants	<p>Canada</p> <p>12 participants: 6 RTT, 6 control group</p> <p>Participants were recruited from a rehabilitation research group database. Date of recruitment not reported</p> <p>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</p> <p>Exclusion criteria: any medical condition that would prevent participation</p> <p>Mean age: RTT 66.2 years (SD 7.7), control 62.3 years (SD 6.6)</p> <p>58% male</p> <p>Stroke details: first stroke, 58% right hemiparesis</p> <p>Timing post stroke: RTT 2.3 years (SD 0.7), control 1.3 years (SD 0.9)</p> <p>Pre-intervention functional ability level: Walking velocity: RTT 76 cm/s (SD 44), control 76 cm/s (SD 39)</p>
Interventions	<p>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</p> <p>Intervention was after discharge from all rehabilitation programmes</p> <p>Sessions were 60 minutes, 3 times per week for 4 weeks = 12 hours</p> <p>Sessions were delivered to a group of 6 participants by two physical therapists, in an rehabilitation centre setting</p> <p>Comparison group: circuit programme designed to improve function of the affected</p>

Dean 2000 (Continued)

	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 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 subject allocation for the clinical assessments but may have been unmasked as a result of the observer inadvertently viewing one 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: (1) a diagnosis of first stroke resulting in hemiplegia within the previous three months; (2) no orthopaedic problems which would interfere with the ability to perform seated reaching tasks; (3) no visual problems which would interfere with reaching to pick up objects or reading; (4) a score of at least 3 on Item 3 (sitting balance) of the Motor Assessment Scale for Stroke; (5) the ability to reach with intact arm a distance equivalent to 140% of arm's length; (6) no major cognitive or perceptual problems identified using the short

	<p>portable mental status questionnaire; (7) no left neglect identified using the Letter Cancellation Test; (8) the ability to give informed consent; and (9) the ability to understand instructions.</p> <p>Exclusion criteria: none stated</p> <p>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</p> <p>Stroke details: side of hemiplegia RTT 3:3, control 5</p> <p>Timing post-stroke: RTT 21 days (SD 8), control 37 days (SD 23)</p> <p>Pre-intervention functional activity level: not reported</p>	
Interventions	<p>RTT intervention: sitting training protocol designed to improve sitting by reaching beyond arm's length using the unaffected hand whilst focusing on: (1) smooth coordinated motion of the trunk and arm to get the hand to the object; (2) appropriate loading of the affected foot; and (3) preventing 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</p> <p>Sessions were delivered to individuals by the first or second author or undergraduate physiotherapy students</p> <p>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</p> <p>Both training programmes were 10 sessions of 30 minutes spread over a two week period (5 hours)</p>	
Outcomes	<p>Outcomes were recorded at baseline, 2 weeks (post-treatment) and 28 weeks</p> <p>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</p> <p>Lower limb functional outcome measures: 10 meter Walk Test</p>	
Notes	<p>Potential baseline imbalance in time from stroke to admission to trial: RTT mean 21 days (SD 8), control mean 37 days (SD 23)</p>	
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

Dean 2007 (Continued)

		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 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 two participants in the control group lost to follow-up at 6 months
Selective reporting (reporting bias)	Unclear risk	No protocol available.

Frimpong 2014

Methods	Randomised controlled trial
Participants	<p>Ghana</p> <p>20 participants: 10 RTT, 10 control</p> <p>Participants were recruited from stroke survivors referred for physiotherapy. Date of recruitment not reported</p> <p>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</p> <p>Exclusion criteria: patients with aphasia, cardiac arrhythmias or any other conditions making exercises contraindicated</p> <p>Mean age: RTT 57.6 ± 0.3 years, control 55.8 ± 6.7</p> <p>64% male</p> <p>Stroke details: ischaemic stroke 66.6% (6), haemorrhagic stroke 33.3% (3)</p> <p>Time since stroke: RTT 2.2 months (SD 0.8), control 2.4 months (SD 0.9)</p> <p>Pre-intervention functional ability: 6 Minute Walk Test RTT 249.5 metres (SD 10.7), control 253.0 (SD 12.5)</p>
Interventions	<p>RTT intervention: -circuit training for 105 minutes three times per week for 8 weeks including treadmill walking, push-ups, squatting, straight leg raise, stairs walking and cycling exercises</p> <p>Comparison group: conventional therapy of passive and active exercises. Subjects also performed upper limb strengthening exercises, walking re-education, as well as standing and balance retraining carried out between parallel bars</p>
Outcomes	<p>Outcomes were recorded at baseline, week 4 and week 8 (post-intervention)</p> <p>Lower limb functional outcome measures: 6 Minute Walk Test, 10 Metre Walk Test, Functional Ambulatory category</p>

Frimpong 2014 (Continued)

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".
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	Randomised controlled trial
Participants	<p>Location: West Indies</p> <p>28 participants: 64 RTT, 64 control</p> <p>Participants were recruited from three hospitals. Date of recruitment not reported</p> <p>Inclusion criteria: 40 years of age or older, community dwelling, 6-24 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</p> <p>Exclusion criteria: none stated</p> <p>Mean age: RTT 63.4 years (SD 9.4), control 64.9 years (SD 11.1)</p> <p>45.3% male</p> <p>Stroke details: ischaemic 71.1% (91), haemorrhagic 11.7% (15)</p> <p>Time since stroke: RTT 12.8 months (SD 3.6), control 11.8 months (SD 3.6)</p> <p>Pre-intervention functional ability level: use of walking aid at recruitment: RTT 26.6% (n=17), control 32.8% (n=21)</p>
Interventions	<p>RTT intervention: Subjects 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 = 9-18 hours</p> <p>Comparison group: Light massage to the affected limbs for 25 minutes, 3 times per week for 12 weeks at home</p>
Outcomes	<p>Outcomes were recorded at baseline, 6 weeks and 12 weeks (post treatment)</p> <p>Lower limb functional outcome measures: 6 Minute Walk Test</p> <p>Impairment outcome measures: Motricity Index</p>

Gordon 2013 (Continued)

	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 activities of daily living dimension of the Older Americans Resources and Services Questionnaire	
Notes	No significant differences between groups at baseline Two intervention related withdrawals (programme too difficult (n=1) and participant not happy with group assignment (n=1)) 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 randomization 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 drop outs 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 randomised controlled trial
Participants	Sweden 34 participants: 15 RTT, 19 control Participants were recruited from Umeå Stroke Unit. There were three 3monthly recruitment periods between February 2005 and June 2007 Inclusion criteria: first ever or recurrent ischaemic or haemorrhagic stroke 3 - 6 months before enrolment and randomization, age ≥ 55 , the ability to walk 10 m 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

	<p>the training facilities</p> <p>Mean age: RTT 77.7 years (SD 7.6), control 79.2 years (SD 7.5)</p> <p>62% male</p> <p>Stroke details: first or recurrent stroke, 97% ischaemic, 3% haemorrhagic</p> <p>Time since stroke: RTT 139.7 days (SD 37.3), control 121.8 days (SD 28.2)</p> <p>Pre-intervention functional activity level: Barthel Index: RTT 44.3 (CI 40.0-48.7), control 44.2 (CI 39.3-49.2)</p>	
Interventions	<p>RTT intervention: The intervention was based on the HIFE (High Intensity Functional Exercise) program, to improve the subjects' 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).</p> <p>A home visit was conducted by a physiotherapist (PT) and an occupational therapist (OT) to determine each subject's ability to perform activities of daily life (ADL) and lifestyle activities and to experience the subject's daily difficulties in their own environment.</p> <p>Sessions were 45 minutes six times per week (twice daily) for 5 weeks = 22.5 hours.</p> <p>Comparison group: subject attendance per week for a 1 hour of educational session during the 5-week period.</p> <p>The session was led by an occupational therapist, group discussions were about communication difficulties, fatigue, depressive symptoms, mood swings, personality changes and dyspnoea, and more or less hidden dysfunctions after stroke and how to cope with these difficulties.</p> <p>There was no special focus on the risks of falling in these discussions.</p>	
Outcomes	<p>Outcomes were recorded at baseline, 5 weeks (post treatment), 3 months and 6 months.</p> <p>Balance/step-to-stand outcome measures: Berg Balance Scale, Falls Efficacy Scale, number of falls.</p> <p>ADL outcome measures: Barthel Index, Frenchay Activities Index.</p>	
Notes	<p>No significant differences between groups at baseline.</p> <p>11 subjects in total fell during study (32%), RTT (n=5), control (n=6).</p>	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Minimization software program
Allocation concealment (selection bias)	Low risk	The randomization procedure was conducted by the two 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 randomization, which was made possible by using code numbers for each participant.

Holmgren 2010 (Continued)

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 subject'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 drop outs, reasons provided
Selective reporting (reporting bias)	Unclear risk	No study protocol

Howe 2005

Methods	Pilot randomised controlled trial
Participants	<p>United Kingdom</p> <p>35 participants: 18 RTT, 17 control</p> <p>Participants recruited from admissions to an acute stroke unit between 2001 and 2002</p> <p>Inclusion criteria: aged 18 and over, acute vascular stroke presenting with hemiplegia, medically stable, able to cooperate, previously independent in mobility + ADL</p> <p>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</p> <p>Mean age: RTT 71.5 years (SD 10.9), control 70.7 years (SD 7.6)</p> <p>1% fatal</p> <p>Stroke details: first or recurrent stroke, 47% right hemiparesis</p> <p>Time since stroke: RTT 26.5 days (SD 15.7), control 23.1 days (SD 17.5)</p> <p>Pre-intervention functional ability level: Rivermead Mobility Index on admission: RTT 24.7 (SD 8.1), control 24.4 (SD 8.9)</p>
Interventions	<p>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</p> <p>16 tasks in total, with 10 repetitions of each exercise</p> <p>Sessions were delivered by trained physiotherapy assistants and were 30 minutes, 3 times per week for 4 weeks = 6 hours</p> <p>Comparison group: usual care, no details given</p>
Outcomes	<p>Outcomes were recorded at baseline, 4 weeks (post treatment) and 8 weeks</p> <p>Balance/sit-to-stand outcome measures: sit to stand, stand to sit (time in seconds), lateral reach test (time to return to quiet sitting)</p>
Notes	<p>No significant differences reported at baseline</p> <p>6% lost to follow up at end of treatment phase</p> <p>No intervention-related reasons for withdrawal</p> <p>Attendance: participants completed 10.6 sessions on average</p>

Howe 2005 (Continued)

<i>Risk of bias</i>		
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 patient was due to be allocated to a group The code was not broken until all patients 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 drop outs balanced across groups with similar reasons for drop out
Selective reporting (reporting bias)	Unclear risk	No study protocol

Kim 2012

Methods	randomised controlled trial
Participants	<p>Korea</p> <p>20 participants: 10 RTT, 10 control</p> <p>Inpatient recruitment, date of recruitment not reported</p> <p>Inclusion criteria: ability to walk 10 meters 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</p> <p>Exclusion criteria: joint contraction, pain or fracture of the musculoskeletal system, hemianopsia</p> <p>Mean age: RTT 52.50 years (SD 11.72), control 53.40 years (SD 12.11)</p> <p>% male: not reported</p> <p>Stroke details: not reported</p> <p>Time since stroke: RTT 7.70 years (SD 6.11), control 13.10 years (SD 10.62)</p> <p>Pre-intervention functional activity level: Timed Up and Go Test: RTT 29.84 seconds (SD 13.32), control 39.10 seconds (SD 14.97)</p>
Interventions	<p>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</p> <p>The 10 tasks were 1) step-ups, 2) balance beam, 3) kicking a ball, 4) stand up and walk, 5) obstacle course, 6) treadmill, 7) walk and carry, 8) speed walk, 9) walk backwards, and 10) stairs. Before commencing training, the subjects warmed up for 5 minutes to</p>

Kim 2012 (Continued)

	<p>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</p> <p>Sessions were in addition to conservative physical therapy and were 1 hour, 3 times per week for 4 weeks = 12 hours</p> <p>Comparison group: Conservative physical therapy for 1 hour per day, 5 days per week for 4 weeks</p> <p>Conservative physical therapy consisted of joint mobilization, muscle strengthening, and balance training</p>
Outcomes	<p>Outcomes were recorded at baseline and 4 weeks (post treatment)</p> <p>Lower limb functional outcome measures: 10 Metre Walk Speed, Balance/Sit-to-stand outcome measures: Trunk Impairment Scale, Berg Balance Scale, Timed Up & Go Test</p>
Notes	<p>Equivalence not reported, but baseline values for Time Since Stroke and the Timed up and Go Test appear different across groups</p>

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 drop outs
Selective reporting (reporting bias)	Unclear risk	No study protocol

Kim 2014

Methods	<p>Randomised controlled trial</p>
Participants	<p>Republic of Korea</p> <p>26 participants: 13 RTT; 13 control</p> <p>Participants were recruited from inpatients in a rehabilitation hospital. Date of recruitment not reported</p> <p>Inclusion criteria: 1) hemiparesis from a single stroke occurring at least six months before, 2) 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), 3) gait speed < 0.8 m/s, 4) ability to walk 10 m independently without an assistive device, 5) absence of a musculoskeletal condition that could potentially affect the ability to walk</p>

	<p>safely, and 6) absence of hemispatial neglect</p> <p>Exclusion criteria: 1) participation in other studies or rehabilitation programs or 2) severe heart disease or uncontrolled hypertension and pain</p> <p>Mean age: 50.45 years</p> <p>50% male</p> <p>Stroke details: 59% right hemiparesis (no baseline data reported for 4 patients who dropped out)</p> <p>Time since stroke: 231.64 days</p> <p>Pre-intervention functional ability: 10 metre Walk Test (m/s) RTT mean 0.51 ± 0.16, control mean 0.48 ± 0.18</p>	
Interventions	<p>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 center</p> <p>Comparison group: All subjects participated in the same standard rehabilitation program consisting of conventional physical and occupational therapy. Conventional physical therapy, including increased trunk stability, lower-extremity muscle strength, and gait, was performed for 30 min per day, five times a week, for four weeks. Occupational therapy, consisting of an upper-extremity training program for activities of daily living, was performed for 30 min per day, five times a week, for four weeks</p>	
Outcomes	<p>Outcomes were recorded at baseline and 4 weeks (post treatment)</p> <p>Lower limb functional outcome measures: 10 Metre Walk Test, 6 Minute Walk Test and Community walk Assessment</p> <p>Quality of life: Stroke Impact Scale social participation domain</p>	
Notes	<p>No apparent baseline imbalance</p>	
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

Kim 2014 (Continued)

Selective reporting (reporting bias)	Unclear risk	No study protocol
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Kim 2016

Methods	Randomised controlled single blind study	
Participants	<p>Korea</p> <p>20 participants: 10 RTT; 10 control</p> <p>Inpatient recruitment between August 2012 and October 2013</p> <p>Inclusion criteria: a clinical diagnosis of a first stroke confirmed by neuroimaging (computed tomography or magnetic resonance imaging); 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</p> <p>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; significant orthopaedic condition or pain that limited participation in exercise; any visual impairment or vestibular system deficit that caused balance impairment</p> <p>Mean age: 65.6 \pm 9 years</p> <p>65% male</p> <p>Stroke details: minor stroke; ischaemic 80% (16), haemorrhage 20% (4)</p> <p>Time since stroke: RTT 30.1 days (SD 21.8), control 29.9 days (SD 20.3)</p> <p>Pre-intervention functional activity level: 6 Minute Walk Test RTT 167.5 metres (SD 127.0), control 157.5 metres (SD 64.0)</p>	
Interventions	<p>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 five 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</p> <p>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</p>	
Outcomes	<p>Outcomes were recorded at baseline and 4 weeks (post treatment)</p> <p>Lower limb functional outcome measures: Fugl-Meyer lower limb score, Berg Balance Scale, 6 Minute Walk Test</p> <p>Activities of daily living: Korean version of the Modified Barthel Index</p>	
Notes	No apparent baseline imbalance	
Risk of bias		
Bias	Authors' judgement	Support for judgement

Kim 2016 (Continued)

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	Multi-centre randomised controlled trial	
Participants	<p>The Netherlands</p> <p>101 participants: 31 leg training group, 33 arm training group, 37 control</p> <p>Participants recruited from 7 hospitals in the Netherlands between 1994 and 1997</p> <p>Inclusion criteria: primary first-ever stroke in the territory of the middle cerebral artery, confirmed by computed tomography or magnetic resonance imaging, aged 30 to 80 years, impaired motor function of the arm and leg, inability to walk at first assessment</p> <p>Exclusion criteria: complicating medical history or severe deficits in communication, memory or understanding</p> <p>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)</p> <p>43% male</p> <p>Stroke details: first ever stroke, 41% right hemiparesis</p> <p>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)</p> <p>Pre-intervention functional ability level: Barthel Index of 9 or lower</p>	
Interventions	<p>Leg training group: sitting, standing and weight-bearing exercise, with an emphasis on achieving stability and improving gait velocity</p> <p>Treadmill training was used if available</p> <p>If treatment at disability level was not possible, strengthening exercises were used</p> <p>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</p> <p>If treatment at disability level not possible, strengthening exercises were used</p> <p>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</p> <p>Sessions were delivered individually by a physiotherapist and were 30 minutes, 5 days per week for 20 weeks = 50 hours</p>	

Kwakkel 1999 (Continued)

	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 1-10, 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 measure: 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	
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 drop outs 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		
<i>Risk of bias</i>		
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

Kwakkel 1999b

Methods	See Kwakkel 1999	
Participants		
Interventions		
Outcomes		
Notes		
<i>Risk of bias</i>		
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

Kwakkel 1999b (Continued)

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 randomised controlled trial
Participants	<p>Norway</p> <p>61 participants: 33 RTT, 28 control</p> <p>Participants were recruited from a hospital in Norway between 1996 and 1997</p> <p>Inclusion criteria: first-ever stroke with hemiparesis verified clinically and by computed tomography</p> <p>Exclusion criteria: more than one 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 of the Motor Assessment Scale</p> <p>Mean age: 78 years (SD 9), range 49 to 75 years</p> <p>59% male</p> <p>Stroke aetiology: first stroke, 56% right hemiparesis</p> <p>Time since stroke: baseline measures taken within 3 days of admission</p> <p>Pre-intervention functional ability level: Barthel Index: RTT 56 (SD 28), control 46 (SD 36)</p>
Interventions	<p>RTT intervention: Motor Relearning Programme as per Carr and Shepherd (Carr 1987)</p> <p>Functional task training in ordinary settings, with ordinary tasks, using the principles of maximal repetition, task and setting variation</p> <p>RTT intervention was instead of usual care</p> <p>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</p> <p>After discharge, some participants received therapy in their own homes, at rehabilitation centres, or private outpatient departments, dependent on need</p> <p>Comparison group: Bobath Programme (Bobath 1990)</p>
Outcomes	<p>Outcomes were recorded at baseline, 2 weeks, 3 months, 1 year and 4 years post stroke</p> <p>Lower limb functional outcome measures: Motor Assessment Scale, Sødtring Motor Evaluation Scale - subscale for trunk/balance/gait</p> <p>Balance/sit-to-stand outcome measures: Berg Balance Scale (1 year only)</p> <p>Impairment outcome measures: Sødtring Motor Evaluation Scale - subscales for leg function, arm function</p> <p>ADL outcome measures: Barthel Index</p> <p>QoL/health status outcome measures: Nottingham Health Profile</p>

Langhammer 2000 (Continued)

Notes	Baseline differences: control group slightly more dependent at entry, but no significant difference in Motor Assessment Scale, 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 three months follow-up
Incomplete outcome data (attrition bias) All outcomes	Low risk	Number of drop outs balanced across groups and reasons provided
Selective reporting (reporting bias)	Unclear risk	No study protocol

Lennon 2009

Methods	Randomised controlled trial
Participants	<p>Ireland</p> <p>61 participants, 31 RTT, 30 control</p> <p>Participants were recruited from an inpatient stroke unit between October 2004 and June 2007</p> <p>Inclusion criteria: stroke admissions within 21 days post-stroke</p> <p>Exclusion criteria: none stated</p> <p>Mean age: RTT 71.55 (SD 13.31), control 72.13 (SD 9.93)</p> <p>58.4% male</p> <p>Stroke details: first or recurrent stroke, 55.7% right hemisphere</p> <p>Timing post-stroke: RTT 10.81 days (SD 5.22), control 10.73 (SD 5.09)</p> <p>Pre-intervention functional ability level: Barthel Index: RTT 10.10 (SD 3.75), control 9.93 (SD 3.66); Motor Assessment Scale: RTT 18.32 (SD 11.59), control 19.97 (SD 10.98)</p>
Intervention	<p>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 repetitive task training</p> <p>Comparison group: 40 minutes of conventional therapy based on Bobath principles administered by the stroke unit therapists</p>
Outcomes	<p>Outcomes were recorded at baseline, 4 weeks (post treatment) and at 3 and 6 months</p> <p>Lower limb functional outcome measures: Motor Assessment Scale, walking speed, Modified Rivermead Mobility Index, Step Test</p>

Lennon 2009 (Continued)

	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 patients with a previous stroke and more patients 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) All outcomes	High risk	Three physiotherapists assisted with both intervention and outcome assessment following resignation of one research associate
Incomplete outcome data (attrition bias) All outcomes	Low risk	No drop outs
Selective reporting (reporting bias)	High risk	Findings for the London Handicap Score (measured at 6 months) not reported

McClellan 2004

Methods	Randomised controlled trial
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	<p>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</p> <p>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</p> <p>Sessions were prescribed 60 minutes per day over 6 weeks = 42 hours</p> <p>Participants were required to keep a record of practice</p> <p>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 and telephone monitoring and clinic visits as the experimental group</p>	
Outcomes	<p>Outcomes were recorded at baseline, 6 weeks (post treatment) and 14 weeks</p> <p>Lower limb functional outcome measures: Motor Assessment Scale - walking</p> <p>Balance/sit-to-stand outcome measures: Functional Reach Test</p>	
Notes	<p>No baseline comparisons reported</p> <p>19% lost to follow-up at end of treatment phase</p> <p>No likely intervention-related reasons for withdrawal</p> <p>Participants reported 75% compliance with prescribed exercises</p>	
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 drop outs balanced across groups and reasons provided
Selective reporting (reporting bias)	Unclear risk	No study protocol

Methods	Single blind randomized controlled trial
Participants	<p>New Zealand</p> <p>58 participants: 31 RTT, 27 control</p> <p>Participants were recruited through the Stroke Foundation of New Zealand, stroke clubs and the local hospital stroke service between June 2007 and February 2008</p> <p>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</p> <p>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</p> <p>Mean age: RTT 69.8 (SD 13.12), control 69.61 (SD 12.81)</p> <p>55% male</p> <p>Stroke details: first or recurrent stroke, 59% right hemisphere</p> <p>Timing post stroke: RTT 49.2 months (SD 40.9), control 69.1 months (SD 54.7)</p> <p>Pre-intervention functional ability level: median score on the physical functioning index of the 36-item Short Form Health Survey: RTT 19, control 17</p>
Interventions	<p>RTT intervention</p> <p>The circuit exercise groups contained up to 9 participants and were led by 1 of the investigators, assisted by 2 physiotherapy students</p> <p>There were 12 stations in the circuit, which were graded to each participant's ability and progressed as tolerated</p> <p>Each station contained either a task-oriented gait or standing balance activity, or strength-training of a lower extremity muscle in a way designed to improve gait (e.g. sit to stand, self-stand, standing balance, step-ups, balance beam, standing hamstring curl, tandem walk, swiss ball squats, tandem stance, calf raise, backward walk, lunges, side leg lifts, marching in place, obstacle course)</p> <p>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</p> <p>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</p> <p>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</p>
Outcomes	<p>Outcomes were recorded at baseline, 4 weeks (post treatment) and 3 months</p> <p>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, Rivermead Mobility Index, Physical Activity and Disability Scale</p> <p>ADL outcome measures: Activities-Based Confidence Scale</p>
Notes	No apparent baseline imbalance
Risk of bias	

Mudge 2009 (Continued)

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 drop outs balanced across groups and reasons provided
Selective reporting (reporting bias)	Unclear risk	No study protocol

Olawale 2011

Methods	Prospective randomised controlled study
Participants	<p>Africa</p> <p>40 participants: 20 RTT, 20 control</p> <p>Participants were recruited from patients referred for outpatient management at the physiotherapy department of a tertiary hospital. Date of recruitment not reported</p> <p>Inclusion criteria: all participants were patients whose stroke occurred not less than three 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</p> <p>Exclusion criteria: None specifically reported but ability to walk <10 metres excluded</p> <p>Mean age: RTT 56.8 years (SD 8.3), control 57.2 years (SD 5.9)</p> <p>55% male</p> <p>Stroke details: 52.5% right hemisphere</p> <p>Timing post stroke: RTT 10.7 months (SD 6.8), control 10.3 (SD 5.9)</p> <p>Pre-intervention functional ability level: able to walk \geq 10 metres</p>
Interventions	<p>RTT intervention: On each day of treatment/training, subjects observed a pre-exercise rest period of 10 minutes during which heart rate and blood pressure measurements were made</p> <p>The RTT group went through a one-hour session of conventional physiotherapy including 25 minutes of over ground walking exercise training</p> <p>The over ground 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 15x10 metre walk course marked out on the flat floor of a remedial gymnasium</p> <p>In each case, exercise would be terminated any time the subject reported symptoms of exertional intolerance, i.e. outside the target zone on Borg's rate of perceived exertion (RPE) scale</p>

Olawale 2011 (Continued)

	Subjects participated in three 25 minute sessions per week for a 12 week period = 15 hours Comparison group: The conventional physiotherapy rehabilitation consisted of one 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: 1 Minute Walk Speed, 6 Minute Walk Test
Notes	Equivalence of groups at baseline was reported 5 subjects 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	Randomized, single-blind, controlled pilot study
Participants	Republic of Korea 25 participants, 13 RTT, 12 control Participants were recruited from patients receiving inpatient management service in a rehabilitation hospital. Date of recruitment not reported Inclusion criteria: the first stroke had occurred six 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	<p>RTT intervention: Subjects from the experimental group underwent 1-hour sessions of community-based ambulation training in addition to functional training</p> <p>The community-based ambulation training programme consisted of four-phase walking training performed in various community situations, which were differently applied according to a weekly schedule</p> <p>The difficulty level of the walking training was increased every week, with different environmental demands in each session</p> <p>During the four-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</p> <p>These sessions were conducted three times per week for a four week period = 12 hours</p> <p>Comparison group: Functional training based on the Bobath concept daily for an hour, according to the routine schedule of the rehabilitation unit</p> <p>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</p>	
Outcomes	<p>Outcomes were recorded at baseline and 4 weeks (post treatment)</p> <p>Lower limb functional outcome measures: 10 Metre Walk Speed, 6 Minute Walk Test, community walking and walking ability questionnaire</p> <p>Balance/stair-related outcome measures: Activities-Specific Balance Confidence Scale</p>	
Notes	No significant differences at baseline	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	The subjects were randomly allocated to the experimental group or control group. Each subject was given an envelope containing two cards and was instructed to blindly draw one 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 patient.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	One withdrawal in each group. Number of participants included in outcome analysis not given.
Selective reporting (reporting bias)	Unclear risk	No study protocol.

Methods	Randomised controlled trial
Participants	<p>Finland</p> <p>56 participants: 22 gait trainer group (not included in this review), 21 WALK group, 13 control group</p> <p>Participants were recruited from inpatients in an acute care hospital between June 2003 and December 2004 and between January 2005 and February 2007</p> <p>Inclusion criteria: (i) first supratentorial stroke or no significant disturbance from an earlier stroke (Modified Ranking Scale 0-2); (ii) Functional Ambulatory Category (FAC) 0-3; (iii) voluntary movement in the leg of the affected side; (iv) Barthel Index (BI) 25-75 points; (v) age 18-85 years; (vi) no unstable cardiovascular disease; (vii) body mass index (BMI) < 32; (viii) no severe malposition of joints; and (ix) no severe cognitive or communicative disorders</p> <p>Exclusion criteria: none reported</p> <p>Mean age (excluding dropouts): RTT 65.3 years (SD 9.9), control 69.5 years (SD 11.0)</p> <p>53% male</p> <p>Stroke details: ischaemic stroke 26 participants, haemorrhagic stroke 8 participants; left hemiparesis 20 participants, right hemiparesis 14 participants</p> <p>Timing post-stroke (excluding dropouts): RTT 7.8 days (SD 3.0), control 9.5 days (SD 1.9)</p> <p>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</p>
Interventions	<p>RTT intervention (WALK group): patients 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</p> <p>Each patient spent a maximum of 1 hour a day to obtain 20 minutes actual walking time. Each patient also received additional gait oriented physiotherapy for 55 minutes a day</p> <p>Comparison group: patients were transferred to a health centre after the first set of measurements and visited the hospital on testing days. While in the health centre, the patients 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</p>
Outcomes	<p>Outcomes were measured at baseline, 2 weeks (not reported), 3 weeks (post treatment) and 6 months</p> <p>Lower limb functional outcome measures: Functional Ambulation Category (primary outcome), 10 Metre Walk Test, 6 Minute Walk Test, Modified Motor Assessment Scale, Rivermead Motor Assessment Scale and Rivermead Mobility Index</p>
Notes	<p>Participants were recruited in two phases, June 2003 - December 2004 and January 2005 and 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</p> <p>No apparent baseline imbalance</p>
<i>Risk of bias</i>	

Peurala 2009 (Continued)

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	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	Randomised controlled trial
Participants	<p>Australia</p> <p>25 participants, 17 RTT, 18 control</p> <p>11 participants were recruited from a rehabilitation hospital (inpatients and outpatients). Date of recruitment not reported</p> <p>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)</p> <p>Exclusion criteria: coexisting 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</p> <p>Mean age: RTT 62.2 years (SD 18.2), control 60.8 years (SD 16.7)</p> <p>48.6% male</p> <p>Stroke details: 85.7% ischaemic, 48.72% right sided hemiplegia</p> <p>Timing post-stroke: RTT median 2.3 months (IQR 0.7 - 4.4), control median 0.7 months (IQR 0.3 - 3.0)</p> <p>Pre-intervention functional ability level: Scandinavian Stroke Scale: RTT 36.2 (SD 11.7), control 39.8 (SD 8.7)</p>
Interventions	<p>RTT intervention: All hand training was based on the principles of task-specific motor training and included repetitive practice of tasks which were individualized to the functional goals of each patient</p> <p>Training was closely supervised on a one-to-one basis by one of a small number of experienced therapists. The amount of actual practice performed in each session was</p>

	<p>carefully monitored, for this purpose a stopwatch was used to record the time spent performing hand activities</p> <p>The aim was to achieve at least 45 minutes of repetitious practice in each session</p> <p>Sessions were 1-hour with a therapist five times per week for six weeks = 30 hours</p> <p>Comparison group: Both groups continued to receive usual arm care which consisted of half an hour of motor training for the shoulder and elbow, three times per week</p> <p>A cup or splint was strapped to participants' hands to standardise inadvertent hand training</p> <p>Usual care for both groups also consisted of strategies such as slings, wheelchair arm troughs and positioning programmes</p> <p>In addition, participants in the control group had similar hand therapy as participants in the experimental group but for only 10 minutes, three times per week</p>	
Outcomes	<p>Outcomes were recorded at baseline and 6 weeks (post treatment)</p> <p>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 disability</p> <p>ADL outcome measures: Canadian Occupational Performance Measure</p>	
Notes	<p>No significant differences at baseline</p>	
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
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	Two drops in the control group unrelated to the intervention
Selective reporting (reporting bias)	Unclear risk	No study protocol

Salbach 2004

Methods	Stratified, multi-centre randomised controlled trial	
Participants	<p>Canada</p> <p>91 participants: 44 mobility group, 47 arm training group</p> <p>Participants were recruited from 9 hospitals and 2 rehabilitation centres in Montreal or Quebec City between May 2000 and February 2003</p> <p>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</p> <p>Exclusion criteria: resident in permanent care facility, co-morbidity precluding participation</p> <p>Mean age: mobility group 71 years (SD 12), arm training group 73 years (SD 8)</p> <p>61.5% male</p> <p>Stroke details: first or recurrent stroke, 83% ischaemic, 56% right hemiparesis</p> <p>Timing post stroke: mean 2.8 days (SD 78)</p> <p>Pre-intervention functional ability level: 6 Minute Walk Test: mobility group 209 metres (SD 126), arm training group 209 metres (SD 131)</p>	
Interventions	<p>Mobility group: walking-related tasks designed to strengthen the lower extremities and enhance walking balance, speed and distance in a progressive manner</p> <p>Arm training group: functional tasks such as manipulating cards, using a keyboard and writing while seated</p> <p>Intervention was after discharge from physical rehabilitation</p> <p>Sessions were 60 minutes, 3 times per week for 6 weeks = 18 hours</p> <p>Sessions were delivered individually by a physical or occupational therapist in a hospital outpatient or rehabilitation setting</p> <p>Comparison group: Salbach 2004a - upper extremity training; Salbach 2004b - lower extremity training</p>	
Outcomes	<p>Outcomes were recorded at baseline, and at 6 weeks (post treatment)</p> <p>Limb-specific functional outcome measures: 6 Minute Walk Test, 5 metre walk at comfortable and maximum speed</p> <p>Balance/sit-to-stand outcome measures: Timed Up and Go Test, Berg Balance Scale, Activities Specific Balance Confidence Scale</p> <p>ADL outcome measures: Barthel Index</p>	
Notes	<p>No comparison of groups at baseline</p> <p>Participants stratified into 3 groups based on comfortable walking speed</p> <p>86% of participants attended 17 or more mobility sessions out of 18, 72% attended 17 or more arm training sessions</p> <p>344 people were evaluated for participation but 73% refused because they could not tolerate the travel required for attendance</p>	
Risk of bias		
Bias	Authors' judgement	Support for judgement

Salbach 2004 (Continued)

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 drop outs balanced across groups and reasons provided
Selective reporting (reporting bias)	Unclear risk	No study protocol

Salbach 2004a

Methods	See Salbach 2004a	
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

Salbach 2004a (Continued)

Selective reporting (reporting bias)	Unclear risk	See Salbach 2004
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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	Randomised controlled trial
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Participants	<p>Korea</p> <p>20 participants: 10 RTT, 10 control (additional individual-based task-oriented circuit training arm not included in the review)</p> <p>Inpatient recruitment, date of recruitment not reported</p> <p>Inclusion criteria: patients with hemiplegia who were diagnosed with stroke</p> <p>Exclusion criteria: not reported</p> <p>Mean age: RTT 62.78 years (SD 9.97), control 59.24 years (SD 5.23)</p> <p>% male: not reported</p> <p>Stroke details: not reported</p> <p>Time since stroke: RTT 36.67 months (SD 15.12), control 27.66 (SD 19.35)</p> <p>Pre-intervention functional activity level: 2 Minute Walk Test RTT 76.6 (SD 33.1), control 57.6 (SD 20.5)</p>
Interventions	<p>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</p> <p>Intervention performed for 30 minutes a day, three times a week for four weeks</p> <p>Comparison group: conventional therapy for 30 minutes a day, five times per week for four weeks</p>
Outcomes	<p>Outcomes were recorded at baseline and 4 weeks (post treatment)</p> <p>Lower limb function outcome measure: 2 Minute Walk Test</p>
Notes	Inadequate specificity 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 randomised controlled trial
Participants	<p>Taiwan</p> <p>32 participants, 16 RTT, 16 control</p> <p>Participants were recruited from a rehabilitation medical centre. Date of recruitment not reported</p>

	<p>reported</p> <p>Inclusion criteria: first cerebrovascular accident 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</p> <p>Exclusion criteria: any medical condition that would prevent participation in the study, deep sensory deficits or hemi-neglect</p> <p>Mean age: RTT 51.0 years (SD 12.1), control 52.7 years (SD 14.1)</p> <p>62.5% male</p> <p>Stroke details: 68.8% right hemiparesis</p> <p>Timing post-stroke: RTT 26.9 months (SD 16.0), control 12.8 months (SD 12.3)</p> <p>Pre-intervention functional ability level: static balance weight distribution (%) affected side: RTT 44.8 (SD 9.7), control 47.5 (SD 8.3)</p>	
Interventions	<p>RTT intervention: Subjects received sit-to-stand training programme for 15 minutes each time in addition to a general physical therapy programme, three times per week for four weeks = 3 hours</p> <p>Comparison group: General physical therapy programme (30 minutes) including balance training, gait training, strengthening exercise for lower extremities, and activities of daily living training</p>	
Outcomes	<p>Outcomes were recorded at baseline and 4 weeks (post treatment)</p> <p>Balance/sit-to-stand outcome measures: The Balance Master System, the limit of stability testing, duration of sit-to-stand, Berg Balance Scale</p>	
Notes	<p>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))</p>	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Block randomization 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 subjects 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 subjects included in outcome analysis
Selective reporting (reporting bias)	Unclear risk	No study protocol

Turton 1990

Methods	Single centre, quasi-randomised trial	
Participants	<p>UK</p> <p>22 participants: 12 RTT, 10 control</p> <p>Participants were recruited from stroke patients discharged from inpatient care at one hospital between 1986 and 1987</p> <p>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</p> <p>Exclusion criteria: none stated</p> <p>Age: RTT 59 years (SD 11.97), control 56 years (SD 6.86)</p> <p>55% male</p> <p>Stroke details: unclear whether first or recurrent stroke, 56% right hemiparesis</p> <p>Time since stroke: RTT 24 weeks (SD 25.6), control 16 weeks (SD 6.1)</p> <p>Pre-intervention disability level: 12.5/20 on Southern Motor Assessment Scale</p>	
Interventions	<p>RTT intervention: Usual outpatient care plus home-based exercise programme for the upper limb, based on motor re-learning principles. Exercises included movement and task-related reach, grasp and grip</p> <p>Participants were assessed by an occupational therapist at home, and given exercises and repetitions</p> <p>Participants were visited every 2 to 4 weeks for review</p> <p>Carers were involved if able and willing</p> <p>Participants were assigned 2 to 3 practice sessions per day (approx. 1 hour in total), 7 days per week for 8 to 11 weeks = 63 hours approx</p> <p>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</p> <p>For comparison group: usual outpatient care (some had therapy, but others did not)</p>	
Outcomes	<p>Outcomes were recorded at baseline and at 8 - 11 weeks (post treatment)</p> <p>Upper limb functional outcome measures: sitting part of the upper limb activity assessment - Southern Motor Group Assessment, 10 Hole Peg Test</p>	
Notes	<p>Baseline differences: difference in time since stroke: experimental group mean of 24 weeks, and usual care mean of 16 weeks</p> <p>10 Hole Peg Test performance: experimental group more disabled, home therapy group had more carers living at home</p> <p>Self-reported rates of compliance: mean 68% (SD 25)</p>	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Assigned to home therapy group or a control group in alternate runs of five
Allocation concealment (selection bias)	High risk	As above

Turton 1990 (Continued)

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	Multi-centre randomised controlled trial
Participants	<p>Netherlands</p> <p>250 participants: 126 RTT, 124 control</p> <p>Participants were recruited from nine rehabilitation centres between June 2008 and December 2010</p> <p>Inclusion criteria: eligible patients had to have had a verified stroke according to the WHO definition, be able to walk a minimum of 10m without physical assistance (functional ambulation categories ≥ 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</p> <p>Exclusion criteria: cognitive deficits as evaluated by the mini-mental state examination (< 24 points), were unable to communicate (< 4 points on the Utrechts Communicatieonderzoek, UCO) or lived more than 30 km from the rehabilitation centre</p> <p>Mean age: RTT 56 years (SD 10), control 58 years (SD 10)</p> <p>64.8% male</p> <p>Stroke details: 81.2% (n=103) ischaemic, 47.2% (n=118) right hemisphere</p> <p>Time since stroke: RTT 91 days (SD 42), control 103 days (SD 51)</p> <p>Pre-intervention functional ability level: Six Minute Walk Test: RTT 339 metres (SD 120), control 306 metres (SD 135)</p>
Interventions	<p>RTT intervention: The training included eight different workstations, intended to improve meaningful tasks relating to walking competency such as balance control, stair walking, turning, transfers and speed walking</p> <p>At each workstation, participants worked together in pairs, while one participant performed the task for three minutes, the other observed their performance</p> <p>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</p> <p>Motivational music was played in the background during the entire training session</p> <p>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)</p> <p>Sessions lasted 90 minutes, twice per week for 12 weeks = 36 hours</p> <p>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</p>

	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, Rivermead Mobility Index, Stroke Impact Scale 3.0 mobility domain Balance/sit-to-stand outcome measures: Timed Up and Go Test, Timed balance test Impairment outcome measures: Modified 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 Twenty nine falls were 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

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 randomised controlled trial
Participants	United Kingdom 120 participants: 60 RTT, 60 control Participants were recruited from admissions to a stroke rehabilitation ward over a period

	<p>of 21 months. Date of recruitment not reported</p> <p>Inclusion criteria: diagnosis of stroke, referral to physiotherapy</p> <p>Exclusion criteria: more than 2 weeks post stroke, unconscious on admission, unable to toilet independently prior to stroke, living more than 20 km from hospital, unable to tolerate more than 30 minutes of physical tasks required in initial assessment</p> <p>Mean age: RTT 75 years (SD 9.1), control 73.5 (SD 10.5)</p> <p>50% male</p> <p>Stroke details: unclear whether first or recurrent stroke included, 51% right hemiparesis</p> <p>Time since stroke: within 14 days</p> <p>Pre-intervention functional ability level: Rivermead Motor Assessment - gross function subscale: RTT median 2 (IRQ 1 to 6), control median 1 (IRQ 1 to 4)</p>	
Interventions	<p>RTT intervention: Movement science-based therapy based on the principle that skill in performance is a direct function of the amount of practice</p> <p>Programme involved use of everyday objects for functional training, and practice outside of delivered sessions</p> <p>Intervention was instead of usual care</p> <p>Participants received a median 25 minutes treatment by a physiotherapist per week day (IQR 13 to 32 minutes)</p> <p>Median total number of minutes of treatment was 365 (IQR 140 to 1160), equating to approximately 6 hours total training time</p> <p>Treatment was delivered by physiotherapists, occupational therapists and physiotherapy assistants in hospital, and as an outpatient after discharge</p> <p>Treatment was delivered for as long as needed</p> <p>Comparison group: Bobath-based therapy</p>	
Outcomes	<p>Outcomes were recorded at baseline, 4 weeks, 3 months and 6 months</p> <p>Lower limb functional outcome measures: Rivermead Motor Assessment, Motor Assessment scale, Six Metre Walk Test</p> <p>Upper limb functional outcome measures: 10 Hole Peg Test</p> <p>ADL outcome measures: Barthel Index, Extended ADL</p>	
Notes	<p>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</p> <p>29% loss to follow up at 3 months</p>	
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

Van Vliet 2005 (Continued)

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

Winstein 2004

Methods	Stratified, single centre pilot randomised controlled trial
Participants	<p>Used 3 participants: RTT 22, control 21</p> <p>Participants were recruited from new admissions to a neurorehabilitation services centre.</p> <p>Date of recruitment not reported</p> <p>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</p> <p>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</p> <p>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)</p> <p>52.5% male</p> <p>Stroke details: first stroke, 85% ischaemic stroke, 62% right hemiparesis</p> <p>Time since stroke: RTT 15.5 days (SD 6), control 15.4 days (SD 5.5)</p> <p>Pre-intervention disability level: 65% Orpington Score 1.6 to 4.1</p>
Interventions	<p>RTT intervention: Usual care plus task-specific functional training based on the principles of motor relearning, focussing on systematic and repetitive practice of tasks</p> <p>Tasks were randomly ordered, and progressed in difficulty</p> <p>Sessions were 1 hour per day, 5 days per week, for 4 weeks = 20 hours additional to usual</p>

Winstein 2004 (Continued)

	<p>care</p> <p>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</p>
Outcomes	<p>Outcomes were recorded at baseline, 4 to 6 weeks (post-treatment) and 9 months after stroke</p> <p>Upper limb functional outcome measures: Functional Test of the Hemiparetic Upper Extremity, Fugl Meyer Assessment</p> <p>ADL outcome measures: Functional Independence Measure</p>
Notes	<p>No significant differences reported at baseline</p> <p>7% loss to follow up at end of treatment phase</p> <p>Intervention-related reasons for withdrawal: 1 participant in the experimental group lost interest</p> <p>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</p>

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	<p>USA</p> <p>361 participants: 119 structured, task-oriented upper extremity training (Accelerated Skill Acquisition Programme), 120 dose-equivalent occupational therapy (DEUCC),</p>

122 monitoring-only occupational therapy (UCC)

Participants were recruited from seven sites, predominantly during inpatient rehabilitation, between June 2009 and March 2014

Inclusion criteria: ischemic or hemorrhagic 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 enrollment window, age 21+, able to communicate in English, willing to attend outpatient therapy and all study evaluations

Exclusion criteria:

Neurologic symptoms or conditions

1. Traumatic or non-vascular brain injury, subarachnoid hemorrhage, AV malformation, acute subdural or epidural hematoma
2. Neurologic condition that may affect motor response (e.g. Parkinson's, ALS, MS)
3. Presence of ataxia per NIHSS and evidence of cerebellar or brainstem lesion
4. Absent upper extremity sensation per NIHSS
5. Neglect asymmetry > 3 per Mesulam Unstructured
6. A second stroke within the last 72 hours cannot be ruled out before the brief medical exam (BME)

Physical attributes affecting movement or function

1. Total UE Fugl-Meyer score <19 or >58, or = 0 for finger mass extension/grasp release hand score
2. UE pain that substantially interferes with ADLs
3. Maximum assistance required for mobility
4. Passive ROM limitation of the hemiparetic upper extremity that prevents functional use of limb/hand, including any of the following:
 1. Shoulder: flexion <90°, abduction <90°, external rotation <45°
 2. Elbow/Forearm: extension <-20°, supination or pronation < 45° from neutral
 3. Wrist/Finger: flexion or extension <0°, MCP or IP extension <30°

Pre-morbid status

1. Head trauma requiring > 48 hours of hospitalization within past 12 mos.
2. Psychiatric illness requiring hospitalization within past 24 mos.
3. Arm or hand injury limiting use prior to stroke
4. Amputation of all fingers or thumb of affected hand
5. Pre-morbid motor impairment of the contralateral upper extremity of neurologic origin
6. Barthel Index < 95

Medication, Drug and/or Alcohol

1. Active or recent drug treatment for dementia
2. Treated with Botox in affected arm within last 3 months
3. Toxicology screen positive for illegal substances or reported use within the past 3 years
4. Reported alcohol use per CAGE or treatment for withdrawal since index stroke

Cognition and Participation

1. Enrollment in a conflicting study
2. Expected inability to participate in study due to illness, social, or geographic reasons
3. Unable to follow a 2-step command per NIHSS
4. < 2 on the Mini-Cog with an abnormal Clock Draw Test (CDT) or score = 0
5. PHQ-9 total score between 10 and 19 without management plan or score >19
6. Judged medically unstable and/or unable to participate by primary physician or SPI

Other

	<p>1. Received > 6 hours of Outpatient Occupational Therapy (OT) since stroke (Home Health and OT Evaluation do not count toward 6 hour maximum)</p> <p>2. Clinician's best judgment (multiple factors in combination): The SPI and CSC concur that the PP is NOT a candidate for randomization</p> <p>14-106 days post-stroke</p> <p>Mean age: ASAP 60.9 years (SD 13.7), DEUCC 61.9 years (SD 10.5), UCC 61.1 years (SD 13.1)</p> <p>56.2% male</p> <p>Stroke details: ischaemic stroke 59.3%, right hemiparesis 46.5%</p> <p>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)</p> <p>Pre-intervention functional ability (total 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))</p>	
Interventions	<p>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</p> <p>Sessions were 1 hour, 3 times per week for 10 weeks = 30 hours</p> <p>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</p>	
Outcomes	<p>Outcome measured at baseline, post-intervention (10 weeks) and at 6 and 12 months</p> <p>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</p>	
Notes	<p>No apparent baseline imbalance</p>	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	A stratified block randomization 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

Winstein 2016 (Continued)

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 randomised controlled trial
Participants	<p>Taiwan</p> <p>30 participants: 13 RTT, 17 control</p> <p>Participants were recruited from a neurology department. Date of recruitment not reported</p> <p>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</p> <p>Exclusion criteria: other conditions that would confound the study such as Parkinson's disease, shoulder subluxation, recurrent stroke during the training period</p> <p>Mean age: RTT 67.55 years (SD 11.2), control 69.53 years (SD 9.23)</p> <p>46% male</p> <p>Stroke details: 10% left stroke, 60% right hemiparesis</p> <p>Time since stroke: RTT 8.4 months (SD 8), control 6.2 months (SD 7.9)</p> <p>Pre-intervention functional ability level: baseline mean 3.28 seconds per item on the Wolf Motor Function Test</p>
Interventions	<p>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</p> <p>Intervention was instead of usual care</p> <p>Sessions were 6 hours per day; it is unclear whether there were 5 or 7 sessions per week</p> <p>Treatment duration was 2 weeks = 60 to 84 hours</p> <p>Sessions were delivered by a physical therapist; it is unclear whether sessions were group based or individual</p> <p>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</p>
Outcomes	<p>Outcomes were recorded at baseline and 2 weeks (post treatment)</p> <p>Upper limb functional outcome measures: Mean time taken to complete individual items on the Wolf Motor Function Test</p> <p>Results for items 8 to 15 are only presented for participants able to complete them within 2 minutes</p>
Notes	<p>Exclusion criteria potentially applied during training</p> <p>No baseline differences reported</p>

<i>Risk of bias</i>		
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 table

ADL: Activities of Daily Living
 IQR: interquartile range
 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 200	Alternative mechanism of action
Banta 2013	Alternative mechanism of action
Bever 2006	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

(Continued)

Hubbard 2010	Compared against another RTT-type intervention
Li 2008	Alternative mechanism of action
Logan 2014	Not repetitive task training
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 repetitive task training
Saeys 2012	Alternative mechanism of action
Sherrington 2005	Not specific to stroke patients
Shimodozono 2013	Alternative mechanism of action
Tang 2009	Alternative mechanism of action
Taub 2013	Compared against another RTT-type intervention
Verheyden 2009	Not repetitive task training
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 patients 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

Dean 2015

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

Eng 2009

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

Ferrari 2015

Methods	RCT
Participants	Patients 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 (common) post-stroke)
Interventions	Repetition of task-specific activities (ATTEND Trial)
Outcomes	Patient-centered goals, QOL
Notes	

Indurkar 2013

Methods	RCT
Participants	Within one year of a first or recurrent stroke and with residual walking deficit
Interventions	Task orientated intervention comprising of five tasks
Outcomes	Balance, Speed and Distance
Notes	

Knox 2014

Methods	Not known
Participants	Stroke patients discharged from hospital
Interventions	Out-patient 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	

Pandian 2014

Methods	RCT
Participants	Stroke patients with early supported discharge
Interventions	Family-led caregiver-delivered, home-based stroke rehabilitation (ATTEND Trial)
Outcomes	QOL, Anxiety and Depression, health Costs
Notes	

Tong 2015

Methods	RCT
Participants	Acute Ischemic Stroke
Interventions	Early and intensive rehabilitation
Outcomes	Motor Function
Notes	

Xu 2012

Methods	RCT
Participants	Stroke
Interventions	Walking training
Outcomes	Lower limb function, ADL
Notes	

Zhu 2013

Methods	RCT
Participants	Stroke patients with upper limb dysfunction
Interventions	rehabilitation training for optimizing motor skills
Outcomes	Hand function
Notes	

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

Alouche 2016

Trial name or title	Effects of Training, Rhythmic and Discrete Aiming Movements on Arm Control and Functionality after Stroke
Methods	Three Arm RCT
Participants	Stroke experienced more than 6 months on enrollment
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

Bosomworth 2013

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

Dromerick 2014

Trial name or title	Critical periods after Stroke Study (CPASS)
Methods	4 Arm RCT (Phase 2)
Participants	Stroke patients 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.Giammetti@medstar.net
Notes	Trial estimated completion date August 2018

Hariohm 2013

Trial name or title	Randomized Controlled Trial 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

Hariohm 2013 (Continued)

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	Three 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	A randomised controlled trial 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
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

Kumaran 2010 (Continued)

Notes	Trial due to complete 2015
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Oza 2015

Trial name or title	Short term effect of circuit class training for improvement of upper limb in stroke patients: A randomized 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	

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 Ass. Score, Motor Activity Log, Grasp strength, hand dexterity, patient satisfaction
Starting date	2002
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

Stuart 2009 (Continued)

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 (3-72 months post-stroke)
Interventions	Virtual reality system
Outcomes	Ambulation, gait, functional reach
Starting date	2008
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 randomized controlled trial
Methods	Randomized 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
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ADL: activities of daily living

For Preview Only

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	700	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	229	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

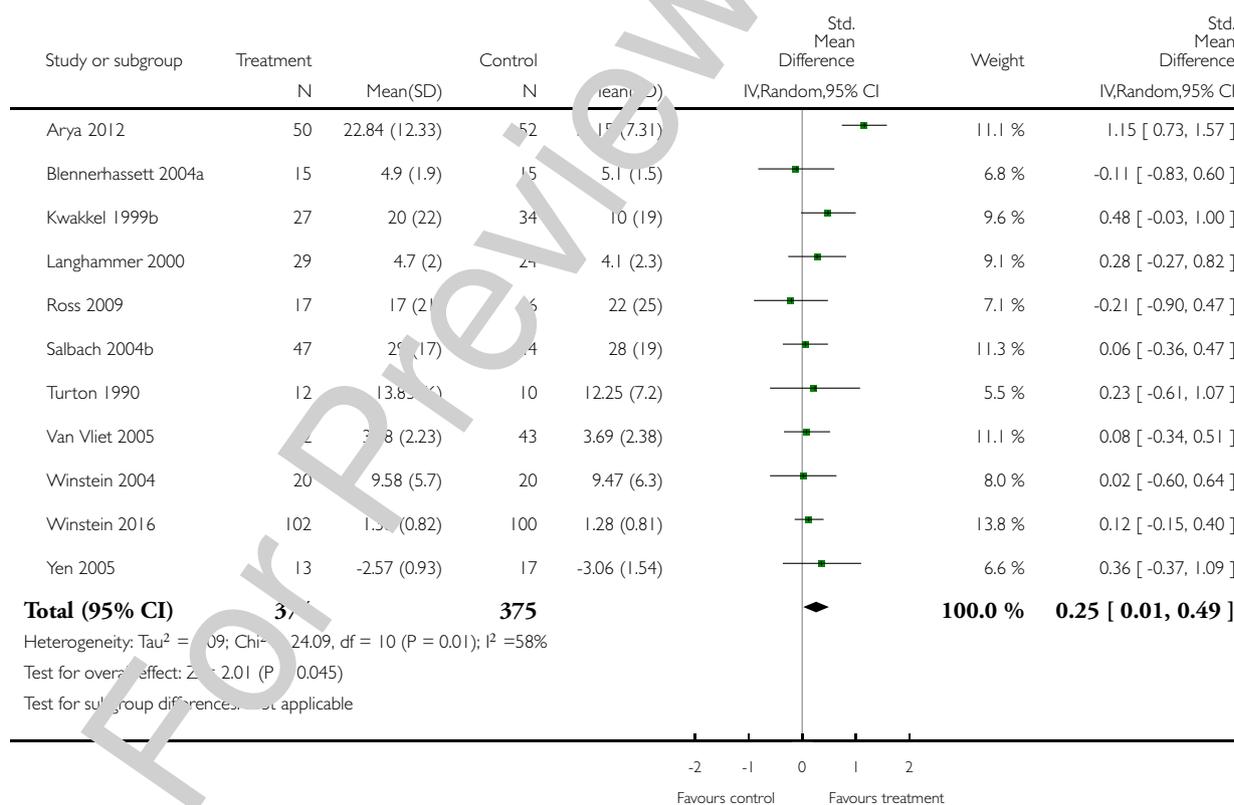
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Activities of daily living function	9	527	Std. Mean Difference (IV, Fixed, 95% CI)	0.28 [0.10, 0.45]
2 Global motor function scales	5	222	Std. Mean Difference (IV, Fixed, 95% CI)	0.38 [0.11, 0.65]
3 Quality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

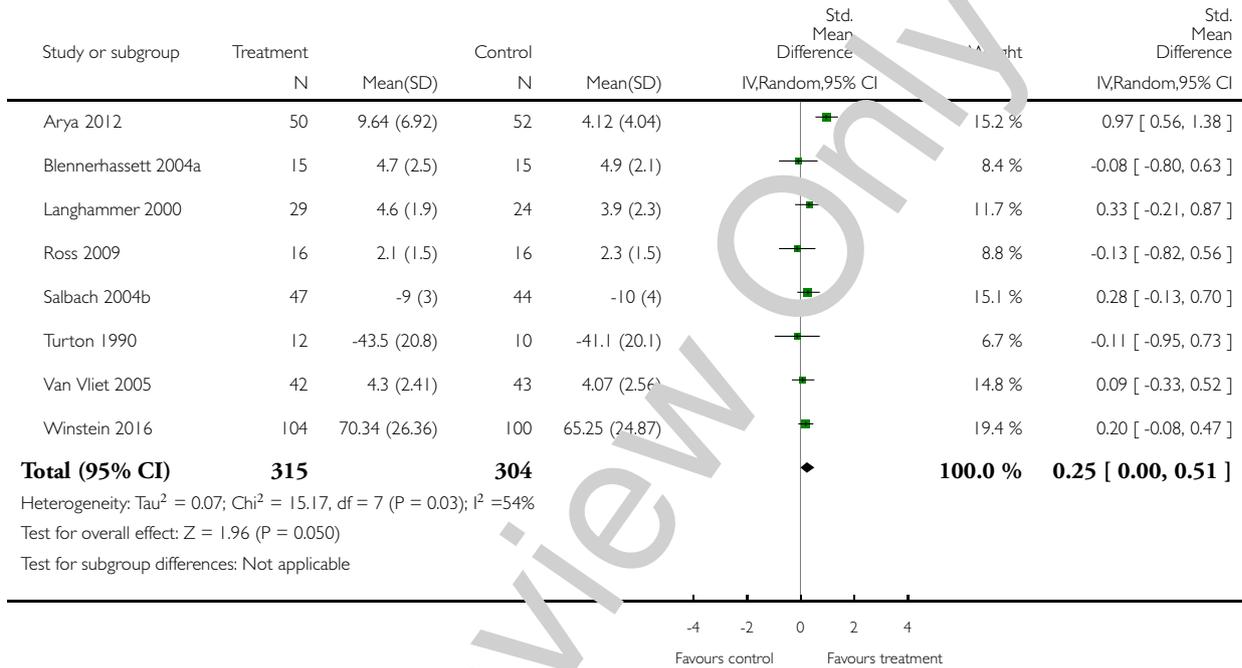


Analysis 1.2. Comparison 1 Upper limb function: post treatment, Outcome 2 Hand function.

Review: Repetitive task training for improving functional ability after stroke

Comparison: 1 Upper limb function: post treatment

Outcome: 2 Hand function

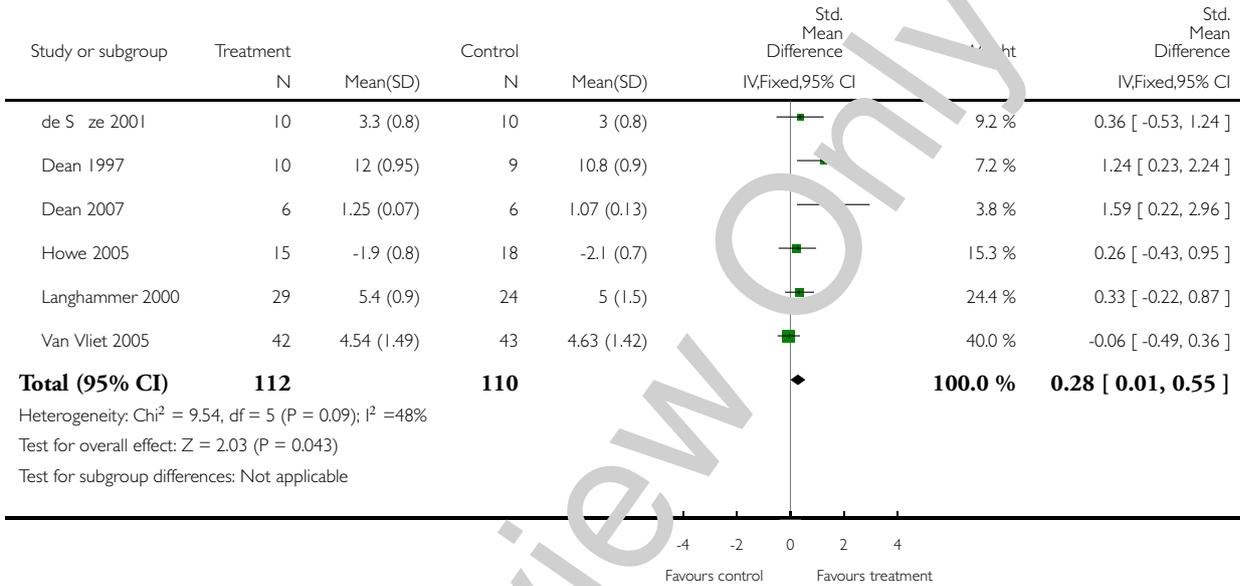


Analysis 1.3. Comparison 1 Upper limb function: post treatment, Outcome 3 Sitting balance/reach.

Review: Repetitive task training for improving functional ability after stroke

Comparison: 1 Upper limb function: post treatment

Outcome: 3 Sitting balance/reach

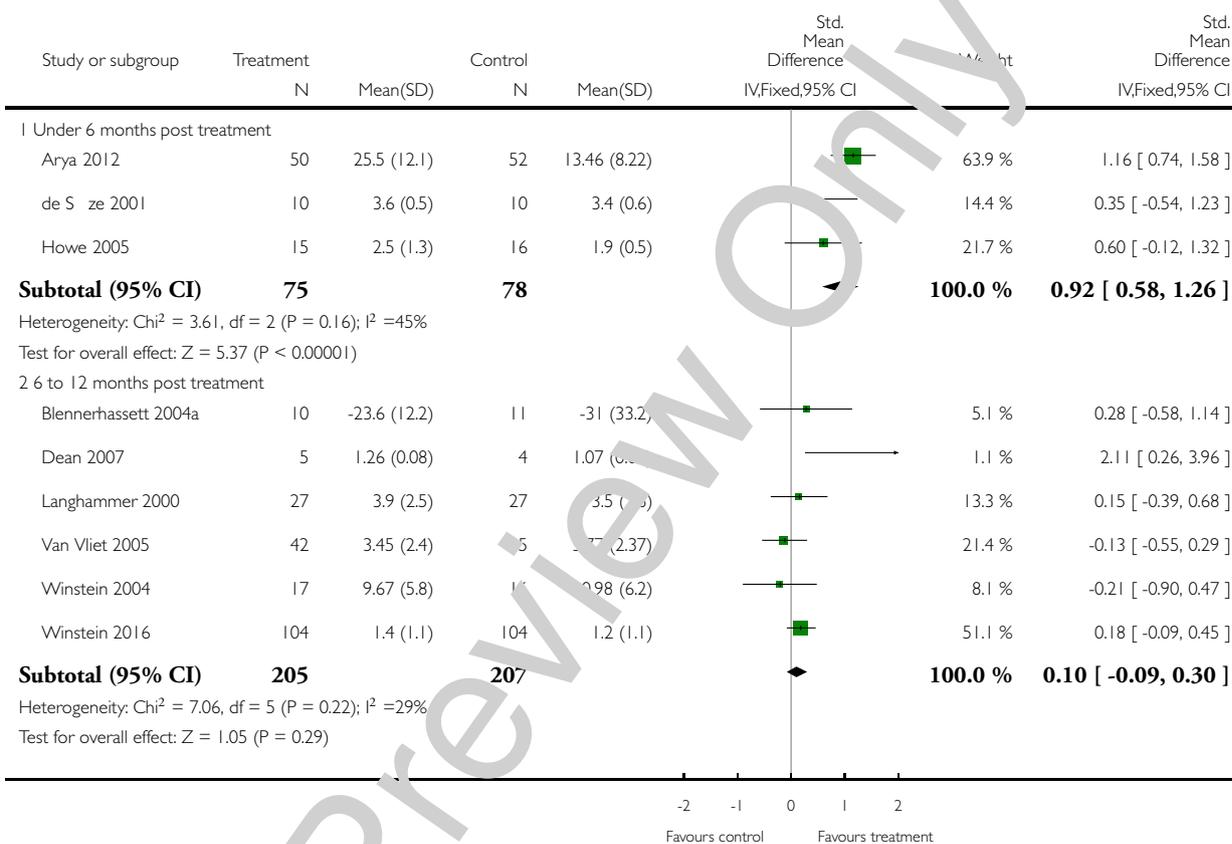


Analysis 2.1. Comparison 2 Upper limb function: follow up, Outcome 1 All outcomes.

Review: Repetitive task training for improving functional ability after stroke

Comparison: 2 Upper limb function: follow up

Outcome: 1 All outcomes

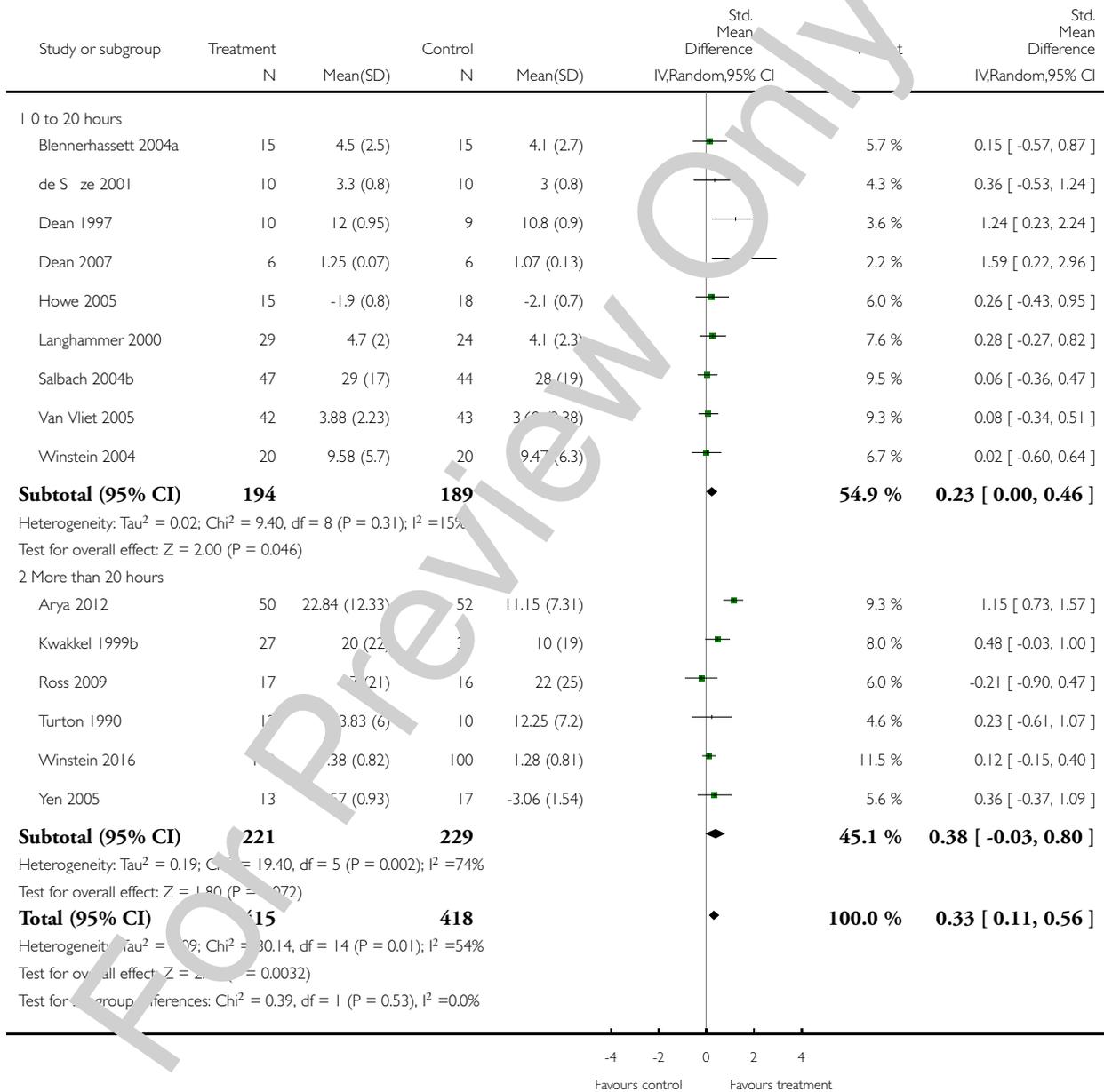


Analysis 3.1. Comparison 3 Upper limb function: subgroup analyses, Outcome 1 Dosage of task practice.

Review: Repetitive task training for improving functional ability after stroke

Comparison: 3 Upper limb function: subgroup analyses

Outcome: 1 Dosage of task practice

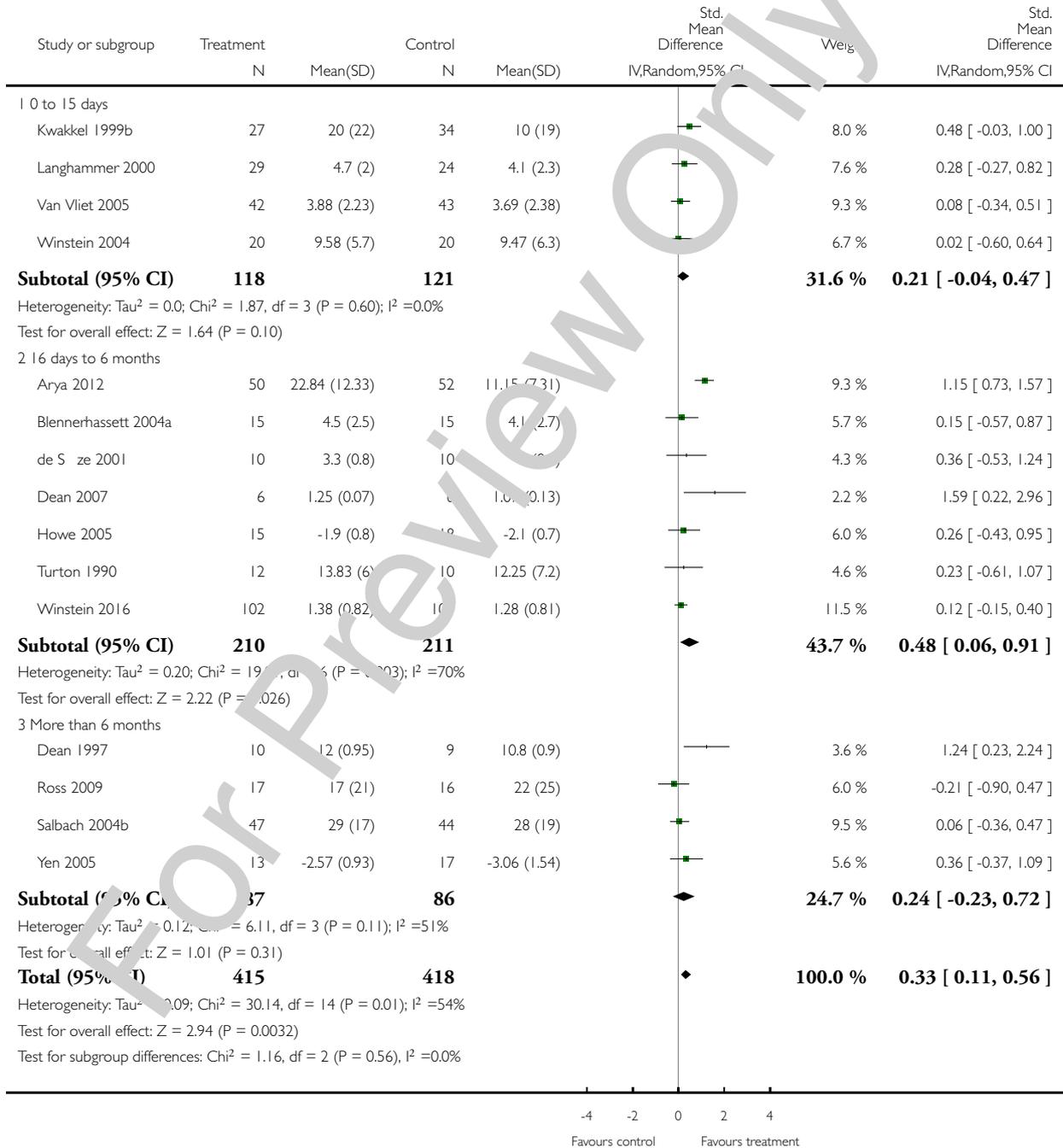


Analysis 3.2. Comparison 3 Upper limb function: subgroup analyses, Outcome 2 Time since stroke.

Review: Repetitive task training for improving functional ability after stroke

Comparison: 3 Upper limb function: subgroup analyses

Outcome: 2 Time since stroke

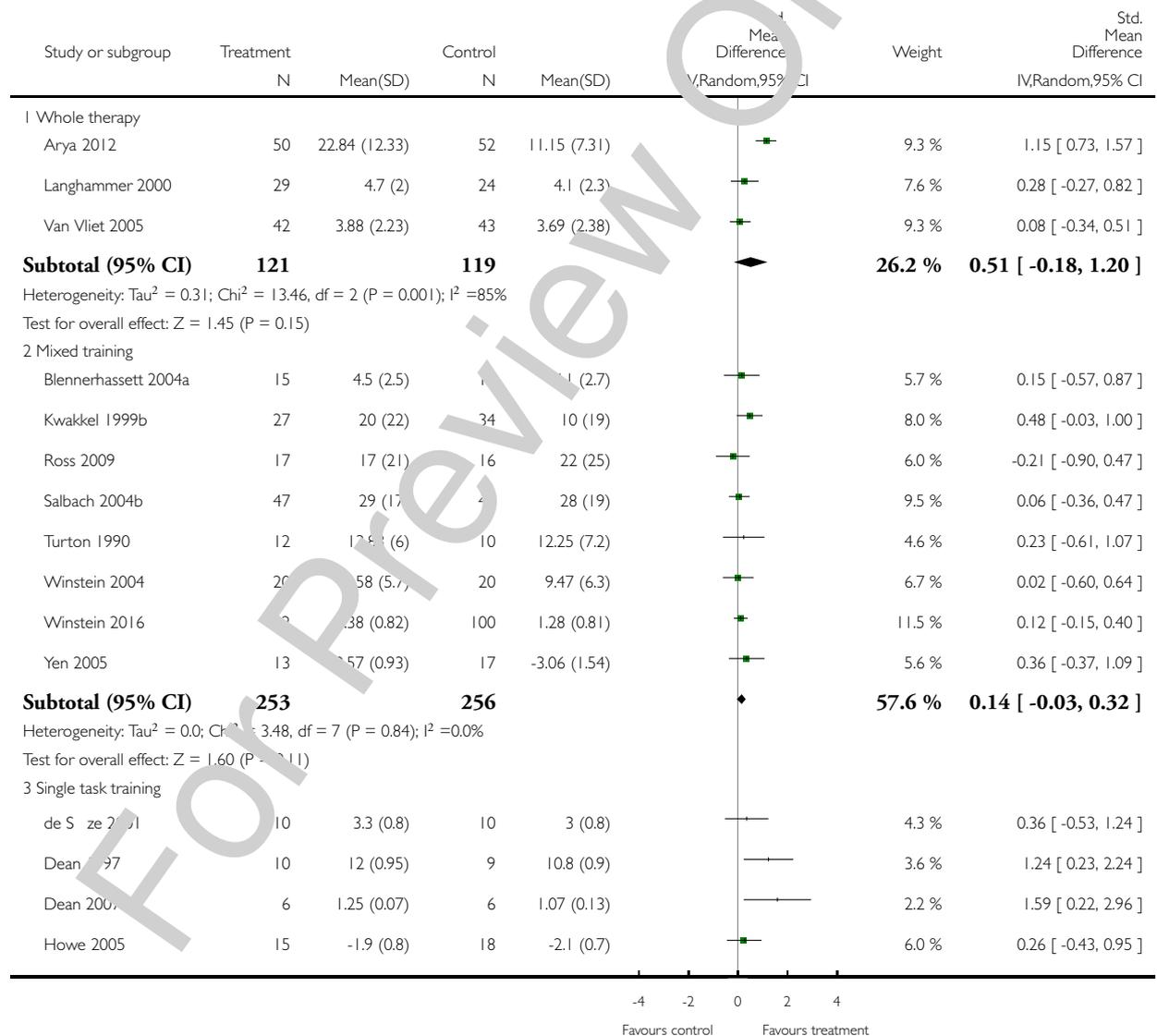


Analysis 3.3. Comparison 3 Upper limb function: subgroup analyses, Outcome 3 Type of intervention.

Review: Repetitive task training for improving functional ability after stroke

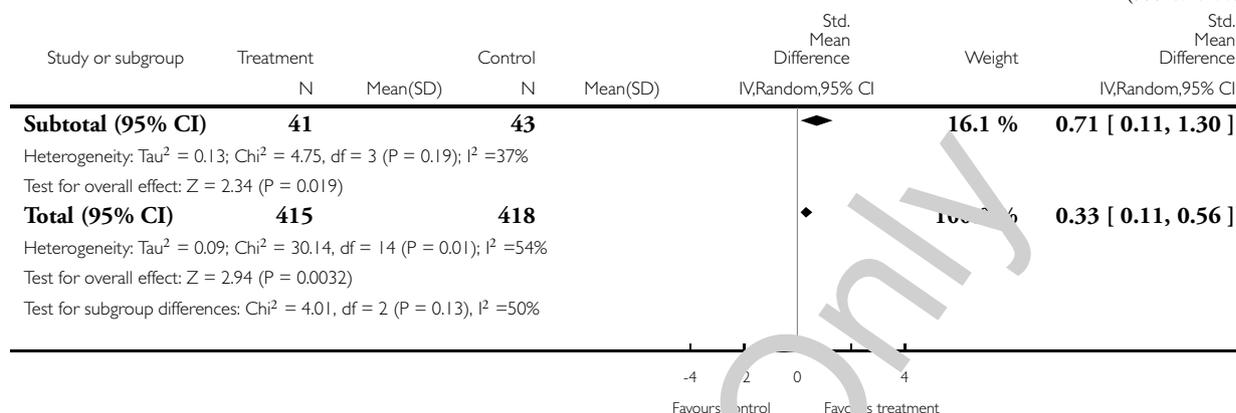
Comparison: 3 Upper limb function: subgroup analyses

Outcome: 3 Type of intervention



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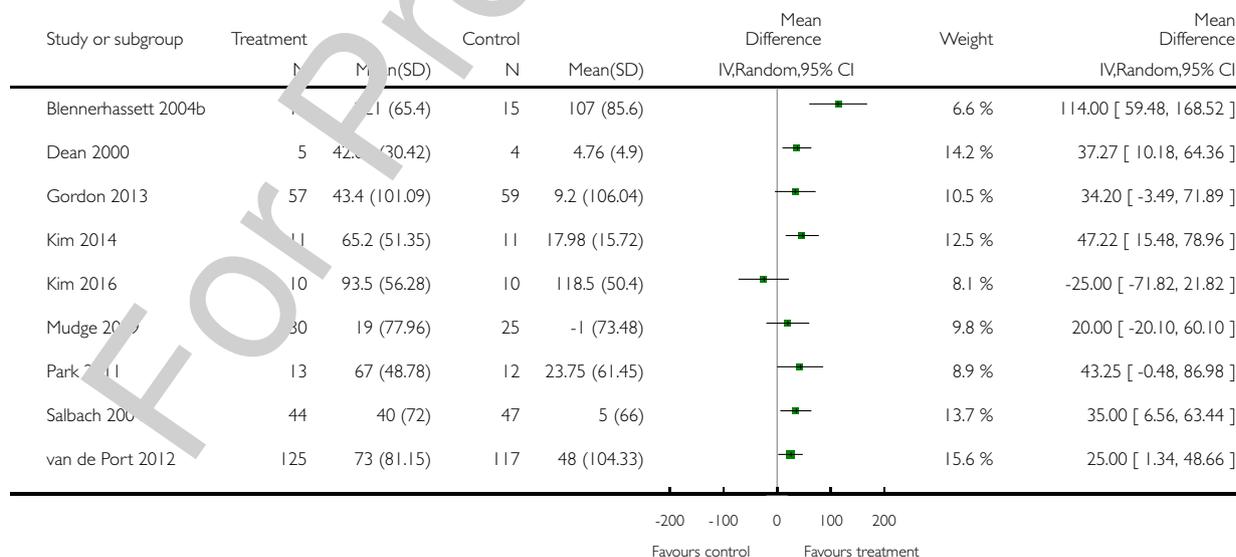


Analysis 4.1. Comparison 4 Lower limb function: post treatment, Outcome 1 Walking distance: change from baseline.

Review: Repetitive task training for improving functional ability after stroke

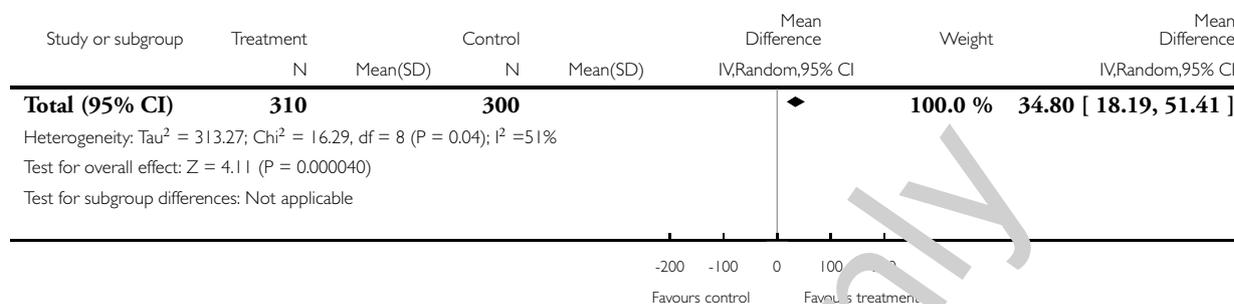
Comparison: 4 Lower limb function: post treatment

Outcome: 1 Walking distance: change from baseline



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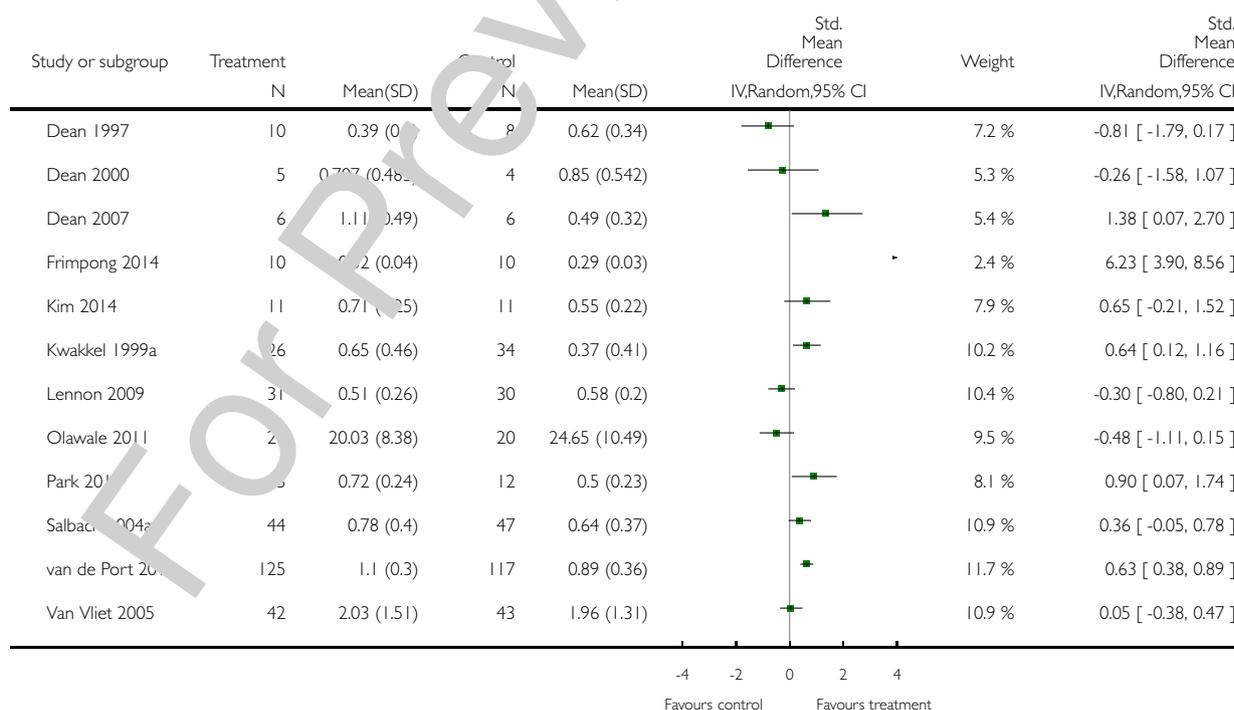


Analysis 4.2. Comparison 4 Lower limb function: post treatment, Outcome 2 Walking speed.

Review: Repetitive task training for improving functional ability after stroke

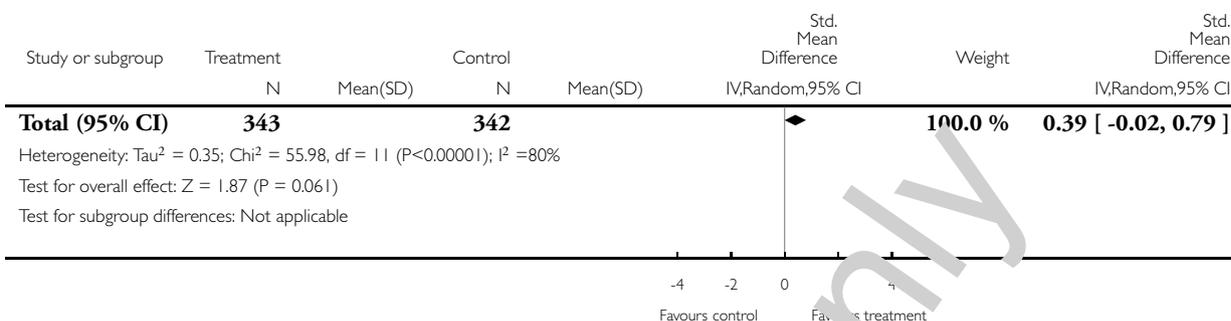
Comparison: 4 Lower limb function: post treatment

Outcome: 2 Walking speed



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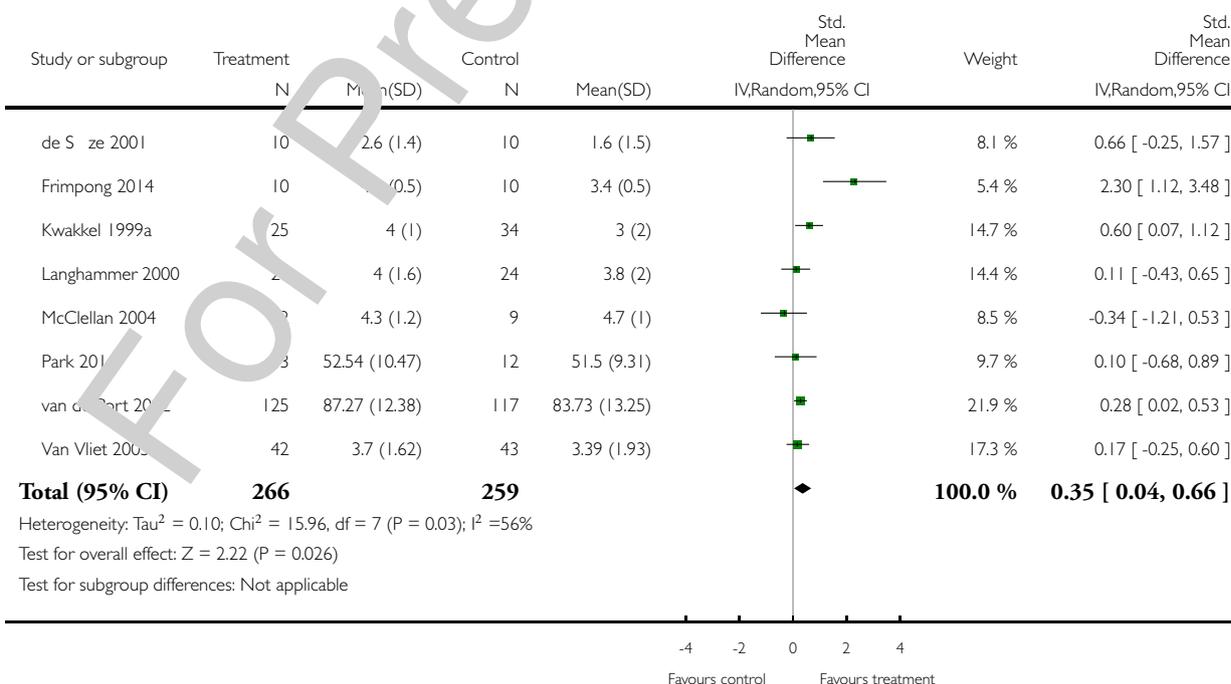


Analysis 4.3. Comparison 4 Lower limb function: post treatment, Outcome 3 Functional ambulation.

Review: Repetitive task training for improving functional ability after stroke

Comparison: 4 Lower limb function: post treatment

Outcome: 3 Functional ambulation

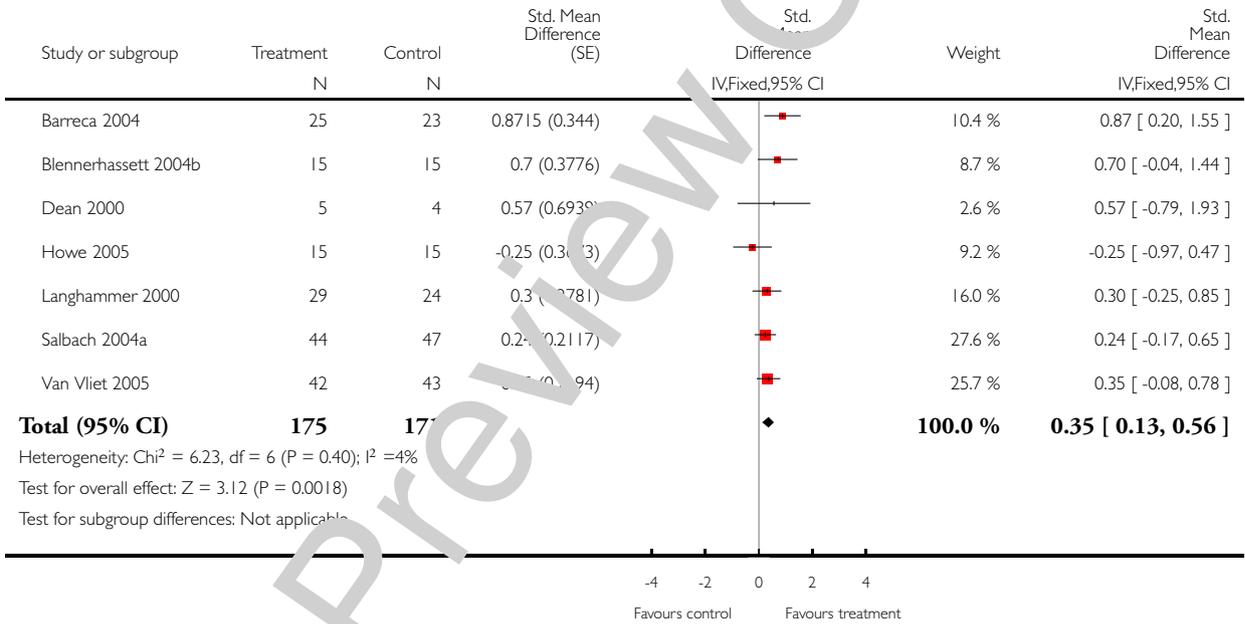


Analysis 4.4. Comparison 4 Lower limb function: post treatment, Outcome 4 Sit to stand: post treatment/change from baseline.

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

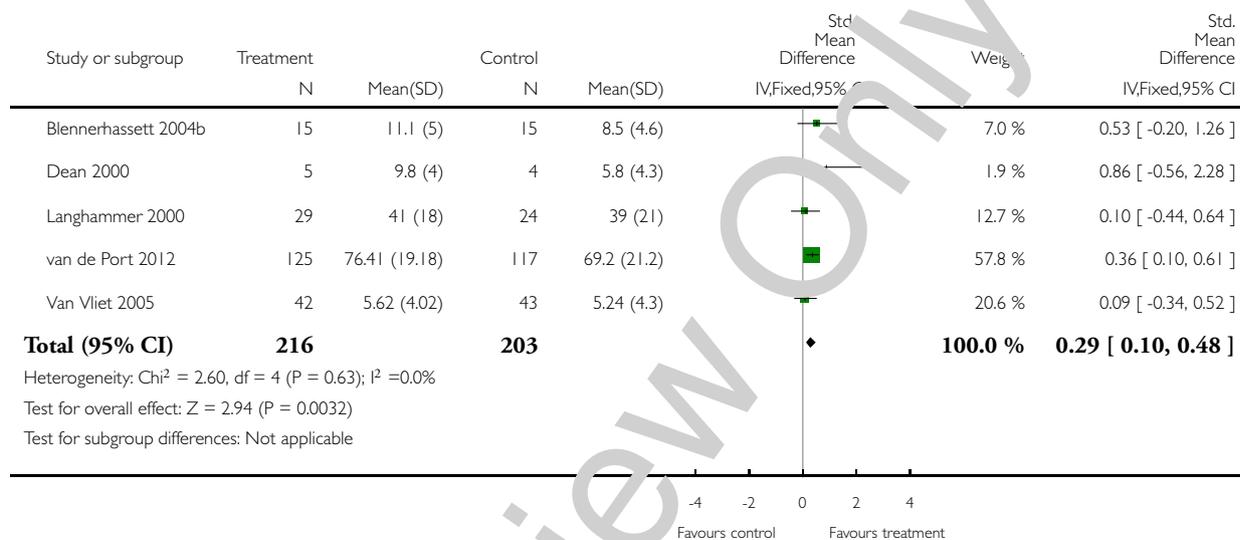


Analysis 4.5. Comparison 4 Lower limb function: post treatment, Outcome 5 Lower limb functional measures.

Review: Repetitive task training for improving functional ability after stroke

Comparison: 4 Lower limb function: post treatment

Outcome: 5 Lower limb functional measures

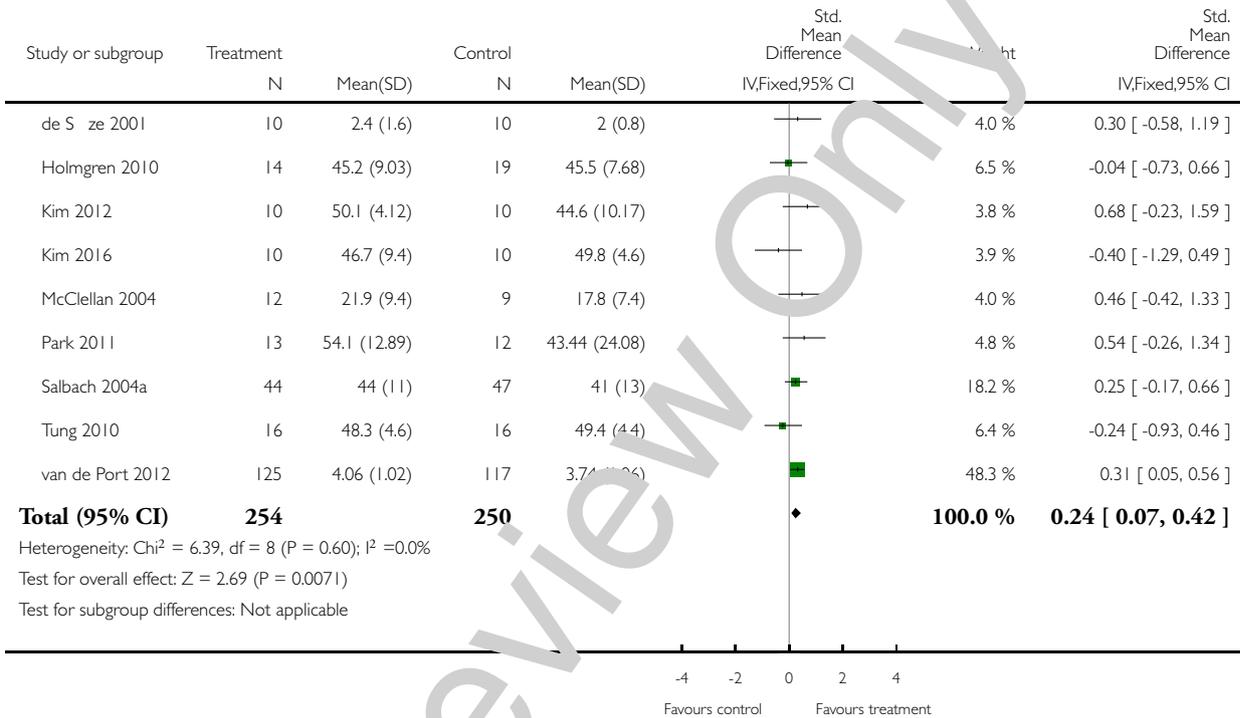


Analysis 4.6. Comparison 4 Lower limb function: post treatment, Outcome 6 Standing balance/reach.

Review: Repetitive task training for improving functional ability after stroke

Comparison: 4 Lower limb function: post treatment

Outcome: 6 Standing balance/reach

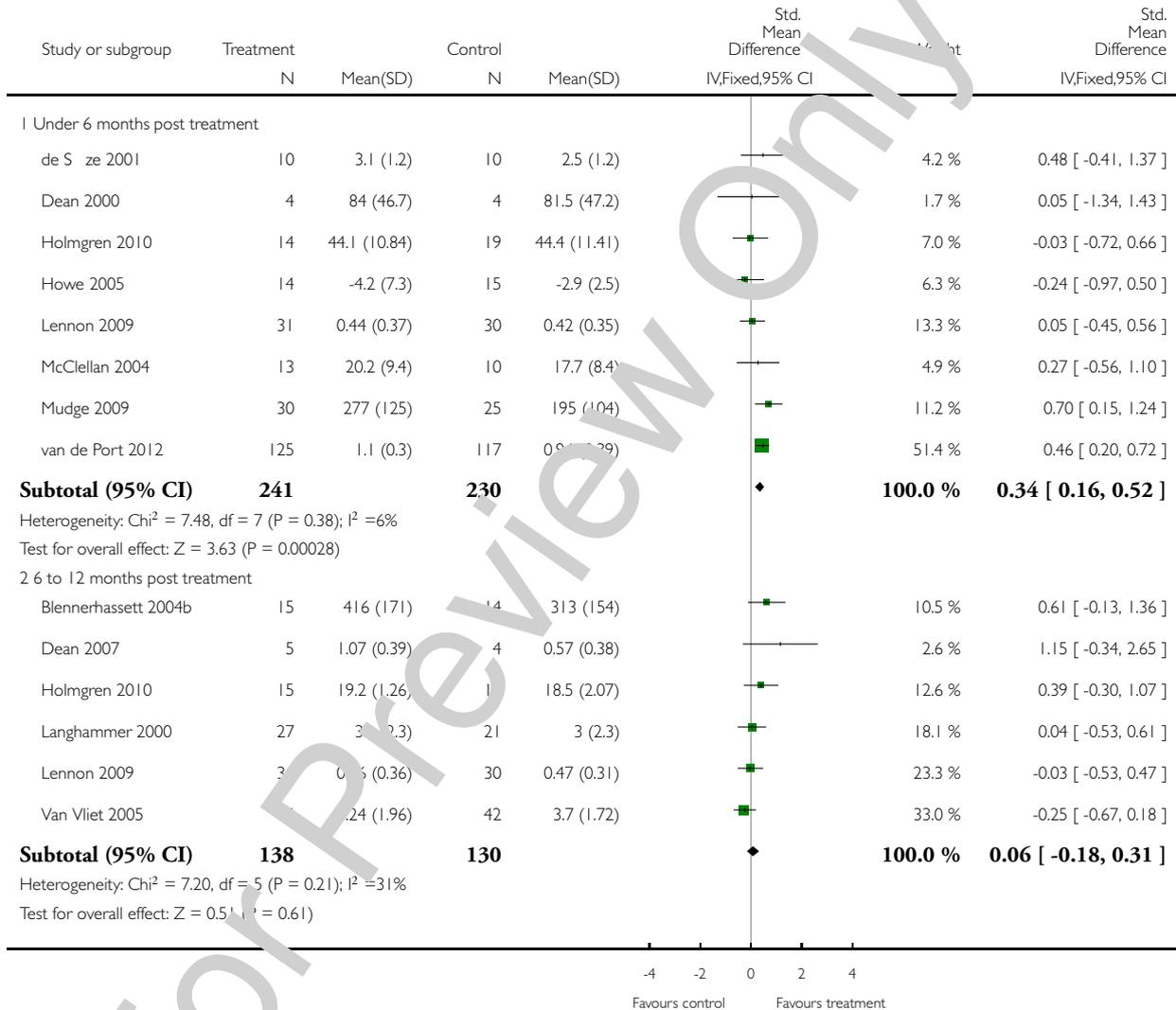


Analysis 5.1. Comparison 5 Lower limb function: follow up, Outcome 1 All outcomes.

Review: Repetitive task training for improving functional ability after stroke

Comparison: 5 Lower limb function: follow up

Outcome: 1 All outcomes

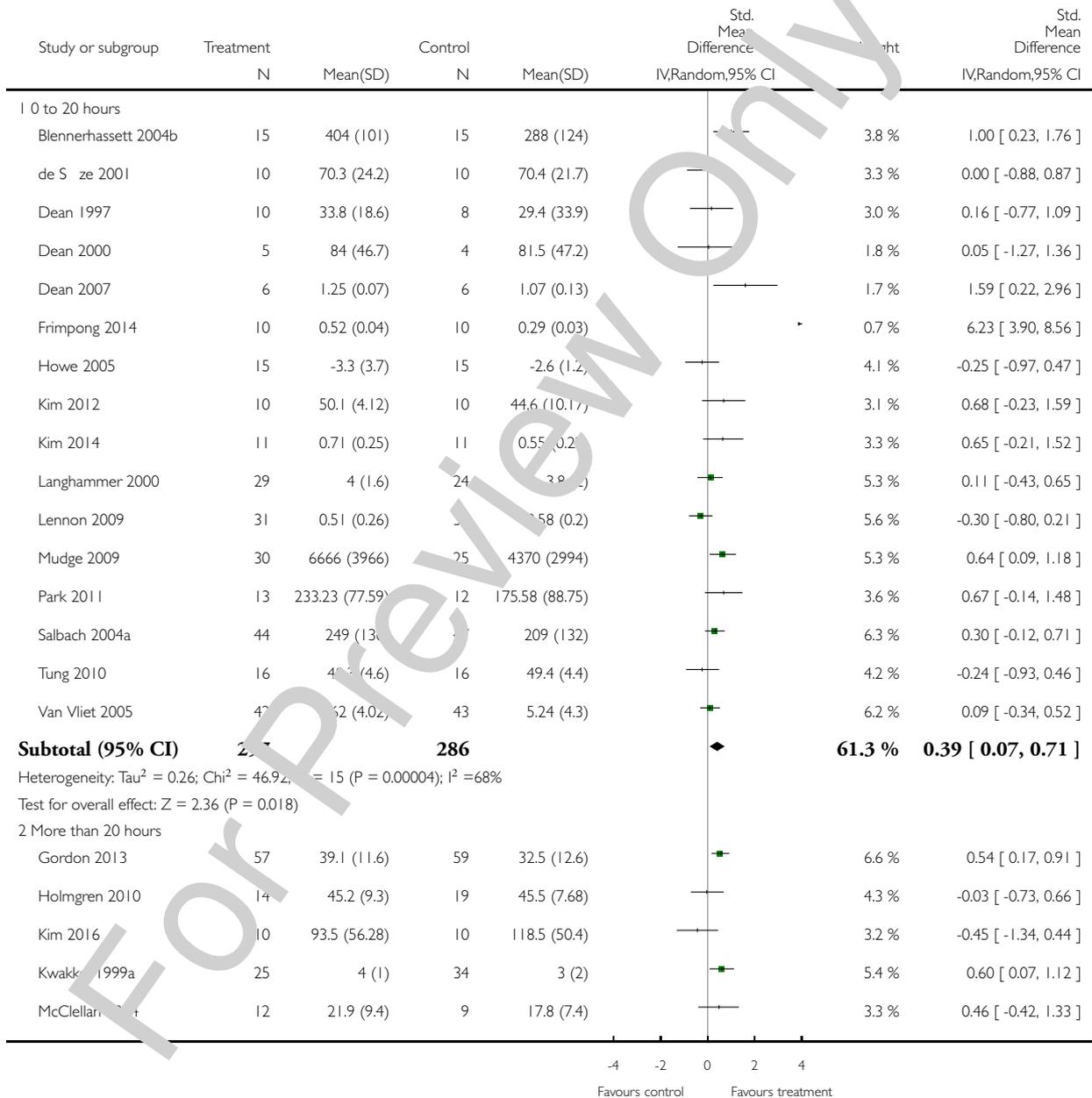


Analysis 6.1. Comparison 6 Lower limb function: subgroup analyses, Outcome 1 Dosage of task practice.

Review: Repetitive task training for improving functional ability after stroke

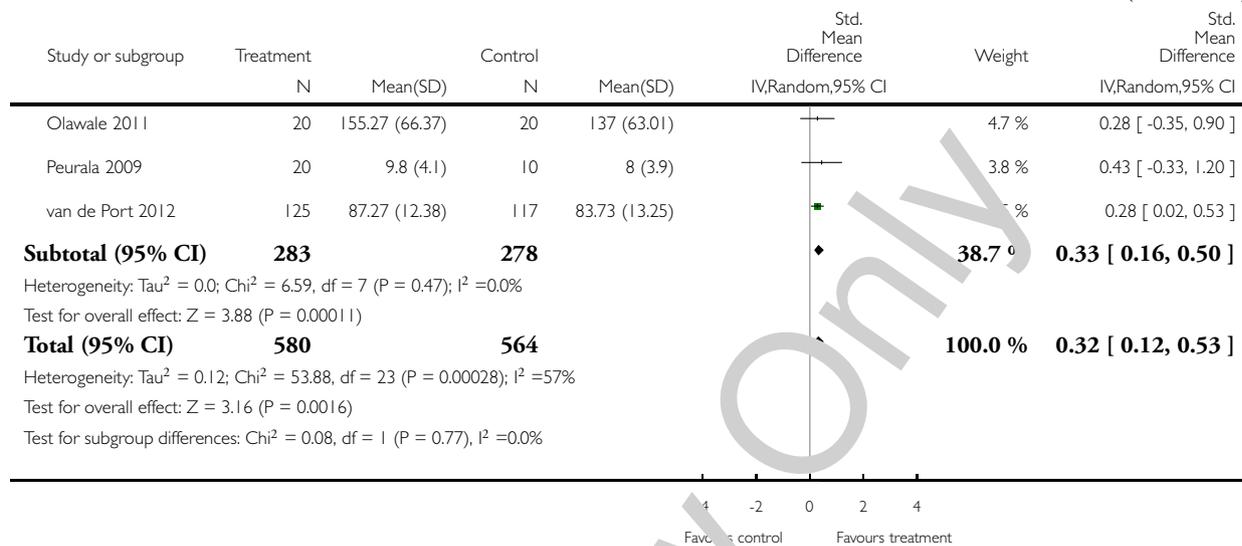
Comparison: 6 Lower limb function: subgroup analyses

Outcome: 1 Dosage of task practice



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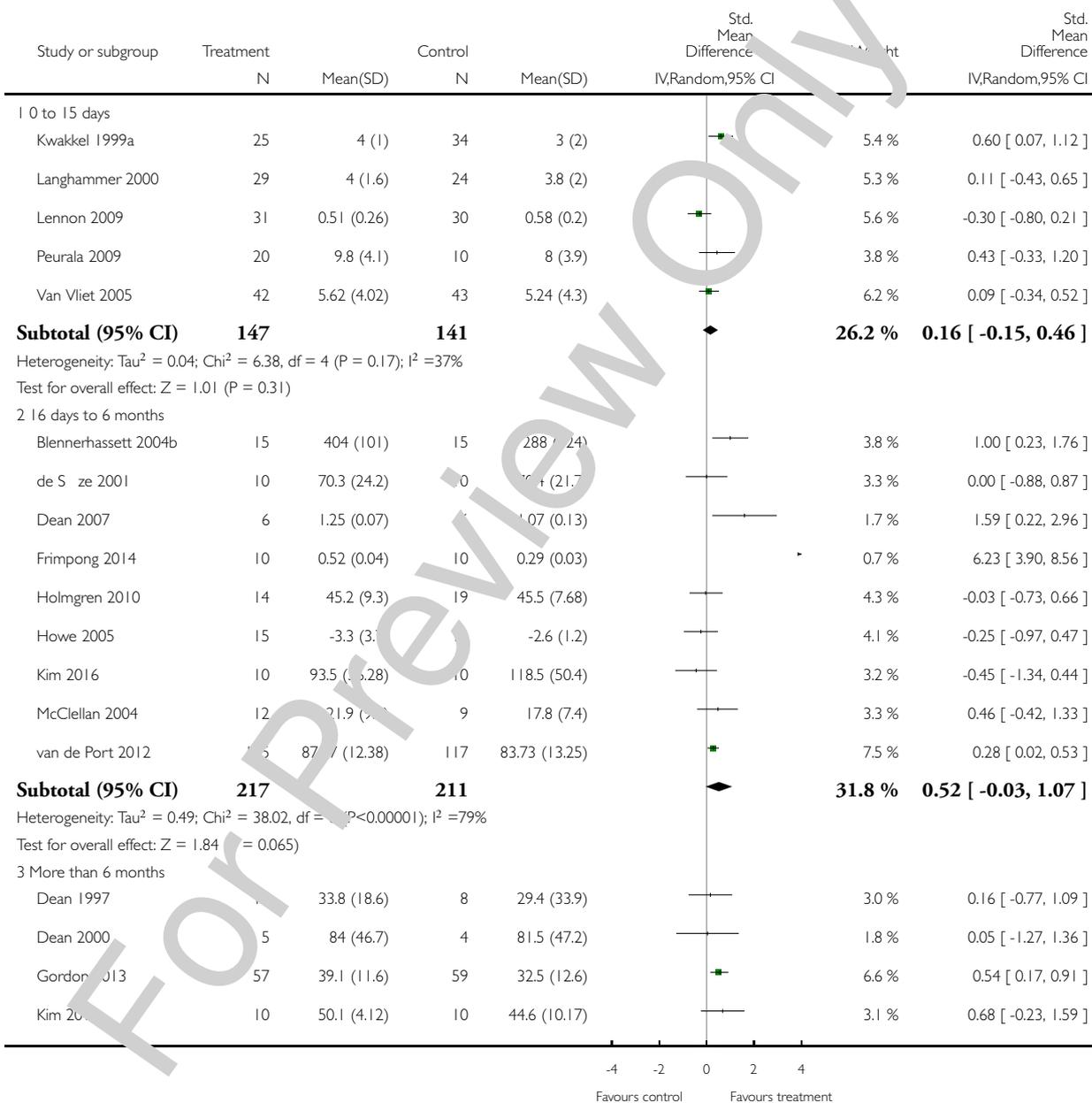


Analysis 6.2. Comparison 6 Lower limb function: subgroup analyses, Outcome 2 Time since stroke.

Review: Repetitive task training for improving functional ability after stroke

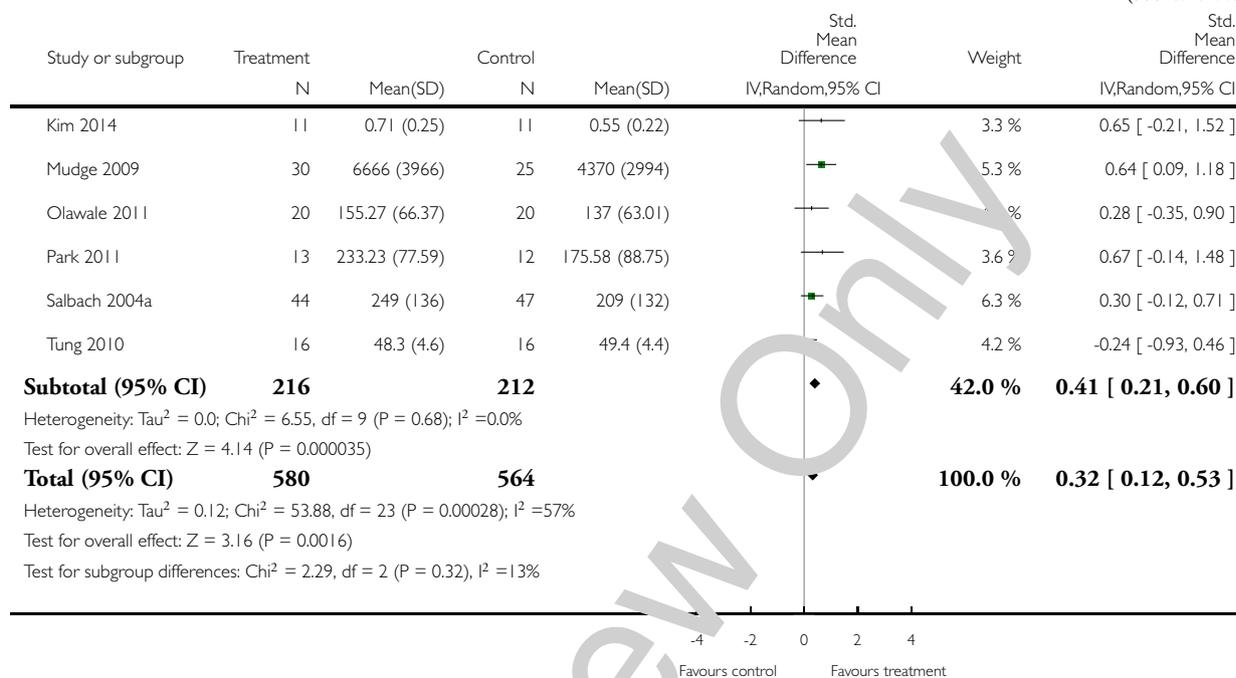
Comparison: 6 Lower limb function: subgroup analyses

Outcome: 2 Time since stroke



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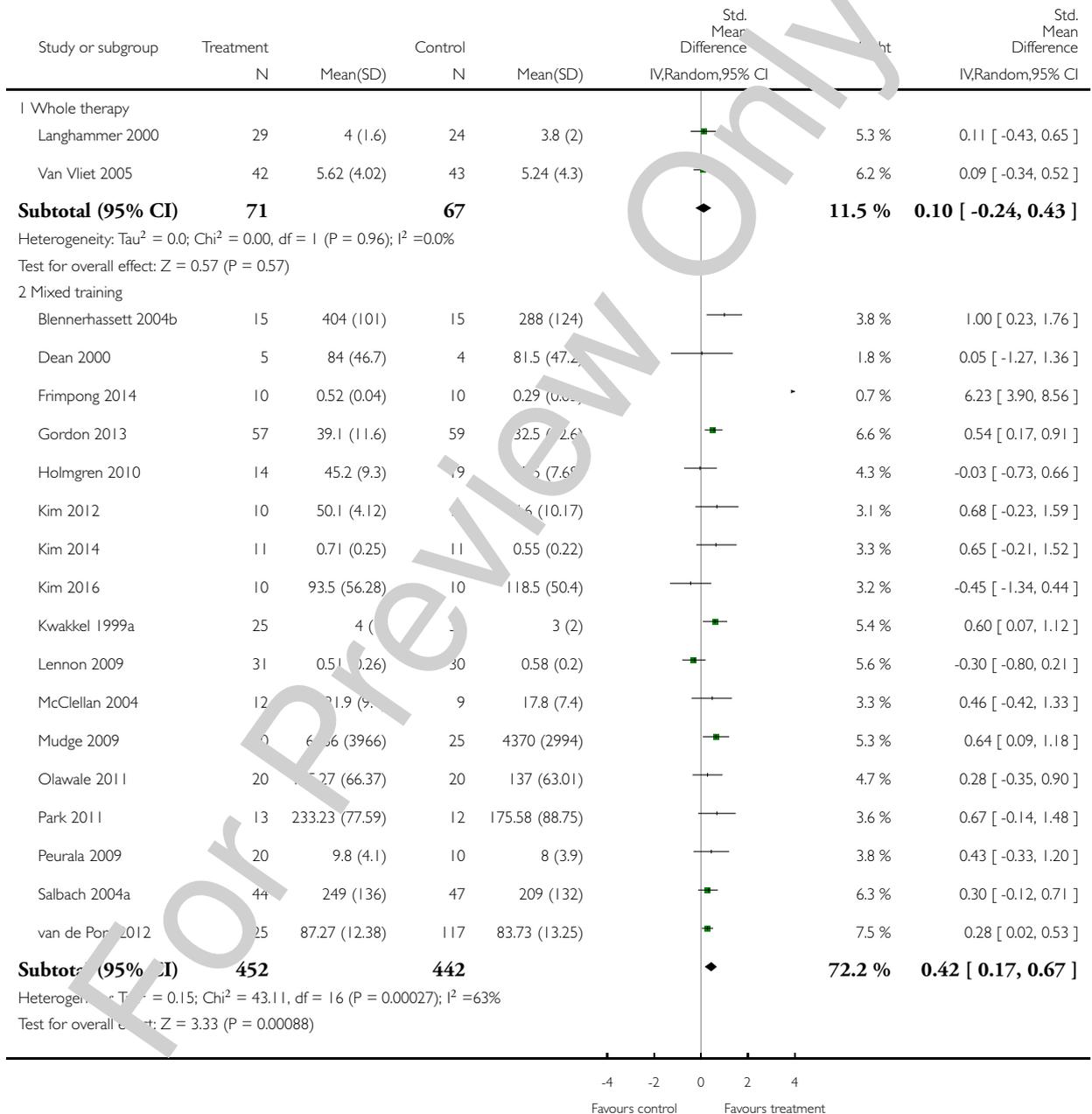


Analysis 6.3. Comparison 6 Lower limb function: subgroup analyses, Outcome 3 Type of intervention.

Review: Repetitive task training for improving functional ability after stroke

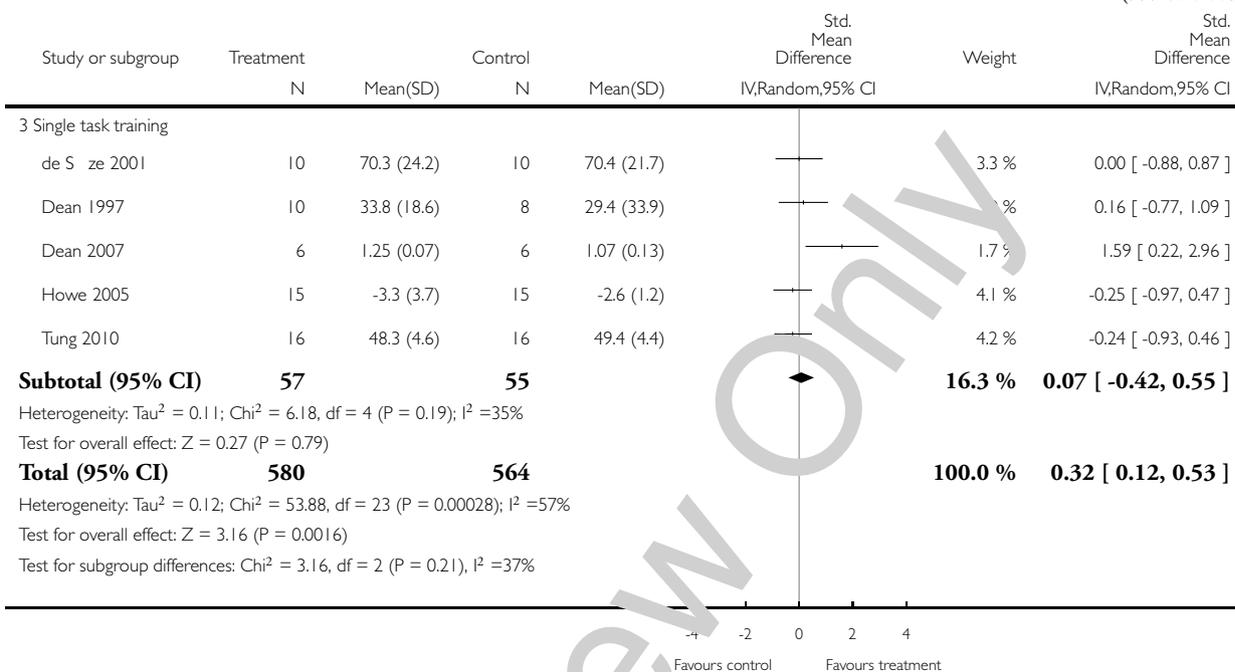
Comparison: 6 Lower limb function: subgroup analyses

Outcome: 3 Type of intervention



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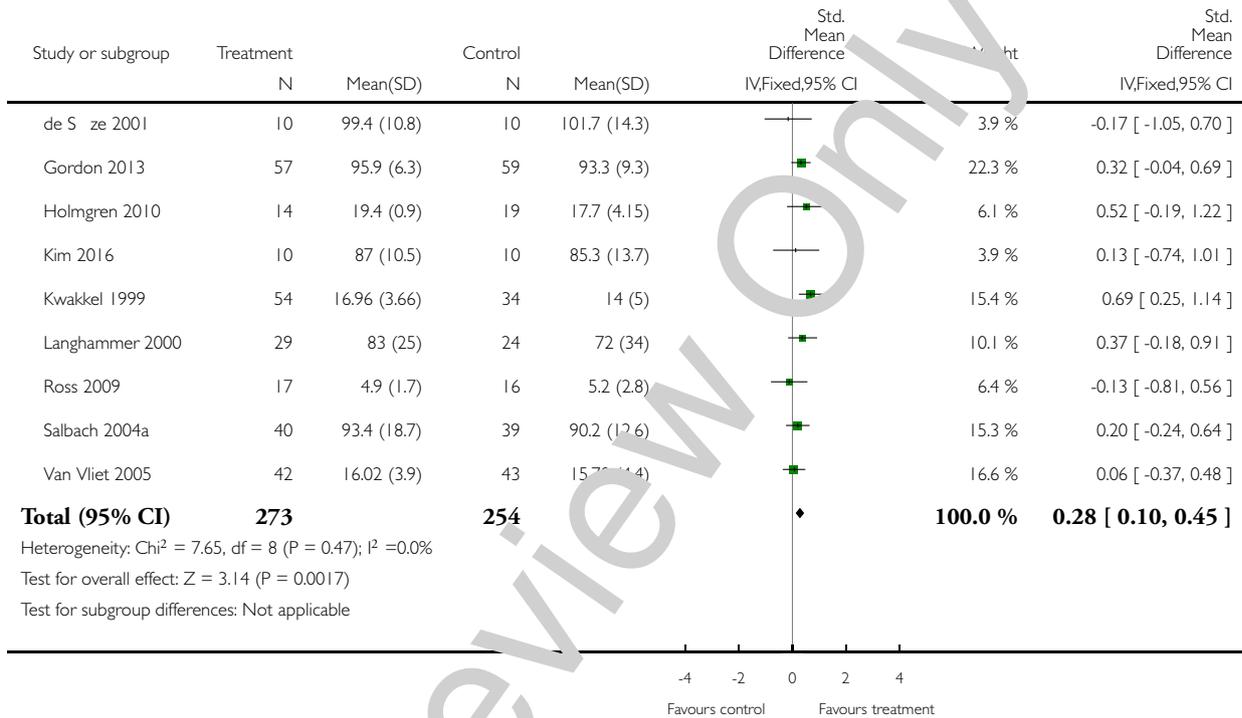


Analysis 7.1. Comparison 7 Secondary outcomes, Outcome 1 Activities of daily living function.

Review: Repetitive task training for improving functional ability after stroke

Comparison: 7 Secondary outcomes

Outcome: 1 Activities of daily living function

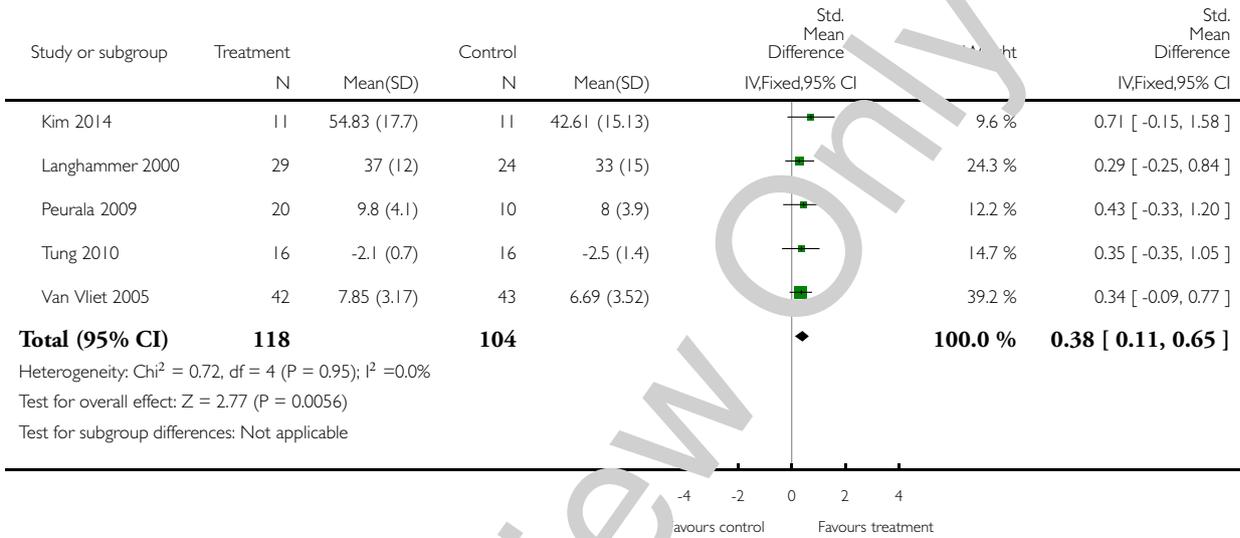


Analysis 7.2. Comparison 7 Secondary outcomes, Outcome 2 Global motor function scales.

Review: Repetitive task training for improving functional ability after stroke

Comparison: 7 Secondary outcomes

Outcome: 2 Global motor function scales

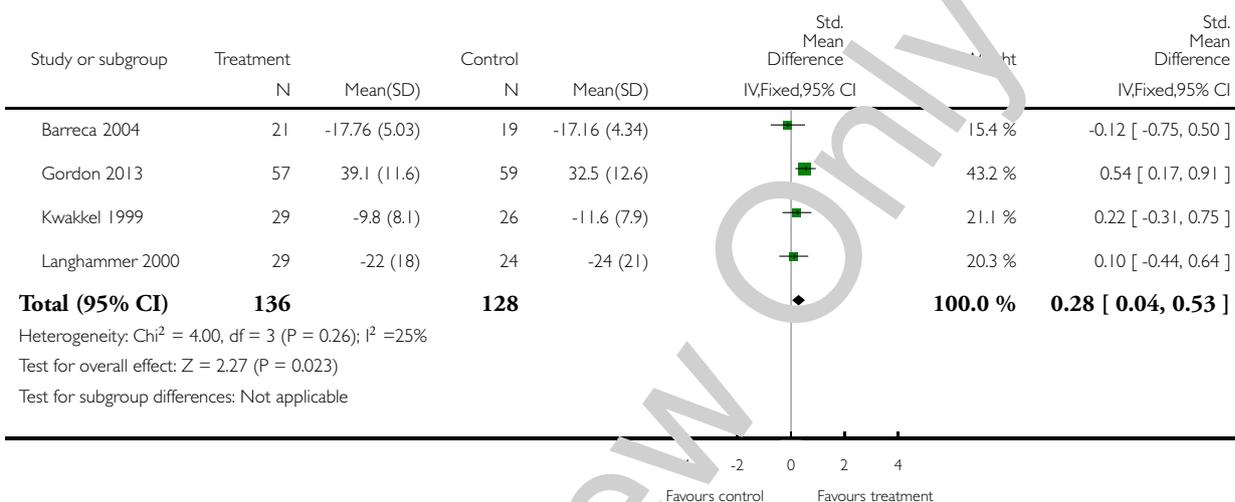


Analysis 7.3. Comparison 7 Secondary outcomes, Outcome 3 Quality of life/health status.

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 2002	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)

Blennerhas- sett 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	AC	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
Langham- mer 2000	1	1	1	1	B	UC	EQ	2
Lennon 2009	1	2	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		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)

Blennerhasset 2004a; Blennerhasset 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 Ind			Functional Independence Measure		
Frimpong 2014		10 Metre Walk Test Functional Ambulatory Category						
Gordon 2013		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 - social partic-	10 Metre Walk Test 6 Minute						

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

	ipation sub-scale	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 Performance 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				Southwestern 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 - cross 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 trunk							
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				

Abbreviations:

6MWT: 6 Minute Walk Test
 ARAT: Action Research Arm Test
 BBS: Berg Balance Scale
 COPM: Canadian Occupational Performance Measure
 Dartmouth COOP: Dartmouth Primary Care Cooperative Information Project
 DASH: Disabilities of the Arm, Shoulder and Hand
 FIM: Functional Independence Measure
 FMA: Fugl Meyer Assessment
 GWMFT: Graded Wolf Motor Function Test
 HADS: Hospital and Depression Scale
 MAS: Motor Assessment Scale
 MAL: Motor Activity Log
 MRMI: Modified Rivermead Mobility Index
 NEADL: Nottingham Extended Activities of Daily Living Scale
 OARS: Older Americans Resources and Services Scale
 OARS-IADL: Older Americans Resources and Services Scale - Instrumental Activities of Daily Living
 PADS: Physical Activity and Disability Scale
 RMI: Rivermead Motor Assessment
 RMI: Rivermead Mobility Index
 SF-36: Short Form Health Survey
 SIS: Stroke Impact Scale
 SMES: Stairing Motor Evaluation Scale
 STREAM: Stroke Rehabilitation Assessment of Movement
 STS: Sit-to-stand
 TEMPA: Test d'Evaluation des Membres supérieurs des Personnes Agées
 Timed 10MWT: Timed 10 Metre Walk Test
 TUG: Timed Up and Go

APPENDICES

Appendix I. 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 embolus\$ 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 (hemipar\$ 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 retrain\$ or learn\$ or relearn\$ 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 of 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 (repea? 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\$ mi\$ or infar\$ 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. (hemipar\$ 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 (repea\$ 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 (schedu\$ 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 double\$ 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 cerebrovascular
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. SI ORTS discuss search strategy

- S19S7 AND S11 AND S12
- 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) 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 oclus*) or AB (ischemi* or ischaemi* or infarct* or thrombo* or emboli* or oclus*))

S2TI (stroke or poststroke or post-stroke or cerebrovasc* or brain vascul* or cerebral vasc or cva or apoplex or SAH) or AB (stroke or poststroke or post-stroke or cerebrovasc* or brain vascul* 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 comparative experiment* or preventive or therapeutic) or AB (clin* or intervention* or comparative 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: 19 October 2016.

Date	Event	Description
22 September 2016	New citation required and conclusions have changed	We updated selected searches to March 2016. We have added 19 new studies and 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). 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

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.

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Christopher J Sutton: none known.

Svetlana Tishkovskaya: none known.

Caroline L Watkins: none known.

SOURCES OF SUPPORT

Internal sources

- NIHR Cochrane Review Incentive Scheme 2015, UK. £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, CINAHL, SPORTSDiscus, AMED, the Cochrane Central Register of Controlled Trials, ClinicalTrials.gov and the World Health Organization International Clinical Trials Registry Platform).