EFFECT OF INPATIENT REHABILITATION TREATMENT INGREDIENTS ON FUNCTIONING, QUALITY OF LIFE, LENGTH OF STAY, DISCHARGE DESTINATION, AND MORTALITY AMONG OLDER ADULTS WITH UNPLANNED ADMISSION: AN OVERVIEW REVIEW

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ABSTRACT

Background

To synthesise the evidence for the effectiveness of inpatient rehabilitation treatment ingredients (versus any comparison) on functioning, quality of life, length of stay, discharge destination, and mortality among older adults with an unplanned hospital admission.

Methods

A systematic search of Cochrane Library, MEDLINE, Embase, PsychInfo, PEDro, BASE, and OpenGrey for published and unpublished systematic reviews of inpatient rehabilitation interventions for older adults following an unplanned admission to hospital from database inception to December 2020. Duplicate screening for eligibility, quality assessment, and data extraction including extraction of treatment components and their respective ingredients employing the Treatment Theory framework. Random effects meta-analyses were completed overall and by treatment ingredient. Statistical heterogeneity was assessed with the inconsistency-value (I^2).

Results

Systematic reviews (n = 12) of moderate to low quality, including 44 non-overlapping relevant RCTs were included. When incorporated in a rehabilitation intervention, there was a large effect of *endurance exercise, early intervention* and *shaping knowledge* on walking endurance after the inpatient stay versus comparison. *Early intervention*, *repeated practice activities*, *goals and planning*, *increased medical care* and/or *discharge planning* increased the likelihood of discharge home versus comparison. The evidence for activities of daily living (ADL) was conflicting. Rehabilitation interventions were not effective for functional mobility, strength, or quality of life, or reduce length of stay or mortality. Therefore, we did not explore the potential role of treatment ingredients for these outcomes.

Conclusion

Benefits observed were often for subgroups of the older adult population e.g., *endurance exercise* was effective for endurance in older adults with chronic obstructive pulmonary disease, and *early intervention* was effective for endurance for those with hip fracture. Future research should determine whether the effectiveness of these treatment ingredients observed in subgroups, are generalisable to older adults more broadly. There is a need for more transparent reporting of intervention components and ingredients according to established frameworks to enable future synthesis and/or replication.

PROSPERO Registration CRD42018114323

KEYWORDS

Physiotherapy, exercise, geriatrics, acute care, hospital, trauma, injury, illness

INTRODUCTION

The world's population is ageing, reflecting advances in economic and social development, public health, sanitation, and medicine[1]. Although people are living longer, multiple chronic and complex health issues increase with age.[2]. This demographic trend, the changing health patterns of multimorbidity in old age contribute to fluctuating health service use and associated increased costs [3, 4]. A consequent increase in unplanned hospital admissions for older adults has the potential to lead to hospital associated deconditioning[5], with slower and poorer recovery without appropriate rehabilitation[6].

Rehabilitation is defined as a "*set of measures aimed at individuals who have experienced or are likely to experience disability to assist them in achieving and maintaining optimal functioning* (all body functions, activities and participation[7]) *when interacting with their environments.*"[8]. Treatment theory "*refers to a class of specific theories that specify mechanisms by which ingredients of a treatment produce change in the treatment target, the*

aspect of function that is directly impacted by the treatment" [9-12]. Treatment theory conceptualises rehabilitation as a complex intervention made up of treatment components which address different targets; each treatment component *e.g.,* skills and habits, is made up of more specific and measurable treatment ingredients, *e.g.,* strength exercises or repeated practice activities (Figure 1)[9-12]. Healthcare policies are shifting care away from the inpatient setting and into the community – either home or facility[13]. Inpatient rehabilitation may reduce the impact and complications of various health conditions and facilitate the earlier restoration of function, maximising potential for discharge home (and not to a facility)[14]. It is therefore essential to maximise the potential benefits from rehabilitation offered in this setting.

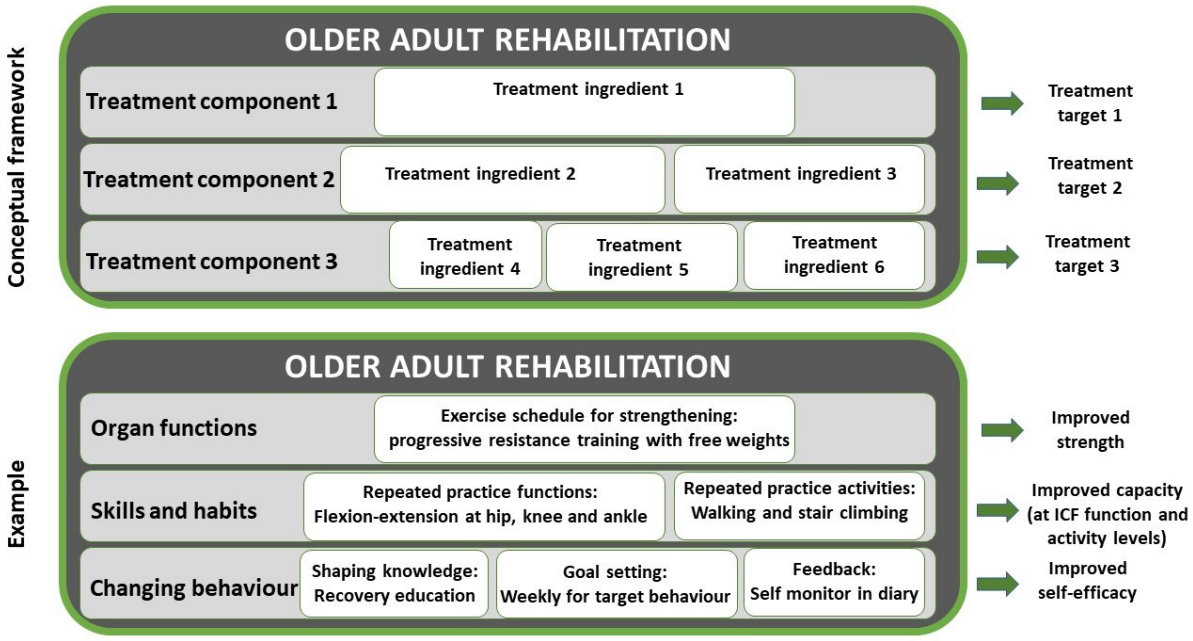

Figure 1: Rehabilitation as a complex intervention made up of treatment components addressing different targets; each treatment component is made up of more specific and measurable treatment ingredients[12].

ICF: International Classification of Functioning

There is a plethora of studies evidencing the effectiveness of inpatient rehabilitation for older adults admitted to hospital with an unplanned episode of injury or illness, summarised in

systematic reviews and meta-analyses[15-17]. This rehabilitation often includes multiple treatment ingredients with uncertainty over which ingredient(s) account for the reported change in outcome[12]. This poses a challenge for clinicians when justifying the inclusion of a given ingredient in practice, and for researchers when determining which ingredient(s) to include in future studies of rehabilitation interventions[18].

It would be of value to both clinicians and researchers to determine which treatment ingredient(s) contribute to the effectiveness of rehabilitation[19]. We proposed to address this evidence gap through application of Treatment Theory in an overview review of rehabilitation treatment ingredients for older adults with unplanned hospital admission.

AIMS AND OBJECTIVES

The aims of this overview review were to inform evidence-based inpatient rehabilitation for older adults following an unplanned hospital admission, and to identify gaps in the evidence to inform future research. More specifically, the primary objective was to synthesise the evidence for the effectiveness of inpatient rehabilitation treatment ingredients (versus any comparison) on functioning (body functions, activities) among older adults with an unplanned hospital admission. Secondary objectives included synthesizing the evidence for additional outcomes of quality of life, length of stay, discharge destination, and mortality.

METHODS

We registered the protocol on the international prospective register of systematic reviews (PROSPERO: CRD42018114323). We reported this review in adherence to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement[20]. We did not require ethical approval as it used data from published systematic reviews and meta-analyses.

Eligibility criteria

Eligibility criteria are outlined in Table 1. Briefly, we included systematic reviews and meta-analyses of randomised controlled trials (RCTs) which compared the effectiveness of inpatient rehabilitation[21] to any comparator group on functioning (body functions, activities), quality of life, discharge destination, length of stay, and/or mortality after inpatient rehabilitation (and where available longest follow-up to one-year) among older adults with an unplanned hospital admission (Table 1). We applied no publication date, language, or geographical limits. We excluded reviews focusing exclusively on older adults post-stroke to avoid conclusions being dominated by the larger evidence base post-stroke.

Table 1: **Eligibility criteria of systematic reviews and meta-analyses in overview review.**

	INCLUDE	**EXCLUDE**
Population	Reviews of adults with unplanned admission (urgent/emergency) to acute hospital care for any diagnosis other than stroke. Explicitly targeted RCTs of 'older adults' as described in eligibility criteria, or which included a subgroup analysis for older adults. Where age was not specified in the review eligibility, we selected relevant RCTs from within reviews which had a median/mean age of at least 65 years.	Reviews of planned admission to acute care. Explicitly targeted RCTs of children, young- or middle-aged adults, adults with stroke, and/or without explicit target of 'older adults', and no subgroup analysis for older adults. Where age was not specified in the review eligibility, we excluded RCTs from within reviews which had a median/mean age of less than 65 years.
Intervention*	*All reviews of rehabilitation provided/prescribed by rehabilitation professionals:* • which include exercise • to enable people with disabilities to attain or maintain maximum functioning at the level of body function, activity, and/or participation* • to prevent immobility related secondary health conditions or complications arising from a primary health condition	*All reviews of:* • rehabilitation involving prevention of first-time health conditions • acute medical management/chronic health condition management unless a goal is explicitly to address functioning (e.g. pulmonary rehabilitation for chronic lung disease with the goal of improving functioning) • rehabilitation directed at improving mental health* • rehabilitation not within the scope of the practice of rehabilitation professionals (e.g. homeopathy, invasive procedures for deep brain stimulation, hyperbaric oxygen therapy)

		• rehabilitation not specific to functioning (e.g. targeting a reduction in nonattendance rates) • first aid, pharmacological (including nutritional), paramedic, emergency, and surgical care*
Comparison	• Usual care • Placebo • Sham rehabilitation • Alternative rehabilitation	• No comparison
Outcome	Validated measure of functioning†, and/or quality of life. Measure of length of stay, discharge destination, or mortality. All measured at intervention end with or without follow up (up to 1 year).	Not (validated) measure of functioning† or quality of life and no measure of length of stay, discharge destination, or mortality. Absence of measure at intervention end.
Time	Rehabilitation endpoint of discharge from inpatient care.	Rehabilitation endpoint after discharge from inpatient care.
Study design	Systematic review and/or meta-analysis where at least 1 of the included primary studies are randomized controlled trials.	Not systematic review, primary research. Systematic review where no primary studies are randomized controlled trials.
Other	• Human • Any geographical region • Any language • Any publication dates	• Non-human

*Modified Cochrane Rehabilitation's criteria for identifying reviews as relevant to rehabilitation.[21]

† categorised by the domains body functions and/or activities (capacity) as specified by the World Health Organisations International Classification of Functioning.[7]

Search methods

We developed structured search strategies, in consultation with a librarian using thesaurus terms for intervention, setting and study design for each database (e.g., EMTREE for EMBASE, MeSH for MEDLINE) and free text, targeting the "title" and "abstract" fields (Supplementary File 1). We searched from inception to December 10th 2020 for published and unpublished systematic reviews in the following electronic databases: Cochrane Library, MEDLINE, Embase, PsychInfo, PEDro, BASE, and OpenGrey. We also screened reference lists of eligible systematic reviews for additional reviews not identified through our search strategies. We exported references to Covidence for deduplication, screening, selection, and quality appraisal[22].

Screening and selection

We screened titles and abstracts and potentially eligible full text reviews in duplicate against eligibility criteria (KL, CK, SG, KS). A third researcher resolved any discrepancies. We quantified inter-rater reliability using Cohen's Kappa statistic[23]. We avoided double-counting outcome data in our overview by primary RCT overlap with the creation of a citation matrix ordered first by publication date and then by lead author surname and excluded eligible reviews with no unique RCTs (retaining the most recent reviews)[24].

Quality appraisal

We assessed the methodological quality of each included review in duplicate using the Assessment of Multiple Systematic Reviews (AMSTAR 2) tool (KL, SH, SG, KS)[25]. AMSTAR 2 is a 16-item checklist which informs an overall qualitative rating on the confidence in the results of a review, based on weaknesses in critical domains[25]. Such domains include whether a protocol was registered, adequacy of literature search, exclusion criteria, and risk of bias. Four options were available when rating, ranging from critically low confidence to high confidence. A third researcher resolved any discrepancies.

Data extraction

We extracted data onto Microsoft Excel table templates defined *a priori* in duplicate (KL, EE, CK, SG, KS). A third researcher resolved any discrepancies. We contacted authors to supplement missing or incomplete data.

We extracted the following data items for the systematic reviews: review author, review year, population, intervention, comparators, outcome, number of studies eligible for the current overview, number of patients from eligibility studies. We extracted the following data items for eligible RCTs within the systematic reviews: RCT author, RCT year, country, sample size (intervention and comparator), characteristics of the population where available -age, gender,

target group, and preadmission residence, comparison/s, interventions, outcomes and follow-up relevant to the current overview. For the interventions, we extracted three main treatment components and their more specific and measurable treatment ingredients specified by Treatment Theory[9-12]. Component 1: *Organ Functions* (example more specific treatment ingredient: strengthening exercise)[12]; Component 2: *Skills and Habits* (example more specific treatment ingredient : repeated practice of activities +/- increasing demands)[12]; and Component 3: *Changing Behaviour* (example more specific treatment ingredients: goals and planning, shaping knowledge)[26]. Where treatment ingredients did not fall under these three treatment components (*e.g.,* increased medical care), we extracted them under *Other Components*. All treatment ingredients cited were assigned to a component in this review. For our outcomes, we extracted mean and standard deviation in each treatment arm for continuous outcome measures and proportions for categorical outcomes after inpatient rehabilitation and on longest follow-up (up to 1 year). We contacted all authors who presented data as medians, ranges, or 95% confidence intervals for means and standard deviations. If no response was received, we converted data presented as medians and ranges to means and standard deviations using methods as described by Hozo et al[27]. We converted data presented as 95% confidence intervals to standard errors[28] and subsequently standard deviations (standard deviation = standard error x √sample size).

Data synthesis

All systematic reviews met the eligibility criteria for inclusion; however, 1) not all RCTs within reviews were relevant, and 2) there was considerable primary RCT overlap between reviews. Therefore, we re-analysed the data by performing random-effects meta-analyses within the subgroup of relevant RCTs for each outcome across the systematic reviews[29]. We estimated Hedges' g or mean differences for continuous outcomes and log odds ratios for categorical outcomes. We interpreted effect sizes of 0.2 as small, 0.5 moderate, and 0.8 as

large[28]. We completed sensitivity analyses with RCTs from reviews of low or critically low quality removed from the analyses.

We stratified meta-analyses which indicated the effectiveness of interventions on outcomes by individual treatment ingredients, e.g. *endurance exercise* [21]. For meta-analyses with at least ten RCTs, small study sample bias was assessed using Egger's test for continuous outcomes and Peters test for categorical outcomes[28]. We assessed the potential for heterogeneity using I^2 and followed the Cochrane convention of 0-40% heterogeneity as may not be important, 30-60% as moderate, 50-90% as substantial, and 75-100% as considerable heterogeneity[28]. Where at least ten RCTs were included in the meta-analysis, we also explored the potential for heterogeneity due to differences in characteristics of the RCTs (mean age, target group, continent of publication, and year of publication) with random-effects meta-regression[28] and stratified meta-analysis where there was a plausible characteristic which may explain the heterogeneity e.g., RCT geography on length of stay due to different organisation of care. All analyses were completed in Stata v16[30]. We summarised RCT findings descriptively where meta-analysis was not possible.

RESULTS

Selection

We included 12 systematic reviews in this overview review. Initial searches identified 2,677 systematic reviews, of which 583 were duplicates. On the title and abstract screening, a further 1,916 were excluded. Of the 178 reviews assessed at full text screening, 155 were ineligible for the following reasons: population (n = 104), intervention (n = 9), outcome (n = 5), study design (n = 17), setting (n = 21). Cohen's Kappa statistic following full text review was 0.73 indicating substantial agreement between assessors. Following generation of a citation matrix ordered by publication date, we excluded a further 10 reviews[16, 31-39]

which contained no RCTs not already included in a more recent review (Supplementary File 2).

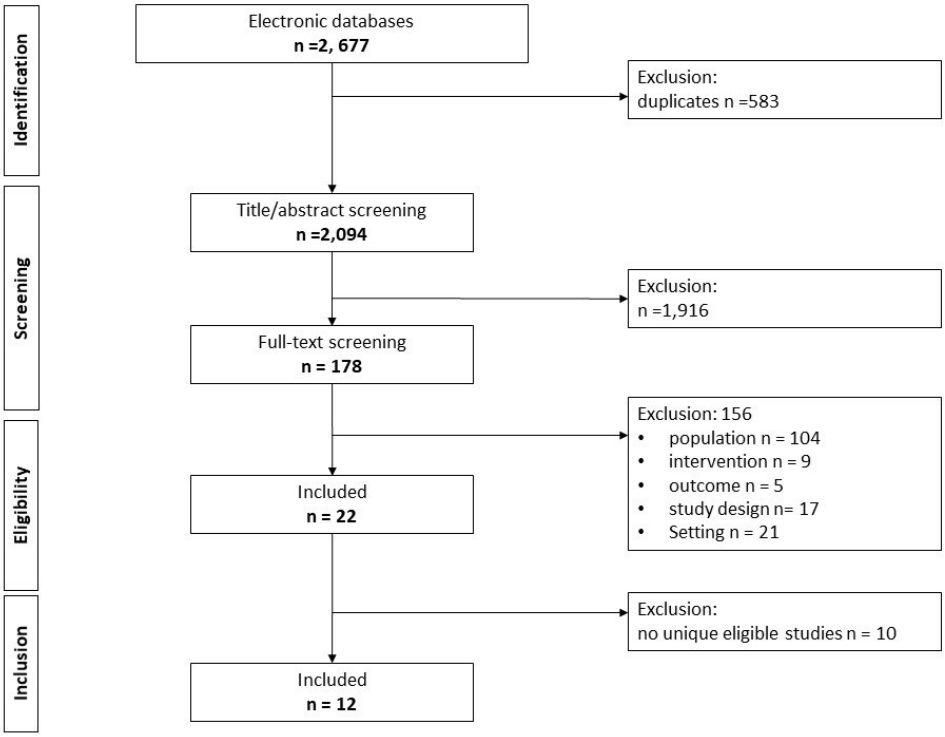

Figure 2: PRISMA Flow Diagram

Quality

The results of the quality assessment are presented in Table 2. Overall, seven systematic reviews were assigned a moderate rating for overall confidence in review results (more than one non-critical weakness but no critical flaws)[15, 40-45], four a low rating (one critical flaw – study selection not in duplication or failure to consider risk of bias for interpretation)[17, 46-48], and one a critically low rating (more than one critical flaw)[49]. Almost all included systematic reviews met the requirements for defining an appropriate research question (n=12) [15, 17, 40-49], search strategy (n=11) [15, 17, 40-48], study selection (n=11) [15, 17, 40-46, 48, 49], risk of bias assessment (n=11) [15, 17, 40-48], explanation of heterogeneity in analyses (n=9) [15, 17, 40, 41, 43-45, 47, 48], and declaring

sources of conflicts of interest (n=12) [15, 17, 40-49]. Most systematic reviews failed to explain their selection of the study designs for inclusion (n=11) [15, 17, 40-45, 47-49], declare sources of funding for studies included in the review (n=11) [15, 40-49] and/or carry out an adequate investigation of potential publication bias (n=5) [40-42, 46, 47].

Table 2: Quality assessment of systematic reviews and meta-analyses included in this overview review using AMSTAR 2

	AMSTAR 2 DOMAIN																
Author, Year (Reference)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	AMSTAR 2 Rating
Bachmann 2010	Y	N	N	PY	Y	N	N	Y	PY	N	Y	Y	Y	Y	Y	Y	Moderate
De Morton, 2007	Y	N	N	Y	Y	Y	Y	PY	Y	Y	Y	N	N	Y	Y	Y	Low
Handoll, 2011	Y	Y	N	PY	Y	Y	Y	Y	Y	N	NMA	NMA	Y	Y	N	Y	Moderate
Heldmann, 2019	Y	PY	N	PY	Y	Y	N	Y	Y	N	NMA	NMA	N	Y	NMA	Y	Low
Machado, 2020	Y	PY	N	PY	Y	N	N	PY	Y	N	Y	N	Y	Y	N	Y	Moderate
Martinez-Velilla, 2016	Y	N	Y	PY	Y	N	N	Y	PY	N	NMA	NMA	N	N	N	Y	Low
Peck 2020	Y	N	N	N	Y	N	N	Y	N	N	NMA	NMA	N	N	NMA	Y	Critically low
Peiris 2018	Y	Y	N	PY	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Moderate
Scrivener, 2015	Y	Y	N	PY	N	Y	N	Y	Y	N	Y	Y	Y	Y	N	Y	Low
Smith, 2020a	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	N	Y	Moderate
Smith 2020b	Y	Y	N	PY	Y	Y	N	Y	Y	N	Y	N	Y	Y	Y	Y	Moderate
Yasmeen 2020	Y	Y	N	Y	Y	Y	N	Y	Y	N	NMA	NMA	Y	Y	NMA	Y	Moderate

Abbreviations: *AMSTAR 2*: Y = meets the requirement, PY = partial yes, N = does not meet the requirement, NMA= no meta-analysis conducted, NSRI = Only includes non-randomised studies of interventions, RCT = Only includes RCTs.

AMSTAR 2 DOMAINS: 1. PICO - "Did the research questions and inclusion criteria for the review include the components of PICO? **2.** Protocol – "Did the report of the review contain an explicit statement that the review methods was established prior to the conduct of the review, and did the report justify any significant deviations from the protocol? **3.** Study design – Did the review authors explain their selection of the study designs for inclusion in the review? **4.** Search strategy – Did the review authors use a comprehensive literature search strategy? **5.** Study selection – Did the review authors perform study selection in duplicate? **6.** Data extraction – Did the review authors perform data extraction in duplicate? **7.** Excluded studies – Did the review authors provide a list of excluded studies and justify the exclusions? **8.** Included studies – Did the review authors describe the included studies in adequate detail? **9.** Risk of bias – Did the review authors use a satisfactory technique for assessing the risk of bias (RoB) in individual studies that were included in the review? **10**. Funding sources – Did the review authors report on the sources of funding for the studies included in the review? **11.** Meta-analysis – If a meta-analysis was justified did the review authors use appropriate methods for statistical combination of results? **12.** Impact risk of bias – If meta-analysis was performed did the review authors assess the potential impact of RoB in individual studies on the results of the meta-analysis or other evidence synthesis? **13.** Discussing risk of bias – Did the review authors account for RoB in individual studies when interpreting/discussing the results of the review? **14.** Heterogeneity – Did the review authors provide a satisfactory explanation for, and discussion of, any heterogeneity observed in the results of the review? **15.** Publication bias – If they performed quantitative synthesis did the review authors carry out an adequate investigation of publication bias (small study bias) and discuss its likely impact on results of the review? **16.** Conflicts of interest – Did the review authors report any potential sources of conflict of interest, including any funding they received for conducting the review?

Characteristics

The 12 systematic reviews included 41 unique RCTs and 10,444 older adults with an unplanned hospital admission relevant to this overview (mean (min - max) sample size per RCT: 261 (12 – 1,531)) (Table 3). The target population of systematic reviews included older adults admitted for a general medical reason (n = 5)[15, 17, 43, 45, 46], for any unplanned reason (n = 3)[44, 47, 48], with hip fracture (n = 2)[40, 42], orthopaedic trauma (n = 1)[49], or an exacerbation of chronic obstructive pulmonary disease (COPD) (n = 1)[41]. Outcomes captured by the systematic reviews included functional mobility, ADLs, walking endurance, walking speed, and/or lower limb strength (n = 11)[15, 17, 40, 41, 43-49]; quality of life (n = 4)[40, 41, 44, 45]; length of stay (n = 9)[15, 17, 40-43, 45, 47, 48]; discharge destination (n = 2);[42, 48] and mortality (n = 7)[15, 17, 40, 44-46, 48].

Characteristics (as well as their treatment components and more specific and measurable ingredients) of the 44 RCTs included in the 12 systematic reviews are detailed in Supplementary Files 3 and 4. Examples of each treatment ingredient are specified in Table 4. For component 1 Organ Functions, treatment ingredients included: endurance exercise (n = 13), strengthening (n = 12), energy applied to soft tissue (n = 7), and/or breathing related exercises/training (n = 6). For component 2 Skills and Habits, treatment ingredients included: repeated practice activities (n = 15), functions (n = 8), and/or 'exercise rehabilitation' (n = 6). For component 3 Changing Behaviour, treatment ingredients included: shaping knowledge (n = 16), feedback and monitoring (n = 14), goals and planning (n = 11), antecedents (n = 12), natural consequences (n = 5), social support (n = 2), and/or comparison of behaviour (n = 1). For Other Components, treatment ingredients included: increased medical care for e.g., avoidance of complications and/or pain management (n = 14), early intervention (n = 12), team meetings and care planning (n = 11), discharge planning (n = 9), nutritional intervention

(n = 8), home visits during inpatient stay (n = 5), and/or cognitive orientation exercise (n = 2).

The comparator was usual care for the majority of RCTs (n = 42, 95.5%) identified from the systematic reviews. Physiotherapy/occupational therapy was a core component of usual care for 21 RCTs (50.0%), provided following a physician referral for 5 RCTs (11.9%), not a component of usual care for 13 RCTs (30.9%), or not specified for 1 RCT (2.4%). Two RCTs (4.8%) included education and usual care (1 RCT with physiotherapy/occupational therapy, 1 RCT usual care not specified) as the comparator. The comparator was an alternative intervention - delayed ambulation or delayed weight bearing for 2 RCTs (4.6%).

Synthesis

Meta-analyses were completed for function (functional mobility, ADL, walking speed, walking endurance, lower limb strength), health-related quality of life, length of stay, discharge destination, and mortality (Table 5). Details for population, intervention treatment ingredients, comparator, outcome measurement, and follow-up for each RCT included in each meta-analysis are available alongside forest plots in Supplementary File 5. We noted no difference in effect estimates or confidence intervals for sensitivity analyses which excluded RCTs from reviews of low or critically low quality. If interventions favored the control group, this is specified in text alongside the results of meta-analyses. Forest plots for meta-analyses by treatment ingredient are available in Supplementary File 6. Meta-regression was used to explore heterogeneity in analyses for ADL, discharge home and length of stay. Outcomes which could not be included in meta-analyses due to absence of measure of central tendency or dispersion, sole study, and/or multiple measures for the same outcome are summarised in text and in Supplementary File 7.

Table 3: Characteristics of reviews included in overview review.

Author, year	Population	Intervention	Comparator	Outcomes	Studies eligible for current overview n (%)	Number of patients (n = 10,444) *
Bachmann, 2010[15]	Medical admission	Inpatient rehabilitation specifically designed for geriatric patients, including multidisciplinary and accelerated rehabilitation programmes	Usual care	Function Length of stay Mortality	1 (5.88)	71
De Morton, 2007[17]	Medical admission	Exercise or multidisciplinary program with exercise	Usual care or no treatment	Function Length of stay Mortality	1 (11.1)	237
Handoll, 2011[40]	Hip fracture	Post-operative mobilisation strategies such as weight bearing, exercises, physical training and muscle stimulation, and mobilisation and nutrition	Any comparator	Function Length of stay Quality of life Mortality	5 (26.3)	568
Heldmann, 2019[48]	Hip fracture Medical admission Abdominal surgery	Exercise or multidisciplinary program with exercise	Any comparator	Function Length of stay Discharge destination Mortality	15 (62.5)	4,941
Machado, 2020[41]	COPD	Pulmonary rehabilitation, exercise training, breathing techniques, airway clearance techniques and/or education and psychosocial support	Usual care of any component of pulmonary rehabilitation	Function Length of stay Quality of life	12 (28.6)	716
Martinez-Velilla, 2016[46]	Medical admission	Exercise and early rehabilitation (physical therapy, occupational therapy, and physical activity as soon as physiological stable)	Any comparator	Function Mortality	3 (17.7)	325
Peck, 2020[49]	Orthopaedic trauma	Mobilisation, defined as any form of activity or exercise, within the first 24 hours of admission	Any comparator	Function	1 (12.5)	89
Peiris, 2018[43]	Medical admission	Additional physical therapy (extra and/or longer sessions) supervised by physical therapists or physical therapy assistants	Usual care	Function Length of stay	1 (4.16)	996
Scrivener, 2015[47]	Hospital admission	After-hours or weekend rehabilitation in any form (e.g., arm exercise, mobility training) and could be unsupervised (i.e., self-monitored programs) or supervised (e.g., therapists, families, assistants, nursing staff)	Any comparator	Function Length of stay	1 (14.3)	47
Smith, 2020a[42]	Hip fracture with/ without dementia	New models of care e.g., protocols for interdisciplinary working and/or discharge planning, enhanced complications monitoring, intensive rehabilitation, extension of rehabilitation into community after discharge, enhanced rehabilitation for persons with dementia	Usual care	Length of stay Discharge destination	1 (14.3)	12

Smith, 2020b[45]	Medical admission	Mobilisation programmes to increase ward-based physical activity, with education for carers and patients, change in healthcare practice (e.g. enhanced rehabilitation, staff allocation and time, earlier assessments of barriers) and/or environmental changes	Any comparator	Function Length of stay Mortality Quality of life	4 (57.1)	2308
Yasmeen, 2020[44]	Hospital admission	Caregiver-mediated interventions to improve mobility or ADL, by providing education, training, preparation for discharge, and/ or collaborating with providers	Any comparator	Function Mortality Quality of life	1 (2.50)	134

COPD = chronic obstructive pulmonary disease * Number assigned from studies relevant to the current overview.

Table 4: Examples of treatment ingredients identified from RCTs included in systematic reviews of inpatient rehabilitation for older adults with unplanned admission to hospital.

Treatment Component	Treatment ingredient	Examples
Organ functions		
	Strengthening exercise	Quadriceps strengthening, leg extensor strengthening, progressive resistance training with weights, elastic bands, and/or body weight, calisthenics, sit to stand or stair training.
	Endurance exercise	Treadmill training, pedal/cycle ergometer, walking programme.
	Energy applied to soft tissues	Neuromuscular electrical stimulation, vibrating platforms.
	Breathing related exercise/training	Deep breathing, relaxation techniques, pursed lip breathing.
Skills and habits		
	Repeated practice functions	Active range of motion exercises for the upper and lower limb in lying, sitting, or standing.
	Repeated practice activities	ADL training (mobility in bed, sitting and standing, chair to bed transfers, wheelchair to bed/toilet transfers, dressing, bathing, personal hygiene, toilet use), transfer practice.
	Repeated exercise rehabilitation	Exercise rehabilitation at an increased frequency.
Changing behaviour		
	Goals and planning	Action planning, goal setting for target behaviour or target outcome.
	Feedback and monitoring	Monitoring outcomes of behaviour without feedback to the participant, self-monitoring through diary entries, feedback during behaviour with modifications as needed e.g., reduce repetitions.
	Social support	Group sessions with other patients, sessions with patients and their carers to build confidence in ADL, assistance at mealtimes.
	Shaping knowledge	Instructions on how to perform a behaviour in person / with leaflet.
	Natural consequences	Information on condition/injury delivered in person with visual aid e.g., leaflet /Xray.
	Comparison of behaviour	Demonstration of an exercise/use of equipment.
	Antecedents	Restructuring the physical environment e.g., removal of clutter from hallways. Assessment and intervention on social environment. Adding objects to the environment e.g., mobility aids, provision of clocks and calendars.
Other intervention components		
	Cognitive orientation exercise	Set of questions asked regularly to improve orientation -day, month, year, date, ward, bed number, nurse name.
	Team meetings and care planning	Multidisciplinary team meetings of increased frequency for planning.
	Discharge planning	Early discharge planning with multidisciplinary team.
	Increased medical care	Increased monitoring of pain, provision of oxygen enriched air, increased monitoring for potential complications e.g., pressure ulcers.
	Nutritional intervention	Protein-enriched meals, nutritional supplements, assistance at mealtimes.
	Early intervention	Early mobilisation (often on day of or after surgery), early start of rehabilitation, early discharge planning, early geriatrician review
	Home visit	Pre-discharge home visit by physiotherapy or occupational therapy

ADL = activities of daily living

Function

Walking endurance

Rehabilitation had a large effect on walking endurance versus comparison after inpatient stay (Total score: 6 RCTs including 307 participants; Hedges' g = 1.50, 95% CI: 0.39, 2.60. I^2 = 94.40; Change score: 3 RCTs including 139 participants; Log OR = 1.23, 95% CI: 0.68, 1.78. I^2 = 54.96) supported by results of RCTs from one systematic review not included in the meta-analysis[41]. When included in a rehabilitation intervention, the treatment ingredients *endurance exercise* (Total score: 3 RCTs including 181 participants; Hedges' g = 2.44, 95% CI: 0.49, 4.38. I^2 = 95.56; Change score: 2 RCTs including 110 participants; Log OR = 0.98, 95% CI: 0.59, 1.37. I^2 = 0.00) and *shaping knowledge* (2 RCTs including 152 participants; Hedges' g = 1.51, 95% CI: 0.56, 2.46. I^2 = 83.24) had a large effect, while *early intervention* had a moderate effect (2 RCTs including 100 participants; Hedges' g = 0.51, 95% CI: 0.12, 0.91. I^2 = 0.00) on walking endurance versus comparison after inpatient stay.

Walking speed

Rehabilitation had a small effect on walking speed versus comparison after inpatient stay (5 RCTs including 1,175 participants; Hedges' g = 0.17, 95% CI: 0.05, 0.28. I^2 = 0.00). One systematic review reported on one RCT which noted no effect at follow-up[40]. When included in a rehabilitation intervention, the treatment ingredients *strengthening exercise* or *repeated exercise rehabilitation* did not increase walking speed.

Activities of daily living

Rehabilitation had a small effect on ADL versus comparison after inpatient stay (15 RCTs including 3,929 participants; Hedges' g = 0.21, 95% CI: 0.00, 0.42. I^2 = 86.58). The effect was similar but non-significant for ADL change score (6 RCTs including 2,779 participants; Log OR = 0.21, 95% CI: -0.07, 0.49. I^2 = 71.46). The effect was not sustained at 1-12 month follow-up (Total score: 5 RCTs including 895 participants; Hedges' g = 0.04, 95% CI: -0.31, 0.38. I^2 = 82.69, 1 RCT favoured comparison; Change score: 2 RCTs including 973 participants; Log OR = 0.45, 95% CI: -0.05, 0.96. I^2 = 52.36). The absence of an effect was supported by results of RCTs from six systematic reviews not included in the meta-analyses[41, 43-46, 48]. There was evidence of small study sample bias for the analysis of total ADL after inpatient rehabilitation (p =0.01). For estimates of total ADL after inpatient stay, the total effect of rehabilitation interventions adjusted for age, target population, RCT geography, and publication year was not significant (p =0.12) in meta-regression.

When included in a rehabilitation intervention, the treatment ingredient *energy applied to soft tissue* had a large effect versus comparison after inpatient stay (3 RCTs including 114 participants; Hedges' g = 0.95, 95% CI: 0.23, 1.66. I^2 = 70.20). There was no effect of *endurance exercise*, *strengthening exercise*, *repeated practice activities*, *repeated exercise rehabilitation*, *goals and planning*, *feedback and monitoring*, *shaping knowledge*, *antecedents*, *increased medical care, nutritional intervention, or early intervention*, on ADL versus comparison.

Other measures of function

Rehabilitation did not improve functional mobility or lower limb strength versus comparison after inpatient stay or functional mobility at follow-up evidenced by meta-analysis. Two systematic reviews identified RCTs reporting a between group difference in functional mobility when measured with the Physical Performance and Mobility Examination after inpatient rehabilitation[45] or the Short Physical Performance Battery at follow-up[48].

Discharge destination

Rehabilitation was effective at increasing the odds of living at home versus comparison after inpatient rehabilitation (11 RCTs including 3,751 participants; Log OR = 0.47, 95% CI: 0.17, 0.76. I^2 = 45.95) and at 3–12-month follow-up (2 RCTs including 676 participants; Log OR = 0.38, 95% CI: 0.03, 0.74. I^2 = 0.00). When included in a rehabilitation intervention, the treatment ingredients *repeated practice activities* (6 RCTs including 2,783 participants; Log OR = 0.49, 95% CI: 0.11, 0.87. I^2 = 60.41), *goals and planning* (2 RCTs including 80 participants; Log OR = 0.83, 95% CI: 0.21, 1.45. I^2 = 16.44), *increased medical care* (8 RCTs including 3,451 participants; Log OR = 0.38, 95% CI: 0.04, 0.73. I^2 = 53.78) *early intervention* (7 RCTs including 1,279 participants; Log OR = 0.60, 95% CI: 0.20, 1.00. I^2 = 27.45), and *discharge planning* (6 RCTs including 3,236 participants; Log OR = 0.46, 95% CI: 0.09, 0.84. I^2 = 62.41) increased the odds of living at home versus comparison after inpatient rehabilitation. When included in a rehabilitation intervention, the rehabilitation ingredients *repeated exercise rehabilitation*, *antecedents*, *team meetings and care planning*, and *nutritional intervention* had no effect on the odds of living at home after the period of inpatient rehabilitation. There was no evidence of small study sample bias. For total estimates after inpatient stay, the total effect of age, target population, RCT geography, and publication

year was not significant (p =0.14) in meta-regression suggesting these variables do not explain the observed heterogeneity. Subsequent meta-analysis was not carried out.

Quality of life

Rehabilitation did not increase health-related quality of life versus comparison after inpatient stay (Total score: 5 RCTs including 1,583 participants; Hedges' g = -0.15, 95% CI: -0.37, 0.07. I^2 = 60.47; Change score: 2 RCTs including 78 participants; Log OR = -0.40, 95% CI: -0.84, 0.04. I^2 = 0.00), or on 12-month follow-up (2 RCTs including 1,150 participants; Hedges' g = 0.01, 95% CI: -0.11, 0.12. I^2 = 0.00). Three systematic reviews reported on RCTs not incorporated in the meta-analysis which favoured rehabilitation intervention versus comparison after inpatient stay [41, 43] and reported conflicting evidence for follow-up[41, 43, 48].

Length of stay

Rehabilitation did not reduce the length of stay versus comparison after inpatient stay (29 RCTs including 6,971 participants; mean difference = -0.54, 95% CI: -1.32, 0.23. I^2 = 88.13, 3 RCTs favoured comparison); however, evidence was detected for small study sample bias (p <0.001). For estimates of length of stay, the total effect of rehabilitation interventions adjusted for age, target population, RCT geography, and publication year was significant (p <0.001) in meta-regression. A subsequent stratified meta-analysis by RCT geography was conducted. The absence of an effect of rehabilitation on length of stay persisted across regions with substantial heterogeneity for Australia (I^2 = 86.26) and Europe (I^2 = 76.47), and heterogeneity which may not be important for the United States of America (I^2 = 18.10%).

Mortality

Rehabilitation did not reduce mortality among older adults with unplanned hospital admission versus comparison after inpatient rehabilitation (12 RCTs including 5,619

participants; Hedges g = -0.09, 95% CI: -0.40, 0.23. I^2 = 4.24, 1 RCT favoured comparison) or 1-12 month follow-up (13 RCTs including 4,366 participants; Hedges' g = -0.12, 95% CI: -0.28, 0.05. I^2 = 0.00), further supported by an RCT from 1 systematic review not included in the meta-analysis[40]. No evidence was detected of small study sample bias.

Table 5. Meta-analyses of the effectiveness of inpatient rehabilitation on function, quality of life, length of stay, discharge destination and mortality, versus comparison, among older adults with unplanned admission to acute care, overall and by treatment ingredient.

	n studies	n total (intervention)	n total (comparison)	Effect size* (95% CI)	Z Score	p	Test for Heterogeneity			Test for small study sample bias†
							Q	I^2	p	p
Functional mobility after inpatient rehabilitation										
overall	**5**	**761**	**733**	**0.10 (-0.04, 0.24)**	**1.38**	**0.17**	**4.36**	**22.30**	**0.36**	**-**
Functional mobility at longest follow-up (4-12 months)										
overall	**2**	**159**	**141**	**0.30 (-0.26, 0.86)**	**1.05**	**0.29**	**3.15**	**68.22**	**0.08**	**-**
ADL after inpatient rehabilitation										
overall	**15**	**1,992**	**1,937**	**0.21 (0.00, 0.42)**	**2.00**	**0.04**	**54.12**	**86.58**	**<0.01**	**0.01**
endurance exercise	4	109	116	0.51 (-0.34, 1.36)	1.18	0.24	27.68	89.43	<0.01	-
strengthening exercise	3	71	65	0.30 (-0.05, 0.64)	1.69	0.09	2.06	5.57	0.36	-
energy applied to soft tissue	3	58	56	0.95 (0.23, 1.66)	2.60	0.01	6.51	70.20	0.04	-
repeated practice activities	7	1,274	1,246	-0.02 (-0.13, 0.10)	-0.27	0.78	7.67	30.29	0.26	-
repeated exercise rehabilitation	3	545	542	0.42 (-0.04, 0.87)	1.80	0.07	7.36	69.94	0.03	-
goals and planning	9	643	613	0.22 (-0.17, 0.61)	1.12	0.26	42.16	90.45	<0.01	-
feedback and monitoring	7	266	262	0.33 (-0.19, 0.84)	1.24	0.21	36.36	88.02	<0.01	-
shaping knowledge	4	362	360	-0.13 (-0.27, 0.02)	-1.73	0.08	3.01	0.00	0.39	-
antecedents	2	762	732	-0.08 (-0.44, 0.28)	-0.46	0.65	3.04	67.16	0.08	-
increased medical care	4	971	932	0.10 (-0.23, 0.43)	0.60	0.55	9.79	85.43	0.02	-
nutritional intervention	2	891	862	0.06 (-0.03, 0.15)	1.25	0.21	0.09	0.00	0.76	-
early intervention	2	215	200	0.35 (-0.23, 0.93)	1.17	0.24	4.86	79.43	0.03	-
ADL at longest follow-up (1-12 months)										
overall	**5**	**649**	**246**	**0.04 (-0.31, 0.38)**	**0.21**	**0.83**	**16.44**	**82.69**	**<0.01**	**-**
Improved ADL after inpatient rehabilitation (categorical)										
overall	**6**	**1,445**	**1,334**	**0.21 (-0.07, 0.49)**	**1.49**	**0.14**	**17.85**	**71.46**	**<0.01**	**-**
Improved ADL at longest follow-up (categorical) (12 months)										
overall	**2**	**333**	**293**	**0.45 (-0.05, 0.96)**	**1.78**	**0.08**	**2.10**	**52.36**	**0.15**	**-**
Walking speed after inpatient rehabilitation										
overall	**5**	**588**	**587**	**0.17 (0.05, 0.28)**	**2.85**	**<0.01**	**6.16**	**0.00**	**0.19**	**-**
strengthening exercise	2	59	56	-0.03 (-0.39, 0.34)	-0.14	0.89	0.09	0.00	0.76	-
repeated exercise rehabilitation	2	509	511	0.53 (-0.34, 1.40)	1.20	0.03	4.80	79.15	0.03	-
Walking endurance after inpatient rehabilitation										
overall	**6**	**173**	**134**	**1.50 (0.39, 2.60)**	**2.66**	**0.01**	**41.35**	**94.40**	**<0.01**	**-**
endurance exercise	3	110	71	2.44 (0.49, 4.38)	2.46	0.01	24.76	95.56	<0.01	-
shaping knowledge	2	95	57	1.51 (0.56, 2.46)	3.11	<0.01	5.97	83.24	0.01	-

	n studies	n total (intervention)	n total (comparison)	Effect size* (95% CI)	Z Score	p	Test for Heterogeneity			Test for small study sample bias†
							Q	I^2	p	p
early intervention	2	49	51	0.51 (0.12, 0.91)	2.56	0.01	0.04	0.00	0.85	-
Walking endurance Pre/post intervention change										
overall	**3**	**69**	**70**	**Log OR: 1.23 (0.68, 1.78)**	**4.36**	**<0.01**	**4.32**	**54.96**	**0.12**	**-**
endurance exercise	2	54	56	Log OR: 0.98 (0.59, 1.37)	4.94	<0.01	0.01	0.00	0.92	-
Lower limb strength after inpatient rehabilitation										
overall	**5**	**130**	**146**	**0.02 (-0.50, 0.55)**	**0.09**	**0.93**	**32.91**	**80.26**	**<0.01**	**-**
Health related quality of life after inpatient rehabilitation										
overall	**5**	**795**	**788**	**-0.15 (-0.37, 0.07)**	**-1.35**	**0.18**	**12.99**	**60.47**	**0.04**	**-**
Health related quality of life at longest follow-up (12 months)										
overall	**2**	**578**	**572**	**0.01 (-0.11, 0.12)**	**0.12**	**0.91**	**0.03**	**0.00**	**0.85**	-
Health related quality of life pre/post intervention change										
overall	**2**	**39**	**39**	**Log OR: -0.40 (-0.84, 0.04)**	**-1.78**	**0.07**	**0.13**	**0.00**	**0.72**	**-**
Length of stay (standardised mean difference)										
overall	**28**	**3461**	**3510**	**MD: -0.54 (-1.32, 0.23)**	**-1.38**	**0.17**	**233.20**	**88.13**	**<0.01**	**<0.001**
Discharge destination: living at home after inpatient rehabilitation										
overall	**11**	**1,914**	**1,837**	**Log OR: 0.47 (0.17, 0.76)**	**3.07**	**<0.01**	**19.03**	**45.95**	**0.04**	**0.22**
repeated practice activities	6	1,551	1,232	Log OR: 0.49 (0.11, 0.87)	2.50	0.01	13.82	60.41	0.02	-
repeated exercise rehabilitation	2	44	31	Log OR: 0.94 (-0.03, 1.90)	1.91	0.06	0.12	0.00	0.73	-
goals and planning	2	55	25	Log OR: 0.83 (0.21, 1.45)	2.63	0.01	1.20	16.44	0.27	-
antecedents	5	1,309	1,208	Log OR: 0.20 (-0.25, 0.64)	0.86	0.39	7.99	47.82	0.09	-
increased medical care	8	1,768	1,683	Log OR: 0.38 (0.04, 0.73)	2.21	0.03	15.47	53.78	0.03	-
early intervention	7	632	647	Log OR: 0.60 (0.20, 1.00)	2.96	<0.01	8.39	27.45	0.21	-
team meetings and care planning	6	1,528	1,421	Log OR: 0.42 (-0.04, 0.88)	1.80	0.07	15.46	65.52	0.01	-
discharge planning	6	1,656	1,580	Log OR: 0.46 (0.09, 0.84)	2.40	0.02	13.59	62.41	0.02	-
nutritional intervention	4	1,414	1,325	Log OR: 0.32 (-0.27, 0.91)	1.07	0.28	13.96	79.34	<0.01	-
Discharge destination: living at home at longest follow-up (3-12 months)										
overall	**2**	**328**	**348**	**Log OR: 0.38 (0.03, 0.74)**	**2.14**	**0.03**	**0.16**	**0.00**	**0.69**	**-**
Mortality after inpatient rehabilitation										
overall	**12**	**2,853**	**2,766**	**Log OR: -0.09 (-0.40, 0.23)**	**-0.55**	**0.58**	**12.62**	**4.24**	**0.32**	**0.09**
Mortality at longest follow-up (1-12 months)										
overall	**12**	**2,108**	**2,120**	**Log OR: -0.12 (-0.28, 0.05)**	**-1.42**	**0.16**	**8.29**	**0.00**	**0.69**	**0.49**

Abbreviations: CI: confidence interval, OR: odds ratio, MD: mean difference * Hedges g unless stated otherwise † for meta-analysis with at least 10 randomised controlled trials.

DISCUSSION

Main findings

We identified 12 systematic reviews of moderate to low quality which included 44 unique RCTs relevant to the current overview. When incorporated in a rehabilitation intervention, we report a large effect of the treatment ingredients *endurance exercise* (exclusively from RCTs of older adults with COPD)*, early intervention* (predominantly from RCTs of older adults after hip fracture) and *shaping knowledge* (exclusively from RCTs of older adults with COPD) on walking endurance after the inpatient stay versus comparison. We also reported beneficial effects of *early intervention*, *repeated practice activities*, *goals and planning*, *increased medical care* and/or *discharge planning* on discharge home. The evidence for effectiveness of treatment ingredients that improve ADL was conflicting. Rehabilitation interventions were not found to be effective for functional mobility, strength, or quality of life, or reduce length of stay or mortality. Therefore, we did not explore the potential role of treatment ingredients for these outcomes.

Interpretation

Given ceaseless drives to decrease inpatient lengths of stay, it is important for clinicians to preferentially select treatment ingredients most likely to improve outcomes at discharge[13]. However, for effective inpatient rehabilitation interventions, previous systematic reviews highlighted a lack of sufficient data to determine the key features of successful interventions[15, 16]. We sought to supplement the existing evidence by exploring the role of individual treatment ingredients in the overall effectiveness of inpatient rehabilitation. We employed Treatment Theory[9-12] as a framework for the identification of treatment ingredients which may contribute to reported effectiveness. Our analyses identified a select few treatment ingredients for consideration by clinicians.

The treatment ingredient *endurance exercise* had a positive effect on walking endurance. This is important as objective quantitative data indicate adults over the age of 65 years take a median of just 468 steps per day during their inpatient stay (no difference by admitting reason or illness severity)[50]. Given the delay between discharge from the inpatient setting to initiation of community rehabilitation, it is important to optimise walking endurance early in rehabilitation[51, 52]. Three RCTs were included in the analysis of *endurance exercise;* all included patients with COPD exacerbations and these favoured the intervention group. The treatment ingredient was comprised of pedal ergometry daily with increased resistance[53], treadmill training twice daily with increasing duration (from 5 to 20 minutes)[54], or walking five times per day[55]. The largest individual effect sizes were noted for walking five times per day, followed by treadmill training twice daily, and then pedal ergometry (Supplementary File 6). A walking program does not require equipment and could be supported by members of the multidisciplinary team[56, 57] as well as formal and informal carers[44] during the inpatient stay. Where staffing levels are low and a walking programme could not be supported, pedal ergometry offers a low-cost alternative which could be completed at the bedside.

With bedrest, muscle strength is lost rapidly at a rate of 5% per day[5]. We found *early intervention* as a treatment ingredient to be effective at increasing endurance and the likelihood of a home discharge when incorporated into inpatient rehabilitation for older adults after an unplanned hospital admission. This is unsurprising given potential for rehabilitation to mitigate hospital-associated deconditioning[46] and prevent discharge to a higher level of care[58]. Most RCTs focused on older adults undergoing surgery for hip fracture (n = 7, 78%) with early intervention defined by mobilisation from bed within the first two days of surgery. This evidence has informed wide acceptance older adults with hip fracture should

receive early mobilisation after surgery with early mobilisation a key performance indicator in national audits[59].

A discharge destination of home was more likely among participants who received interventions which incorporated treatment ingredients of *goals and planning*, *repeated practice of activities*, *increased medical care*, and/or *discharge planning* versus comparison. More specific detail for these treatment ingredients was limited. For example, *repeated practice of activities* often reflected 'ADL training' with no further detail related to the frequency, duration, or type of activities. One RCT specified transfers were practiced twice daily for 30 minutes[60]. Another indicated ADL training was completed twice daily for five days of the week but did not specify which activities were practiced[61].

Comparison with other studies

The findings of the current overview are consistent with those of the underlying systematic reviews which conclude that inpatient rehabilitation can improve functioning[15, 44-46] and the likelihood of discharge to home[15, 17, 45], but has no effect on mortality[17, 45] or length of stay[17, 45, 47] versus comparison (usual care for 95% of RCTs). This current overview does not support previous findings where inpatient rehabilitation led to improvements in quality of life[41, 43], or reductions in length of stay[42] or mortality[15]. This absence of an effect for the current overview may be due to the fact usual care comprised some form of rehabilitation in 29 of the 44 RCTs (2 additional not specified) which may attenuate the estimate of rehabilitation effectiveness between groups.

Limitations

There are several limitations to this overview review. First, we needed to make two protocol changes a) outcome data were extracted at 'end of inpatient rehabilitation', which was a change from our protocol which specified 'on discharge' due to lack of clarity in published

data, and b) we excluded systematic reviews exclusively addressing post-stroke rehabilitation at full text selection due to their often impairment focus (e.g., upper limb motor deficit) that would not be potentially translatable to other admitting diagnoses. Second, where intervention detail was limited, we termed treatment ingredients such as *repeated exercise rehabilitation* where exercise rehabilitation was mentioned but not detailed, *shaping knowledge* where education was specified but not detailed, or *increased medical care* where examples of what 'increased care' may entail were provided but not explicitly measured. This may have led to an underestimation of more specific treatment ingredients. Third, we noted moderate to substantial heterogeneity for several outcomes overall and by treatment ingredient. It was not possible to complete meta-regression across all analyses due to the low number of RCTs[28]. For each analysis, we report the count of RCTs that favoured the comparison to guide the reader in their interpretation of uncertainty due to heterogeneity. Fourth, we attempted to reduce the number of analyses (and risk of multiplicity) by focusing on outcomes which changed following rehabilitation interventions[28]. Nonetheless, there is a risk some of the reported effects may be due to chance alone[28]. Fifth, we stratified meta-analyses by treatment ingredient to explore which treatment ingredients may be more or less effective. We were not able to determine whether potentially ineffective treatment ingredients become effective when combined with other treatment ingredients[10]. Sixth, we defined 'functioning' by body functions and activities and did not evaluate the effect of treatment ingredients on participation as an aspect of functioning [7]. Finally, an overview review only reports on data that have been published, systematically reviewed and/or meta-analysed and includes limitations of included RCTs[62].

Implications for clinical practice and research

The effect of *endurance exercise* on endurance was reflective of three RCTs of older adults with an unplanned admission due to an exacerbation of COPD while the findings from *early*

intervention predominantly reflected older adults with hip fracture. These treatment ingredients should be prioritised for implementation for these patient groups. It may be reasonable to generalise the recommendations to similar groups of older adults with an unplanned admission to hospital. For example, *early intervention* may be generalised to other non-hip fragility fractures [63], and *endurance exercise* to patients admitted with exacerbations of other chronic lung diseases [64]. Whether the recommendations may be generalised to less similar groups require more consideration. For example, in the current overview no systematic reviews included RCTs explicitly focusing on older adults with heart failure. This is likely as most cardiac rehabilitation spans both hospital and community settings (and therefore would be excluded from the current overview). *Endurance exercise* is a key component of most cardiac rehabilitation programmes offered to older adults with heart failure [65]. However, the time at which an endurance programme begin relative to hospital admission is not clear. Given *early intervention* (mobilisation) is recommended for older adults admitted with an exacerbation of heart failure [66] a walking programme with a gradual increase in intensity from early post-admission likely reflects current clinical practice. Whether outcomes would vary for higher dosage and following the use of alternate equipment e.g., cycle ergometers requires additional research.

It was possible to assign treatment ingredients to inpatient rehabilitation interventions. However, for many, the interventions were poorly described limiting exploration of more specific treatment ingredients and/or the ingredient dose. Moreover, the description of usual care comparator groups was limited and those inclusive of rehabilitation could attenuate the between group comparisons for effectiveness. These are not new findings with several previous systematic reviews highlighting the challenges in synthesizing the evidence for rehabilitation interventions[15, 16]. This may have contributed to the observed heterogeneity for some analyses of the current overview. There is a need for more transparent reporting of

rehabilitation interventions in line with established frameworks such as the template for intervention description and replication (TIDieR)[67]. A taxonomy of rehabilitation techniques similar to the taxonomy of behaviour change techniques is required for future analyses by individual treatment ingredients and interactions between ingredients [26].

CONCLUSION

The designation of treatment ingredients to interventions was challenging due to a paucity of detail specified by published interventions. Despite this, we reported the treatment ingredients *early intervention* and *endurance exercise* were effective at improving endurance, and *early intervention*, *goals and planning*, *repeated practice of activities*, *increased medical care*, and/or *discharge planning* effectively increased the likelihood of discharge to home for older adults following an unplanned admission to hospital. Benefits observed were often for subgroups of the older adult population e.g., *endurance exercise* was effective for endurance in older adults with COPD, and *early intervention* was effective for endurance for those with hip fracture. Future research should seek to determine whether the benefits observed from these treatment ingredients are generalisable to older adults more broadly. Further, there is a need for more transparent reporting of rehabilitation intervention treatment ingredients to enable future synthesis and/or replication. Finally, the challenge of making meaningful change during a short period of inpatient rehabilitation emphasizes the importance of comprehensive post-discharge rehabilitation.

LIST OF ABBREVIATIONS

ADL: Activities of daily living

CI: Confidence Interval

OR: Odds ratio

ICF: International classification of functioning

PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analysis

RCT: Randomised controlled trial

AMSTAR: Assessment of Multiple Systematic Reviews

DECLARATIONS OF INTEREST

Ethics approval and consent to participate

Not applicable

Consent for publication

Not applicable

Availability of data and materials

This overview review reflects a synthesis of previously published randomized controlled trials. All data generated or analysed during this study are included in this published article (and its supplementary files).

Competing interests

KS received a grant from UK Research & Innovation Future Leaders Fellowship to support this work. This funding provides salary support for KS, KL, and SG. KS also received funding from the National Institutes of Health Research (NIHR) and Chartered Society of Physiotherapy Charitable Trust for hip fracture health services research. CS, NEF, NW and EG receive funding from the National Institute for Health Research (NIHR). CS and NEF are NIHR Senior Investigators. The views expressed are those of the author(s) and not necessarily those of the NHS, the NIHR or the Department of Health and Social Care. CLG

receives funding from Versus Arthritis (ref 22086). GSdP, SA, IDC, and FCM have no competing interests to declare.

Funding

This work was supported by a UKRI Future Leaders Fellowship [Grant Ref: MR/S032819/1].

Authors' contributions

All authors contributed to the conception and design of the study. In addition, KL, SG, KJS, GSdP, and SA contributed to the acquisition and the analysis of data. All authors contributed to the interpretation of the analysis. KL, SG and KJS drafted the manuscript. All authors critically revised the manuscript. All authors approved the final version for submission.

Acknowledgements

Thank you to Camilla Kristensen, Sofia Hemrage, and Esme Elsden who supported screening, quality appraisal and data extraction respectively.

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SUPPLEMENTARY FILES

Supplementary File 1: Search strategies

Search strategies for electronic databases of published and unpublished evidence.

Supplementary File 2: Citation matrix

Citation matrix detailing the identification of unique (non-overlapping) randomized controlled trials from systematic reviews included in this overview review.

Supplementary File 3: Characteristics of randomized controlled trials

Characteristics of eligible randomized controlled trials identified from systematic reviews included in this overview review.

Supplementary File 4: Treatment ingredients

Treatment ingredients employed by eligible randomized controlled trials identified from systematic reviews included in this overview review.

Supplementary File 5: Meta-analyses results

Results of meta-analyses (forest plot) of randomized controlled trials identified from systematic reviews included in this overview review for functioning, quality of life, length of stay, discharge destination and mortality. Each meta-analysis is accompanied by a table which describes the characteristics of each randomized controlled trial included in each meta-analysis.

Supplementary File 6: Treatment ingredient meta-analyses results

Results of meta-analyses (forest plot) of randomized controlled trials identified from systematic reviews included in this overview review by treatment ingredient.

Supplementary File 7: Narrative results

Results of randomized controlled trials identified from systematic reviews included in this overview review which were not incorporated into the meta-analyses and reasons why they were not incorporated.

Supplementary File 1

Source	Search Strategy
Cochrane Library	#1 MeSH descriptor: [Rehabilitation] explode all trees #2 rehab* #3 MeSH descriptor: [Exercise] explode all trees #4 exercis* #5 MeSH descriptor: [Physical Therapy Modalities] explode all trees #6 physiotherap* #7 OR #2 OE #3 OR #4 OR #5 OR #6 #8 MeSH descriptor: [Inpatients] explode all trees #9 inpatient #10 "acute care" #11 MeSH descriptor: [Subacute Care] this term only #12 subacute care #13 MeSH descriptor: [Subacute Care] this term only #14 postacute care #15 #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 #16 (#1 OR #2 OE #3 OR #4 OR #5 OR #6) AND (#8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14)
MEDLINE	1 exp Rehabilitation/ 2 rehabilitation.m_titl. 3 exp Exercise/ 4 exercise.m_titl. 5 rehab*.mp. 6 exercis*.mp. 7 "physical therap*".mp. 8 1 or 2 or 3 or 4 or 5 or 6 or 7 9 "acute care".mp. 10 exp Subacute Care/ 11 "subacute care".mp. 12 "postacute care".mp. 13 exp Inpatients/ 14 inpatient*mp. 15 9 or 10 or 11 or 12 or 13 or 14 16 exp "Systematic Review"/ 17 "systematic review".mp 18 exp Meta-Analysis/ 19 "meta analys*".mp 20 16 or 17 or 18 or 19 21 8 and 15 and 20
EMBASE	1 exp rehabilitation/ 2 rehab*.mp. 3 exp exercise/ 4 exercise*.mp. 5 exp physiotherapy/ 6 physical therapy.mp. 7 1 or 2 or 3 or 4 or 5 or 6 8 inpatient.mp. 9 exp subacute care/ 10 subacute care.mp. 11 postacute care.mp. 12 acute care.mp. 13 8 or 9 or 10 or 11 or 12 14 exp "systematic review"/ 15 systematic review.mp.

	16 exp meta analysis/ 17 meta analys*mp. 18 14 or 15 or 16 or 17 19 7 and 13 and 18
PsycINFO	1 exp Rehabilitation/ 2 rehabilitation.mp. 3 exp Exercise/ 4 exercise.mp. 5 rehab*.mp. 6 exercis*.mp. 7 exp Physical Therapy/ 8 physiotherapy.mp. 9 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 10 inpatient.mp. 11 acute care.mp. 12 subacute care.mp. 13 exp Hospitalized Patients/ 14 postacute care.mp. 15 10 or 11 or 12 or 13 or 14 16 exp “Systematic Review”/ 17 systematic review.mp. 18 exp Meta Analysis/ 19 meta-analysis.mp. 20 16 or 17 or 18 or 19 21 9 and 15 and 20
PEDRo	'systematic review' with each of: acute care” OR “sub-acute care” OR “subacute care” OR “sub-acute” OR subacute OR “post-acute care” OR “post-acute” OR “postacute care” OR postacute OR inpatient* OR “emergency care” ‘meta-analysis’ with each of: “acute care” OR “sub-acute care” OR “subacute care” OR “sub-acute” OR subacute OR “post-acute care” OR “post-acute” OR “postacute care” OR postacute OR inpatient* OR “emergency care”
OpenGrey	Systematic review Meta-analysis
BASE	systematic review (entire document row) and subj:inpatient*

Supplementary File 2

Review with unique studies	Review Author, Year	RCT Author, Year	Unique RCT?
Yes	Machado 2020	Borges 2014	Yes
		Greulich 2014	Yes
		He 2015	Yes
		Kirsten 1998	Yes
		Liao 2015	Yes
		Lopez-Lopez 2018	Yes
		Lopez-Lopez 2019a	Yes
		Lopez-Lopez 2019b	Yes
		Nava 1998	Yes
		Torres Sanchez 2017	Yes
		Torres Sanchez 2018	Yes
		Torres-Sanchez 2016	Yes
Yes	Peck 2020	Resnick 2016	Yes
Yes	Smith, 2020a	Marcantonio, 2001	Yes
Yes	Smith 2020b	Counsell 2000	Yes
		Landefeld 1995	Yes
		Lenze 2012	Yes
		Timmer 2019	Yes
Yes	Yasmeen 2020	Louie 2012	Yes
Yes	Heldmann 2019	Counsell 2000	No
		He 2015	No
		Huusko 2000	No
		Landefeld 1995	No
		Torres-Sanchez 2017	No
		Abizanda 2011	Yes
		Asplund 2000	Yes
		Barnes 2012	Yes
		Blanc-Bisson 2008	Yes
		Brown 2016	Yes
		Hagsten 2004	Yes
		Jeffs 2013	Yes
		Jones 2006	Yes
		Kimmel 2016	Yes
		Naglie 2002	Yes
		Oldmeadow 2006	Yes
		Prestmo 2015	Yes
		Stenvall 2007	Yes

		Vidan 2005	Yes
No	Hu 2019	Nava 1998	No
No	Talevski, 2019	Naglie 2002	No
		Prestmo 2015	No
		Stenvall 2007	No
		Vidan 2005	No
Yes	Peiris 2018	Kimmel 2016	No
		Peiris 2013	Yes
Yes	Martinez-Velilla 2016	Abizanda 2011	No
		Asplund 2000	No
		Blanc-Bisson 2008	No
		Counsell 2000	No
		Jones 2006	No
		Landefeld 1995	No
		Saltvedt 2002	Yes
		Tibaek 2014	Yes
No	Puhan, 2016	Borges, 2014	No
		He, 2015	No
		Kirsten, 1998	No
		Liao, 2015	No
		Nava, 1998	No
		Tang, 2012	No
Yes	Scrivener 2015	Peiris 2013	No
		Said 2012	Yes
No	Thorne 2014	Stenvall 2007, Olofsson2007	No
No	Fox 2012	Asplund 2000	No
		Barnes 2012	No
		Counsell 2000	No
		Landefeld 1995	No
		Stenvall 2007, Olofsson2007	No
Yes	Handoll, 2011	Oldmeadow, 2016	No
		Baker, 1992	Yes
		Graham, 1968	Yes
		Karumo, 1977	Yes
		Lauridsen, 2002	Yes
		Mitchell, 2001	Yes
Yes	Bachmann 2010	Naglie 2002	No
		Stenvall 2007	No
		Saltvedt 2002	No
		Swanson 1998	Yes
No	Crotty, 2010	Hagsten, 2004	No
No	Van Craen 2010	Counsell 2000	No

		Landefeld 1995	No
		Saltvedt 2002-2006	No
No	Chudyk 2009	Hagsten 2004	No
		Hagsten 2006	No
		Huusko 2000	No
		Lauridsen 2002	No
		Mitchell 2001	No
		Naglie 2002	No
		Swanson 1998	No
No	Handoll, 2009	Huusko, 2002	No
		Naglie, 2002	No
		Stenvall, 2007	No
		Swanson, 1998	No
		Vidan, 2005	No
Yes	De Morton 2007	Asplund 2000	No
		Counsell 2000	No
		Jones 2006	No
		Landefeld 1995	No
		Slaets 1997	Yes
No	Cameron 2000	Naglie 2002	No
		Swanson 1998	No

RCT: randomised controlled trial. RCTs in grey are duplicates. Reviews in grey are reviews with no unique studies after removing duplicates.

Supplementary File 3: Characteristics of 41 unique randomized controlled trials identified from 12 systematic reviews relevant to the current overview review.

Systematic Review	Randomized controlled trial	Population	Sample size I:C*	Intervention	Comparator*	Outcome measure	Follow up
Bachmann 2010	Swanson 1998	Hip fracture I: mean age 78.5 years; gender m:f 11:27; from home 92.1% C: mean age 77.8 years; gender m:f 5:28; from home 87.9%	38:33	Repeated exercise rehabilitation; Team meetings & care planning; Discharge planning; Increased medical care; Early intervention; Home visit	Usual care (Australia). Physiotherapy. Occupational therapy on referral.	Modified Barthel Index, length of stay, discharge destination, mortality	1 month
de Morton 2007	Slaets 1997	Medical admission (referred to Department of General Medicine on admission) mean age 83 years, gender m:f 69:198; from home 72%	140:97	Repeated exercise rehabilitation; Team meetings & care planning; Increased medical care	Usual care (The Netherlands). Services provided by physicians and nurses.	SIVIS dependency scale, length of stay, mortality	
Handoll 2011	Baker 1991	Hip fracture mean age 83.5 years, m:f 0:12	6:6	Endurance exercise; Antecedents	Usual care (Australia) including conventional gait training with ambulatory aids.	walking speed, length of stay	
Handoll 2011	Graham 1968	Hip fracture	141:132	Endurance exercise; Early intervention	Delayed weight bearing until 12 weeks after surgery	12 months	
Handoll 2011	Karumo 1977	Hip fracture mean age 80 years, gender m:f 22:65	39:48	Repeated practice activities (+/- increasing demands); Repeated exercise rehabilitation	Usual care (Finland). Physiotherapy 30 minutes.	length of stay	
Handoll 2011	Lauridsen 2002	Hip fracture mean age 80 years, gender m:f 0:51	20:31	Repeated practice functions (+/- increasing demands); Repeated practice activities (+/- increasing demands)	Usual care (Denmark). Physiotherapy 15-30 minutes per weekday.	length of stay	

Systematic Review	Randomized controlled trial	Population	Sample size I:C*	Intervention	Comparator*	Outcome measure	Follow up
Handoll 2011	Mitchell 2001	Hip fracture mean age 80 years, gender m:f 13:67	40:40	Strengthening exercise; Repeated practice functions (+/-increasing demands)	Usual care (UK). 20 minutes physiotherapy per weekday.	Elderly Mobility Scale, Barthel Index, walking speed, Nottingham Power Rig leg extensor power (watts)	16 weeks
Heldmann 2019	Abizanda 2011	Medical admission (acute medical illness e.g., pneumonia or exacerbation of previous chronic condition) mean age 84 years, gender m:f 187:227	198:202	Repeated practice activities (+/- increasing demands); Goals and planning; Shaping knowledge; Cognitive orientation exercise	Usual care (Spain). Includes physiotherapy.	Barthel Index, length of stay	
Heldmann 2019	Asplund 2000	Medical admission (main presenting symptoms of chest pain, other pain, dyspnea, nausea/vomiting, vertigo) mean age 81 years, gender m:f 162:251	190:223	Early intervention; Discharge planning; Increased medical care	Usual care (Sweden). Physiotherapy and occupational therapy not routinely available.	Discharge destination, mortality	3 months
Heldmann 2019	Barnes 2012	Medical admission (acute medical illness including pulmonary, gastrointestinal, cardiovascular, infection, neurological) mean age 80.6 years, gender m:f 538:1094, from home 84%	858:774	Repeated practice activities (+/- increasing demands); Antecedents; Team meetings & care planning; Discharge planning; Increased medical care; Nutritional intervention	Usual care (USA). Physiotherapy if referred.	Katz ADL Index, discharge destination, mortality	
Heldmann 2019	Blanc-Bisson 2008	Medical admission (admitted to acute-care geriatric medicine unit) mean age 85 years, gender m:f 21:55	38:38	Strengthening exercises; Repeated practice functions	Usual care (France). Physiotherapy.	Katz ADL	
Heldmann 2019	Brown 2016	Medical admission (admitted to medical wards, common diagnoses included pneumonia, heart facilure and COPD) mean age 74 years, gender m:f 97:3	50:50	Endurance exercise; Goals and planning; Feedback and monitoring	Usual care (USA). Allied health if referred.	modified Katz ADL Index, length of stay	

Systematic Review	Randomized controlled trial	Population	Sample size I:C*	Intervention	Comparator*	Outcome measure	Follow up
Heldmann 2019	Hagsten 2004	Hip fracture mean age 80 years, gender m:f 20:80	50:50	Repeated practice activities; Shaping knowledge; Home visit	Usual care (Sweden). Physiotherapy.	Modified Klein-Bell ADL Scale;	
Heldmann 2019	Jeffs 2013	Medical admission (admitted to medical unit) mean age 79 years, gender m:f 308:340	305:343	Strengthening exercise; Feedback and monitoring; Shaping knowledge; Cognitive orientation exercise	Usual care (Australia). Allied health if referred.	length of stay	
Heldmann 2019	Jones 2006	Medical admission (admitted to general medical ward) mean age 82 years, gender m:f 68:92	80:80	Strengthening exercise; Repeated practice activities (+/- increasing demands)	Usual care (Australia). Standard physiotherapy.	length of stay, discharge destination, mortality	
Heldmann 2019	Kimmel 2016	Hip fracture mean age 81 years, gender m:f 33:59	46:46	Repeated exercise rehabilitation	Usual care (Australia). Daily physiotherapy.	Timed Up and Go, length of stay, discharge destination	
Heldmann 2019	Naglie 2002	Hip fracture mean age 84 years, gender m:f 56:223	141:138	Repeated practice activities (+/- increasing demands); Feedback and monitoring; Shaping knowledge; Team meetings & care planning; Discharge planning; Increased medical care; Early intervention; Home visit	Usual care (Canada). Physiotherapy if referred. Occupational therapy rarely.	length of stay, discharge destination, mortality	6 months
Heldmann 2019	Oldmeadow 2006	Hip fracture I: mean age 78.8 years, gender m:f 8:21 C: mean age 80.8 years, gender m:f 11:20	29:31	Early intervention	Delayed assisted ambulation to post op day 3 or 4	Mean walking distance at 7 days (metres), length of stay, discharge destination, mortality	
Heldmann 2019	Prestmo 2015	Hip fracture I: mean age 83.4 years, gender m:f 53:145, from home alone 58%	198:199	Repeated practice activities (+/- increasing demands); Goals and planning; Team meetings & care planning; Discharge planning; Increased medical care; Nutritional intervention; Early intervention	Usual care (Norway). Physiotherapy according to guidelines. No	Timed Up and Go, Barthel Index, EQ-5D, length of stay, discharge destination	12 months

Systematic Review	Randomized controlled trial	Population	Sample size I:C*	Intervention	Comparator*	Outcome measure	Follow up
		C: mean age 83.2 years, gender m:f 51:148, from home alone 48%			occupational therapists.		
Heldmann 2019	Stenvall 2007	Hip fracture mean age 82 years, gender m:f 51:148, from home 36.7%	102:97	Endurance exercise; Repeated practice activities (+/- increasing demands); Goals and planning; Shaping knowledge; Team meetings & care planning; Increased medical care; Nutritional intervention; Early intervention	Usual care (Sweden). Exercise rehabilitation with daily physiotherapy and occupational therapy as needed.	Less dependent, based on Katz Index, length of stay, mortality	12 months
Heldmann 2019	Vidan 2005	Hip fracture mean age 82 years, gender m:f 59:260, from home alone 84.3%	155:164	Repeated exercise rehabilitation; Antecedents; Team meetings & care planning; Increased medical care	Usual care (Spain) Physiotherapy. Occupational therapy not available.	length of stay, mortality	12 months
Machado 2020	Borges 2014	COPD I: mean age 64.1 years, gender m:f 8:7 C:mean age 67.8 years, gender m:f 10:4	15:14	Repeated practice functions (+/-increasing demands); Shaping knowledge; Comparison of behavior	Usual care (Brazil). Chest physiotherapy and advice re physical activity.	Change in 6-minute walk test, St George's Respiratory Questionnaire	
Machado 2020	Greulich 2014	COPD I:mean age 66.4 years, gender m:f 14:6 C: mean age 70.4 years, gender m:f 12:8	20:20	Energy applied to soft tissue; Early intervention	Usual care (Germany). 20 minutes physiotherapy.	6-minute walk test (metres), Chair rising test, St George's Respiratory Questionnaire, length of stay	
Machado 2020	He 2015	COPD I:mean age 69.2 years, gender m:f 6:60 C: mean age 73.9 years, gender m:f 5:23	66:28	Strengthening exercise; Endurance exercise; Energy applied to soft tissue; Breathing related exercise/training; Shaping knowledge; Natural consequences	Usual care (China)	6-minute walk test (metres)	
Machado 2020	Kirsten 1998	COPD	15:14	Endurance exercise	Usual care (Germany). No regular exercise,	6-minute walk test (metres)	

Systematic Review	Randomized controlled trial	Population	Sample size I:C*	Intervention	Comparator*	Outcome measure	Follow up
		I: mean age 62.3 years, gender m:f 12:3 C: mean age 65.6 years, gender m:f 14:0			walking assessments on 4 days.		
Machado 2020	Liao 2015	COPD I:mean age 68 years, gender m:f 16:14 C: mean age 70 years, gender m:f 21:10	30:31	Endurance exercise; Breathing related exercise/ training; Shaping knowledge; Natural consequences; Nutritional intervention	Usual care (Taiwan). Health education, monitoring of vital signs and symptoms, assessing nutritional status, and nasal oxygen therapy	Change in 6-minute walk test	
Machado 2020	Lopez-Lopez 2018 (1)	COPD I:mean age 62.8 years, gender m:f 11:3 C: mean age 64.3 years, gender m:f 10:2	14:12	Energy applied to soft tissue	Usual care (Spain). Medical care alone.	London Chest Activity of Daily Living Score, 5-times sit to stand, length of stay	
Machado 2020	Lopez-Lopez 2018 (2)	COPD I:mean age 63.9 years, gender m:f 10:3 C: mean age 64.3, years, gender m:f 10:2	13:12	Strengthening exercise	Usual care (Spain). Medical care alone.	5-times sit to stand, London Chest Activity of Daily Living Score, length of stay	
Machado 2020	Lopez-Lopez 2019a (1)	COPD I: mean age 71.2 years C:mean age 71.35 years	22:22	Endurance exercise; Energy applied to soft tissue; Goals and planning; Feedback and monitoring	Usual care (Spain). Medical care alone.	Functional Independence Measure, 5-times sit to stand, EQ-5D, length of stay	
Machado 2020	Lopez-Lopez 2019a (2)	COPD I: mean age 72.63 years C: mean age 71.35 years	22:22	Endurance exercise; Energy applied to soft tissue; Goals and planning; Feedback and monitoring	Usual care (Spain). Medical care alone.	Functional Independence Measure, 5-times sit to stand, EQ-5D, length of stay	

Systematic Review	Randomized controlled trial	Population	Sample size I:C*	Intervention	Comparator*	Outcome measure	Follow up
Machado 2020	Lopez-Lopez 2019b (1)	COPD I: mean age: 71.7 years C: mean age 68.5 years	15:16	Energy applied to soft tissue; Repeated practice functions (+/-increasing demands)	Usual care (Spain). Medical care alone.	length of stay	
Machado 2020	Lopez-Lopez 2019b (2)	COPD I: mean age 68.6 years C: mean age 68.5 years	17:16	Energy applied to soft tissue; Breathing related exercise/ training; Repeated practice functions (+/-increasing demands); Goals and planning; Feedback and monitoring; Shaping knowledge; Natural consequences	Usual care (Spain). Medical care alone.	length of stay	
Machado 2020	Nava 1998	COPD mean age 66 years; m:f 51:29	60:20	Strengthening exercise; Endurance exercise; Breathing related exercise/training	Usual care (Italy). Progressive ambulation programme.	6-minute walk test	
Machado 2020	Torres-Sanchez 2016	COPD I: mean age 72.4 years, gender m:f 24:0 C: mean age 73.7 years, gender m:f 23:2	24:25	Endurance exercise; Shaping knowledge	Usual care (Spain). Medical care alone.	2-minutes step in place test (number of repetitions), EQ-5D, length of stay	
Machado 2020	Torres-Sanchez 2017	COPD I: mean age: 75.7 years, gender m:f 22:7 C: mean age 72.1 years, gender m:f 20:9	29:29	Endurance exercise; Shaping knowledge	Usual care (Spain). Medical care alone.	Steps per day, 30-second sit to stand (number of repetitions), length of stay	
Machado 2020	Torres-Sanchez 2018 (1)	COPD I: mean age 75.1 years, gender m:f 28:2 C: mean age 71.1 years, gender m:f 24.6	30:30	Breathing related exercise/ training; Repeated practice functions (+/-increasing demands); Feedback and monitoring	Usual care (Spain). Medical care alone.	EQ-5D, length of stay	

Systematic Review	Randomized controlled trial	Population	Sample size I:C*	Intervention	Comparator*	Outcome measure	Follow up
Martinez-Velilla, 2016	Saltvedt 2002	Medical admission (admitted to Internal Medicine) I: mean age 81.4 years, gender m:f 46:81, from home 91% C: mean age 82.4 years, gender m:f 43:84, from home 87%	127:127	Shaping knowledge; Antecedents; Team meetings & care planning; Discharge planning; Increased medical care; Early intervention; Home visit	Usual care (Norway), Allied health if referred.	mortality	12 months
Martinez-Velilla 2016	Tibaek 2014	Older adult (admitted to the Department of Geriatric Rehabilitation, diagnoses included cancer, lung disease, falls, fracture or allopathic in lower extremities, stroke, Parkinsons disease, pancreatitis, heart disease, medicine disease, back disease) I: mean age 80 years C: mean age 79 years gender m:f 30:41, from home alone 62%	36:35	Strengthening exercise	Usual care (Denmark). Physiotherapy.	Barthel Index, 10-metre walk test	
Peck 2020	Resnick 2016	Orthopaedic trauma mean age 80 years, gender m:f 30:59	50:39	Repeated practice activities (+/- increasing demands); Goals and planning; Feedback and monitoring; Shaping knowledge; Antecedents; Increased medical care	Usual care (USA) plus education.	Physical Performance and Mobility Examination, Barthel Index, discharge destination, mortality	1 month
Peiris 2018	Peiris 2013	Medical admission (orthopaedic, pain, cardiac/pulmonary, neurological, other disabling impairment) I: mean age 75 years, gender m:f 188:308, from home 94% C: mean age 74 years, gender m:f 171:329, from home 93%	496:500	Repeated exercise rehabilitation	Usual care (Australia). Physiotherapy weekdays.	Timed Up and Go, Functional Independence Measure, 10-metre walk test, EQ-5D, length of stay	12 months

Systematic Review	Randomized controlled trial	Population	Sample size I:C*	Intervention	Comparator*	Outcome measure	Follow up
Scrivener 2015	Said 2012	Older adult (musculoskeletal, cardiac/respiratory, other surgical, neurological, falls/functional decline) I: mean age 80.8 years, gender m:f 9:13 C: mean age 81.6 years, m:f 15:10	22:25	Endurance exercise; Repeated practice activities (+/- increasing demands)	Usual care (Australia). Physiotherapy 1-2 sessions on weekdays.	Barthel Index, length of stay	3 months
Smith 2020a	Marcantonio 2001	Hip fracture I: mean age 78 years, gender m:f 13:49 C: mean age 80 years, gender m:f 14:50	62:64	Antecedents; Increased medical care; Nutritional intervention; Early intervention	Usual care (USA). Medical care.	length of stay, discharge destination	
Smith 2020b	Lenze 2012	Medical admission (cardiovascular problem, stroke, hip fracture, cervical spine fusion, colectomy, tibial fracture) I: mean age 80.2 years, gender m:f 4:10 C: mean age 75.7 years, gender m:f 2:10	14:12	Repeated exercise rehabilitation; Goals and planning; Feedback and monitoring	Usual care (USA). Physiotherapy and occupational therapy.	Barthel Index, walking speed, 6 minute walk test	
Smith 2020b	Counsell 2020	Medical admission (cardiac, infection, pulmonary, neurological, gastrointestinal, diabetes, failure to thrive) I: mean age 80 years, gender m:f 305:462, from home 100% C: mean age 79 years, gender m:f 300:464, from home 100%	767:764	Repeated practice activities (+/- increasing demands); Antecedents; Team meetings & care planning; Discharge planning; Increased medical care; Nutritional intervention	Usual care (USA). Medical care.	Independent Activities of Daily Living, modified Katz ADL Index, length of stay, mortality	3 months
Smith 2020b	Timmer 2019	Medical admission (respiratory, general medicine, digestive, circulatory, kidney)	51:48	Repeated practice activities (+/- increasing demands); Goals and planning; Feedback and monitoring; Social support; Shaping knowledge; Natural consequences	Usual care (Australia) plus a brief activity pacing education.	Functional Independence Measure, length of stay, mortality	3 months

Systematic Review	Randomized controlled trial	Population	Sample size I:C*	Intervention	Comparator*	Outcome measure	Follow up
		I: mean age 80 years, gender m:f 14:37, from home 63% C: mean age 81 years, gender m:f 12:37, from home 57%			Physiotherapy and occupational therapy.		
Smith 2020b	Landefeld 1995	Medical admission (cardiac, neurological, infection, pulmonary, gastrointestinal, diabetes, failure to thrive) I: mean age 80.2 years, gender m:f 104:223, from home 93% C: mean age 80.1 years, gender m:f 112:212, from home 91%	327:324	Repeated practice activities (+/- increasing demands); Antecedents; Team meetings & care planning; Discharge planning; Increased medical care; Nutritional intervention	Usual care (USA). Physiotherapy.	Katz ADL Index, length of stay, discharge destination, mortality	3 months
Yasmeen 2020	Louie 2012	Hip fracture I: mean age 77.81 years, gender m:f 11:52 C: mean age 78.7 years, gender m:f 14:57	63:71	Repeated practice activities (+/- increasing demands); Goals and planning; Feedback and monitoring; Social support; Shaping knowledge; Natural consequences; Comparison of behavior	Usual care (Hong Kong, China). Hip fracture protocol including ADL training.	Functional Independence Measure (motor scores)	

I:C = intervention: control. m: f = male: female. ADL = activities of daily living. COPD = chronic obstructive pulmonary disease. EQ-5D = EuroQol 5 dimensions. SIVIS = the Health Care Information Center Foundation.

*comparator and extent to which exercise/professionals who prescribe exercise were involved in the usual care arm.

Supplementary File 4

Review author, year	RCT author, year	Population	ORGAN FUNCTIONS			
			Strengthening exercise	Endurance exercise	Energy applied to soft tissue	Breathing related exercise/ training
Handoll, 2011	Baker, 1991	hip fracture	0	1	0	0
	Graham, 1968	hip fracture	0	1	0	0
	Mitchell, 2001	hip fracture	1	0	0	0
Heldmann, 2019	Stenvall, 2007	hip fracture	0	1	0	0
	Blanc-Bisson, 2008	medical admission	1	0	0	0
	Brown, 2016	medical admission	0	1	0	0
	Jeffs, 2013	medical admission	1	0	0	0
	Jones, 2006	medical admission	1	0	0	0
Machado, 2020	Greulich, 2014	copd	0	0	1	0
	Torres-Sanchez, 2017	copd	0	1	0	0
	Torres-Sanchez 2016	copd	1	0	0	1
	Lopez-Lopez 2019a (1)	copd	0	1	1	0
	Lopez-Lopez 2019a (2)	copd	0	1	1	0
	Lopez-Lopez 2019b (1)	copd	0	0	1	0
	Lopez-Lopez 2019b (2)	copd	0	0	1	1
	Torres-Sanchez 2018 (1)	copd	0	0	0	1
	Torres-Sanchez 2018 (2)	copd	1	0	0	0
	Lopez-Lopez 2018 (1)	copd	0	0	1	0
	Lopez-Lopez 2018 (2)	copd	1	0	0	0
	Borges, 2014	copd	1	0	0	0
	He, 2015	copd	1	1	0	1
	Kirsten, 1998	copd	0	1	0	0
	Liao, 2015	copd	0	1	0	1
	Nava, 1998	copd	1	1	0	1
	Tang, 2012	copd	1	1	0	0
Martinez-Vellilla, 2016	Tibaek 2014	older adult	1	0	0	0
Scrivener, 2015	Said, 2012	older adult	0	1	0	0
Total			**12**	**13**	**7**	**6**

Review Author, year	RCT author, year	Population	SKILLS AND HABITS		
			Repeated practice functions (+/- increasing demands)	Repeated practice activities (+/- increasing demands)	Repeated exercise rehabilitation, detail not specified
Bachmann, 2010	Swanson, 1998	hip fracture	0	0	1
de Morton, 2007	Slaets 1997	medical admission	0	0	1
Handoll, 2011	Karumo, 1977	hip fracture	1	1	0
	Lauridsen, 2002	hip fracture	1	1	0
	Mitchell, 2001	hip fracture	1	0	0
Heldmann, 2019	Hagsten, 2004	hip fracture	0	1	0
	Counsell 2000	medical admission	0	1	0
	Landefeld 1995	medical admission	0	1	0
	Naglie, 2002	hip fracture	0	1	0
	Stenvall, 2007	hip fracture	0	1	0
	Vidan, 2005	hip fracture	0	0	1
	Kimmel, 2016	hip fracture	0	0	1
	Abizanda, 2011	medical admission	0	1	0
	Blanc-Bisson, 2008	medical admission	1	0	0
	Jones, 2006	medical admission	0	1	0
	Barnes, 2012	medical admission	0	1	0
	Prestmo, 2015	hip fracture	0	1	0
Machado, 2020	Torres-Sanchez 2016	copd	1	0	0
	Lopez-Lopez 2019b (1)	copd	1	0	0
	Lopez-Lopez 2019b (2)	copd	1	0	0
	Torres-Sanchez 2018 (1)	copd	1	0	0
Peck,2020	Resnick, 2016	orthopaedic trauma	0	1	0
Peiris, 2018	Peiris, 2013	medical admission	0	0	1
Scrivener, 2015	Said, 2012	older adult	0	1	0
Smith, 2020b	Lenze, 2012	medical admission	0	0	1
Smith, 2020b	Timmer, 2019	medical admission	0	1	0
Yasmeen, 2020	Louie, 2012	hip fracture	0	1	0
Total			**8**	**15**	**6**

Review author, year	RCT author, year	Population	CHANGING BEHAVIOUR						
			Goals and planning	Feedback and monitoring	Social support	Shaping knowledge	Natural consequences	Comparison of behaviour	Antecedents
Handoll, 2011	Baker, 1991	hip fracture	0	0	0	0	0	0	1
Heldmann, 2019	Hagsten, 2004	hip fracture	0	0	0	1	0	0	0
	Counsell 2000	medical admission	0	0	0	0	0	0	2
	Landefeld 1995	medical admission	0	0	0	0	0	0	2
	Naglie, 2002	hip fracture	0	1	0	1	0	0	0
	Stenvall, 2007	hip fracture	1	0	0	1	0	0	0
	Vidan, 2005	hip fracture	0	0	0	0	0	0	1
	Abizanda, 2011	medical admission	1	0	0	1	0	0	0
	Brown, 2016	medical admission	1	1	0	0	0	0	0
	Jeffs, 2013	medical admission	0	1	0	1	0	0	0
	Barnes, 2012	medical admission	0	0	0	0	0	0	2
	Prestmo, 2015	hip fracture	1	0	0	0	0	0	0
	Torres-Sanchez, 2017	copd	0	0	0	1	0	0	0
	Torres-Sanchez 2016	copd	0	1	0	1	0	0	0
	Lopez-Lopez 2019a (1)	copd	0	1	0	0	0	0	0
	Lopez-Lopez 2019a (2)	copd	0	1	0	0	0	0	0
	Lopez-Lopez 2019b (2)	copd	1	2	0	1	1	0	0
	Torres-Sanchez 2018 (1)	copd	0	1	0	0	0	0	0
	Torres-Sanchez 2018 (2)	copd	0	1	0	0	0	0	0
	He, 2015	copd	0	0	0	1	1	0	0
	Liao, 2015	copd	0	0	0	2	1	0	0
Martinez-Vellilla, 2016	Saltvedt 2002	medical admission	0	0	0	1	0	0	1
	Saltvedt 2006	medical admission	0	0	0	1	0	0	1
Peck,2020	Resnick, 2016	orthopaedic trauma	1	1	0	1	1	0	1
Smith,2020	Marcantonio,2001	hip fracture	0	0	0	0	0	0	1
Smith, 2020b	Lenze, 2012	medical admission	2	1	0	0	0	0	0
	Timmer, 2019	medical admission	1	1	1	1	0	0	0

Yasmeen, 2020	Louie, 2012	hip fracture	2	1	1	1	1	1	0
Total			**11**	**14**	**2**	**16**	**5**	**1**	**12**

Review author, year	**RCT author, year**	**Population**	**OTHER INTERVENTION COMPONENTS**						
			Cognitive orientation exercise	**Team meetings & care planning**	**Discharge planning**	**Increased medical care**	**Nutritional intervention**	**Early intervention**	**Home visit**
Bachmann 2010	Swanson, 1998	hip fracture	0	1	1	1	0	1	1
de Morton, 2007	Slaets 1997	medical admission	0	1	0	1	0	0	0
Handoll, 2011	Graham, 1968	hip fracture	0	0	0	0	0	1	0
Heldmann, 2019	Hagsten, 2004	hip fracture	0	0	0	0	0	0	1
	Asplund 2000	medical admission	0	0	1	1	0	1	0
	Counsell 2000	medical admission	0	1	1	1	1	0	0
	Landefeld 1995	medical admission	0	1	1	1	1	0	0
	Naglie, 2002	hip fracture	0	1	1	1	0	1	1
	Stenvall, 2007	hip fracture	0	1	0	1	1	1	0
	Vidan, 2005	hip fracture	0	1	0	1	0	0	0
	Oldmeadow, 2006	hip fracture	0	0	0	0	0	1	0
	Abizanda, 2011	medical admission	1	0	0	0	0	0	0
	Blanc-Bisson, 2008	medical admission	0	0	0	0	1	1	0
	Jeffs, 2013	medical admission	1	0	0	0	0	0	0
	Barnes, 2012	medical admission	0	1	1	1	1	0	0
	Prestmo, 2015	hip fracture	0	1	1	1	1	1	0
Machado, 2020	Greulich, 2014	copd	0	0	0	0	0	1	0
	Liao, 2015	copd	0	0	0	0	1	0	0

Martinez-Vellilla, 2016	Saltvedt 2002	medical admission	0	1	1	1	0	1	1
	Saltvedt 2006	medical admission	0	1	1	1	0	1	1
Peck,2020	Resnick, 2016	orthopaedic trauma	0	0	0	1	0	0	0
Smith,2020	Marcantonio,2001	hip fracture	0	0	0	1	1	1	0
Total			**2**	**11**	**9**	**14**	**8**	**12**	**5**

COPD = chronic obstructive pulmonary disease

SUPPLEMENTARY FILE 5

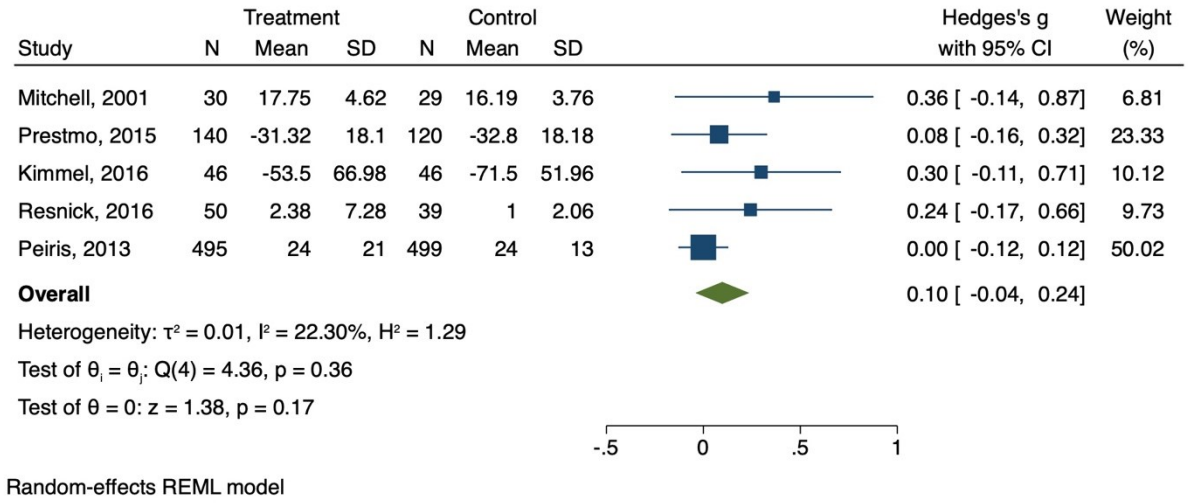
List of meta-analyses:

1. Inpatient rehabilitation vs. comparator on functional mobility after inpatient rehabilitation.
2. Inpatient rehabilitation vs. comparator on functional mobility at follow up.
3. Inpatient rehabilitation vs. comparator on activities of daily living after inpatient rehabilitation.
4. Inpatient rehabilitation vs. comparator on activities of daily living at follow up.
5. Inpatient rehabilitation vs. comparator on maintained or improved activities of daily living after inpatient rehabilitation.
6. Inpatient rehabilitation vs. comparator on maintained or improved activities of daily living at follow up.
7. Inpatient rehabilitation vs. comparator on walking speed after inpatient rehabilitation.
8. Inpatient rehabilitation vs. comparator on walking endurance after inpatient rehabilitation.
9. Inpatient rehabilitation vs. comparator on walking endurance pre/post intervention.
10. Inpatient rehabilitation vs. comparator on lower limb strength after inpatient rehabilitation.
11. Inpatient rehabilitation vs. comparator on health-related quality of life after inpatient rehabilitation.
12. Inpatient rehabilitation vs. comparator on health-related quality of life at follow up.
13. Inpatient rehabilitation vs. comparator on health-related quality of life pre post intervention change scores.
14. Inpatient rehabilitation vs. comparator on length of stay.
15. Inpatient rehabilitation vs. comparator on length of stay, by region.
16. Inpatient rehabilitation vs. comparator on discharge destination of home after inpatient rehabilitation.
17. Inpatient rehabilitation vs. comparator on final discharge destination of home.
18. Inpatient rehabilitation vs. comparator on mortality after inpatient rehabilitation.
19. Inpatient rehabilitation vs. comparator on mortality at follow up.

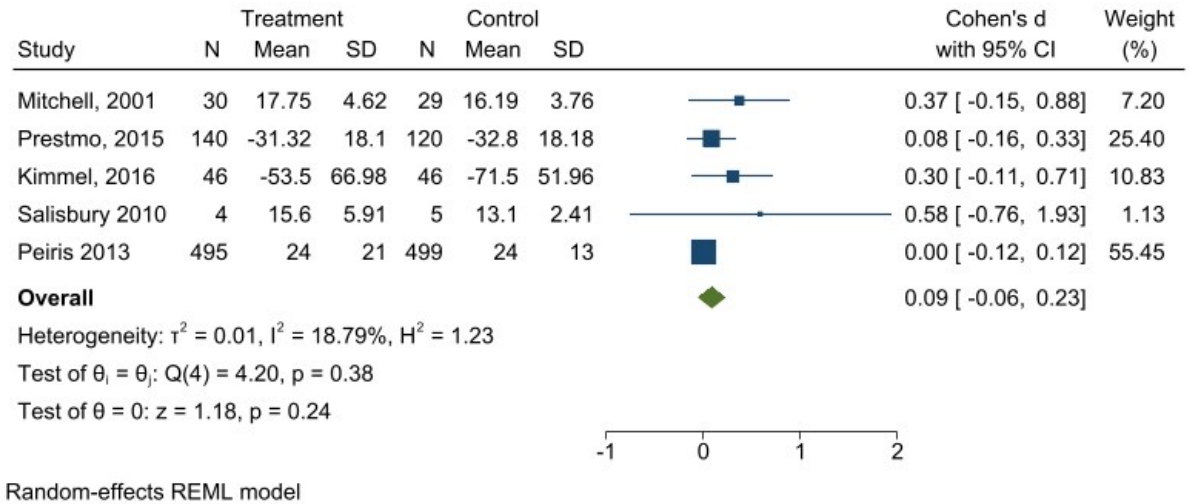
INPATIENT REHABILITATION VERSUS COMPARATOR ON FUNCTIONAL MOBILITY AFTER INPATIENT REHABILITATION.

Systematic Review	Randomized controlled trial	Population	Intervention	Comparator	Outcome measure
Handoll 2011	Mitchell 2001	Hip fracture	Strengthening exercise; Repeated practice functions (+/- increasing demands)	Usual care (UK). 20 minutes physiotherapy per weekday.	Elderly Mobility Scale
Heldmann 2019	Prestmo 2015	Hip fracture	Repeated practice activities (+/- increasing demands); Goals and planning; Team meetings & care planning; Discharge planning; Increased medical care; Nutritional intervention; Early intervention	Usual care (Norway). Physiotherapy according to guidelines. No occupational therapists.	Timed Up and Go
Heldmann 2019	Kimmel 2016	Hip fracture	Repeated exercise rehabilitation	Usual care (Australia). Daily physiotherapy.	Timed Up and Go
Peck 2020	Resnick 2016	Orthopaedic trauma	Repeated practice activities (+/- increasing demands); Goals and planning; Feedback and monitoring; Shaping knowledge; Antecedents; Increased medical care	Usual care (USA), plus education	Physical Performance and Mobility Examination

Peiris 2018	Peiris 2013	Medical admission	Repeated exercise rehabilitation	Usual care (Australia). Physiotherapy weekdays.	Timed Up and Go

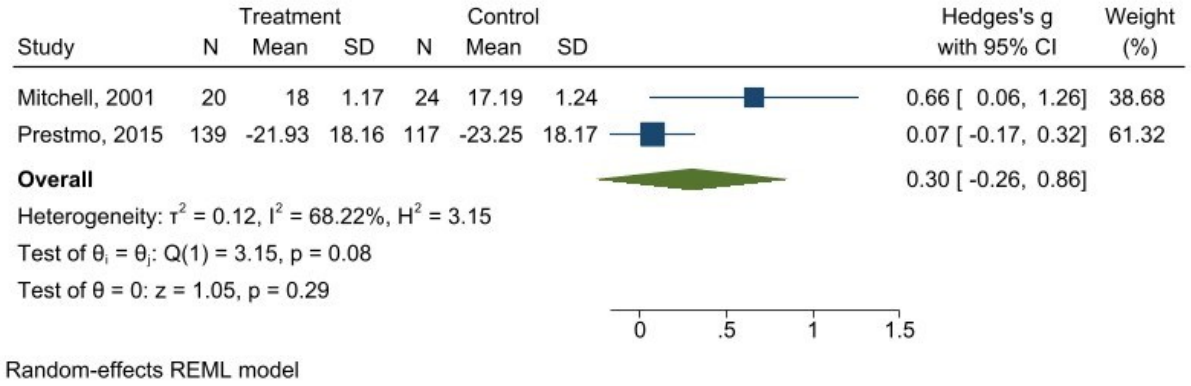


With removal of RCT from systematic review of critically low quality



INPATIENT REHABILITATION VERSUS COMPARATOR ON FUNCTIONAL MOBILITY AT FOLLOW UP

Systematic Review	Randomized controlled trial	Population	Intervention	Comparator	Outcome measure	Length of follow up
Handoll 2011	Mitchell 2001	Hip fracture	Strengthening exercise; Repeated practice functions (+/- increasing demands)	Usual care (UK). 20 minutes physiotherapy per weekday.	Elderly Mobility Scale	16 weeks
Heldmann 2019	Prestmo 2015	Hip fracture	Repeated practice activities (+/- increasing demands); Goals and planning; Team meetings & care planning; Discharge planning; Increased medical care; Nutritional intervention; Early intervention	Usual care (Norway). Physiotherapy according to guidelines. No occupational therapists.	Timed Up and Go	12 months

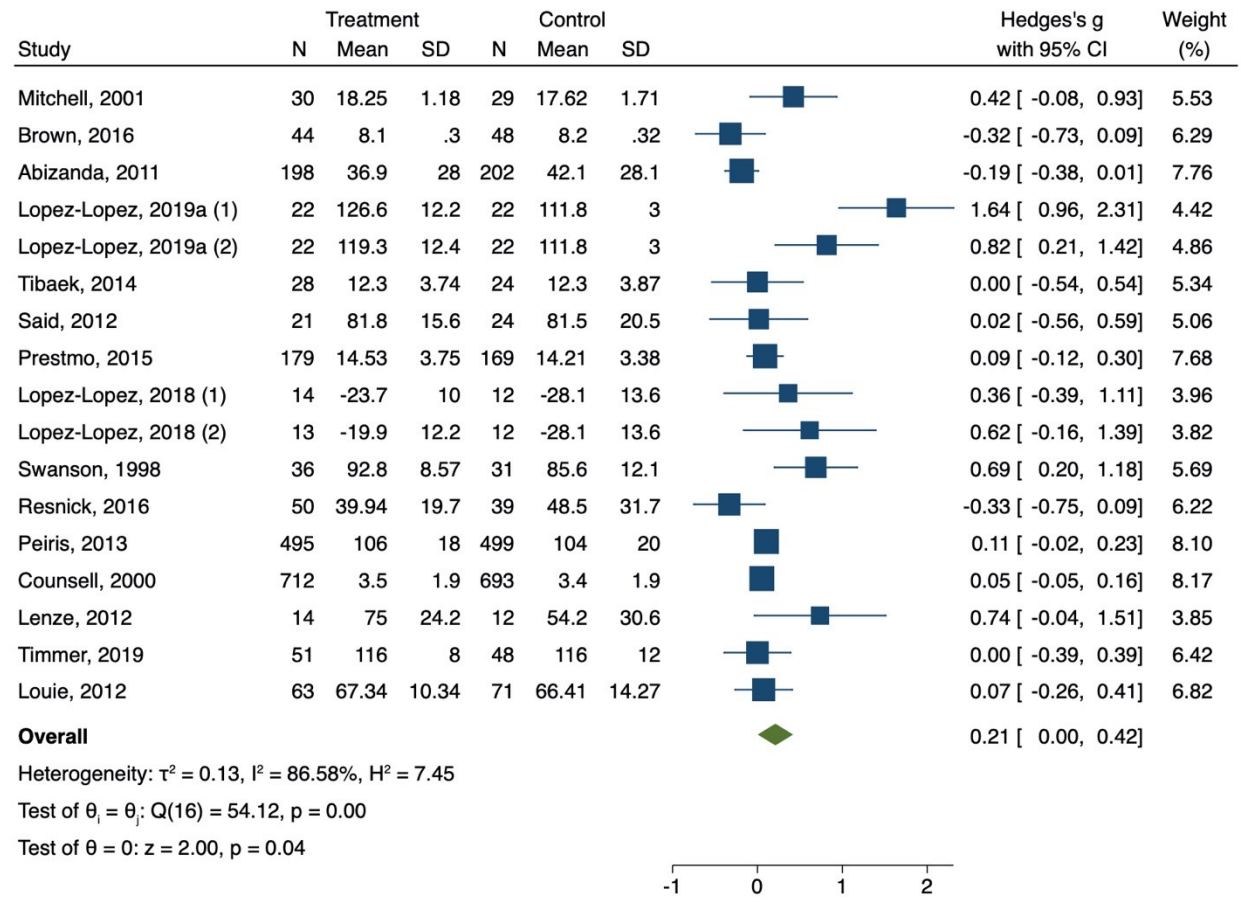


INPATIENT REHABILITATION VERSUS COMPARATOR ON ACTIVITIES OF DAILY LIVING AFTER INPATIENT REHABILITATION.

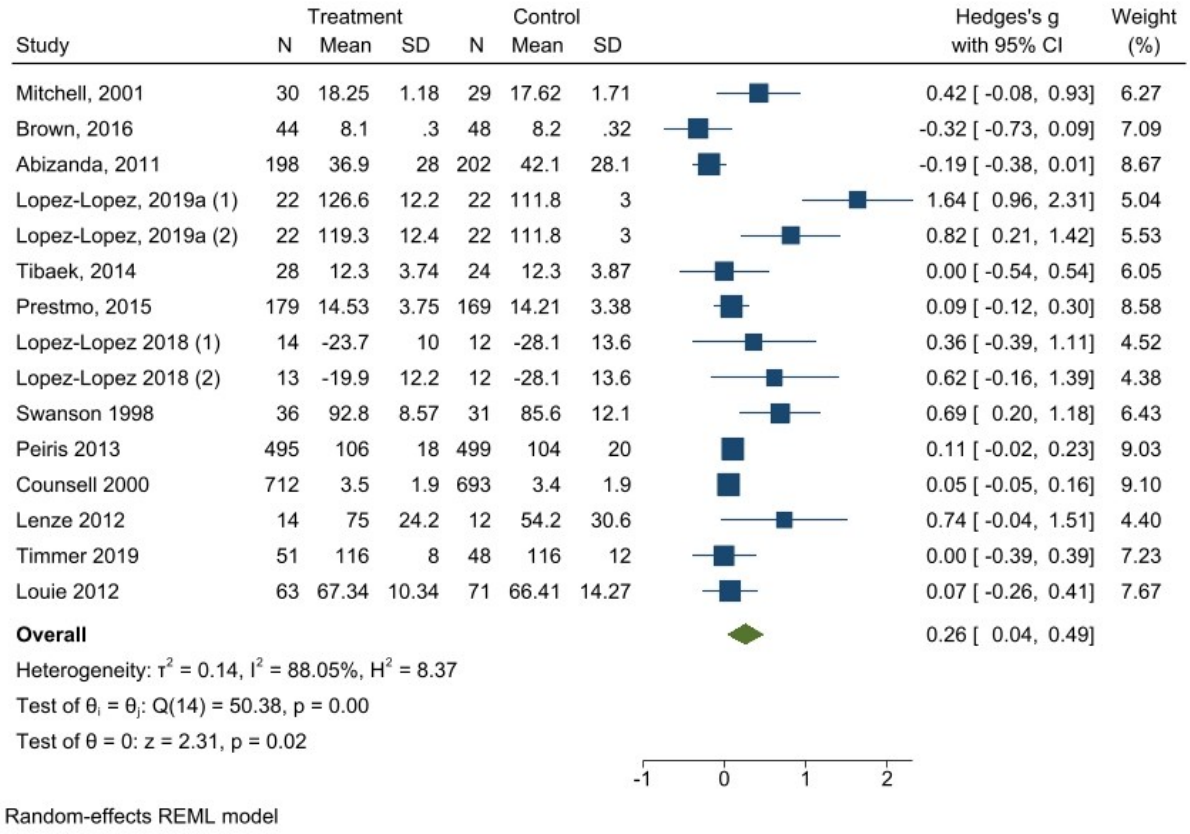
Systematic review	Randomized controlled trial	Population	Intervention	Comparator	Outcome measure
Handoll 2011	Mitchell 2001	Hip fracture	Strengthening exercise; Repeated practice functions (+/-increasing demands)	Usual care (UK). 20 minutes physiotherapy per weekday.	Barthel Index
Heldmann 2019	Brown 2016	Medical admission	Endurance exercise; Goals and planning; Feedback and monitoring	Usual care (USA). Allied health if referred.	modified Katz Activities of Daily Living Index
Heldmann 2019	Abizanda 2011	Medical admission	Repeated practice activities (+/- increasing demands); Goals and planning; Shaping knowledge; Cognitive orientation exercise	Usual care (Spain). Includes physiotherapy.	Barthel Index
Heldmann 2019	Prestmo 2015	Hip fracture	Repeated practice activities (+/- increasing demands); Goals and planning; Team meetings & care planning; Discharge planning; Increased medical care; Nutritional intervention; Early intervention	Usual care (Norway). Physiotherapy according to guidelines. No occupational therapists.	Barthel Index
Machado 2020	Lopez-Lopez 2018 (1)	COPD	Energy applied to soft tissue	Usual care (Spain). Medical care alone.	London Chest Activity of Daily Living Score
Maranesi 2020	Lopez-Lopez 2018 (2)	COPD	Exercise scheduling for strengthening	Usual care (Spain). Medical care alone.	London Chest Activity of Daily Living Score
Machado 2020	Lopez-Lopez 2019a (1)	COPD	Endurance exercise; Energy applied to soft tissue; Goals and planning; Feedback and monitoring	Usual care (Spain). Medical care alone.	Functional Independence Measure
Machado 2020	Lopez-Lopez 2019a (2)	COPD	Endurance exercise; Energy applied to soft tissue; Goals and planning; Feedback and monitoring	Usual care (Spain). Medical care alone.	Functional Independence Measure
Martinez-Velilla 2016	Tibaek 2014	Older adult	Strengthening exercise	Usual care (Denmark). Physiotherapy.	Barthel Index
Scrivener 2015	Said 2012	Older adult	Endurance exercise; Repeated practice activities (+/- increasing demands)	Usual care (Australia). Physiotherapy 1-2 sessions on weekdays.	Barthel Index

Bachmann 2010	Swanson 1998	Hip fracture	Repeated exercise rehabilitation; Team meetings & care planning; Discharge planning; Increased medical care; Early intervention; Home visit	Usual care (Australia). Physiotherapy. Occupational therapy on referral.	Modified Barthel Index
Smith 2020b	Lenze 2012	Medical admission	Repeated exercise rehabilitation; Goals and planning; Feedback and monitoring	Usual care (USA). Physiotherapy and occupational therapy.	Barthel Index
Smith 2020b	Counsell 2020	Medical admission	Repeated practice activities (+/- increasing demands); Antecedents; Team meetings & care planning; Discharge planning; Increased medical care; Nutritional intervention	Usual care (USA). Medical care.	Independent Activities of Daily Living
Peck 2020	Resnick 2016	Orthopaedic trauma	Repeated practice activities (+/- increasing demands); Goals and planning; Feedback and monitoring; Shaping knowledge; Antecedents; Increased medical care	Usual care (USA), plus education	Barthel Index
Smith 2020b	Timmer 2019	Medical admission	Repeated practice activities (+/- increasing demands); Goals and planning; Feedback and monitoring; Social support; Shaping knowledge; Natural consequences	Usual care (Australia) plus a brief activity pacing education. Physiotherapy and occupational therapy.	Functional Independence Measure
Peiris 2018	Peiris 2013	Medical admission	Repeated exercise rehabilitation	Usual care (Australia). Physiotherapy weekdays.	Functional Independence Measure
Yasmeen 2020	Louie 2012	Hip fracture	Repeated practice activities (+/- increasing demands); Goals and planning; Feedback and monitoring; Social support; Shaping knowledge; Natural consequences; Comparison of behavior	Usual care (Hong Kong, China). Hip fracture protocol including activities of daily living training.	Functional Independence Measure (motor scores)

COPD = chronic obstructive pulmonary disease

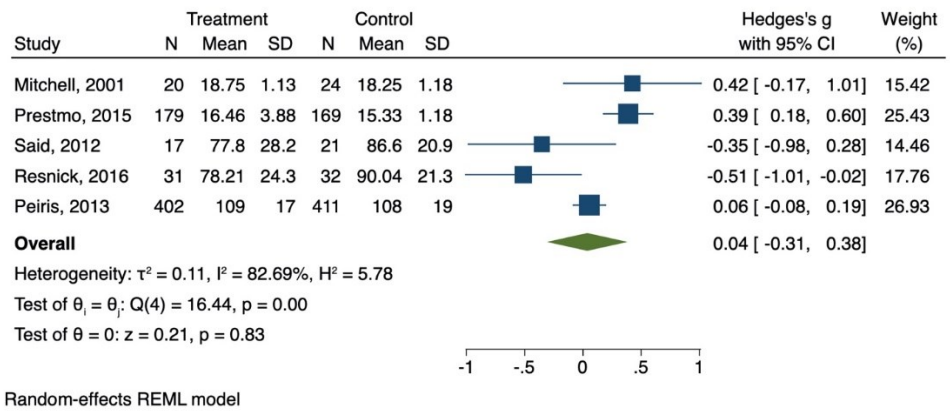

Treatment
Control
Study
N
Mean
SD
N
Mean
SD
Hedges's g with 95% CI
Weight (%)
Mitchell, 2001 30 18.25 1.18 29 17.62 1.71 0.42 [-0.08, 0.93] 5.53
Brown, 2016 44 8.1 .3 48 8.2 .32 -0.32 [-0.73, 0.09] 6.29
Abizanda, 2011 198 36.9 28 202 42.1 28.1 -0.19 [-0.38, 0.01] 7.76
Lopez-Lopez, 2019a (1) 22 126.6 12.2 22 111.8 3 1.64 [0.96, 2.31] 4.42
Lopez-Lopez, 2019a (2) 22 119.3 12.4 22 111.8 3 0.82 [0.21, 1.42] 4.86
Tibaek, 2014 28 12.3 3.74 24 12.3 3.87 0.00 [-0.54, 0.54] 5.34
Said, 2012 21 81.8 15.6 24 81.5 20.5 0.02 [-0.56, 0.59] 5.06
Prestmo, 2015 179 14.53 3.75 169 14.21 3.38 0.09 [-0.12, 0.30] 7.68
Lopez-Lopez, 2018 (1) 14 -23.7 10 12 -28.1 13.6 0.36 [-0.39, 1.11] 3.96
Lopez-Lopez, 2018 (2) 13 -19.9 12.2 12 -28.1 13.6 0.62 [-0.16, 1.39] 3.82
Swanson, 1998 36 92.8 8.57 31 85.6 12.1 0.69 [0.20, 1.18] 5.69
Resnick, 2016 50 39.94 19.7 39 48.5 31.7 -0.33 [-0.75, 0.09] 6.22
Peiris, 2013 495 106 18 499 104 20 0.11 [-0.02, 0.23] 8.10
Counsell, 2000 712 3.5 1.9 693 3.4 1.9 0.05 [-0.05, 0.16] 8.17
Lenze, 2012 14 75 24.2 12 54.2 30.6 0.74 [-0.04, 1.51] 3.85
Timmer, 2019 51 116 8 48 116 12 0.00 [-0.39, 0.39] 6.42
Louie, 2012 63 67.34 10.34 71 66.41 14.27 0.07 [-0.26, 0.41] 6.82
Overall 0.21 [0.00, 0.42]
Heterogeneity: τ^2 = 0.13, I^2 = 86.58%, H^2 = 7.45
Test of $\theta_i = \theta_j$: Q(16) = 54.12, p = 0.00
Test of θ = 0: z = 2.00, p = 0.04
-1
0
1
2
Random-effects REML model

With removal of RCT from systematic review of low or critically low quality

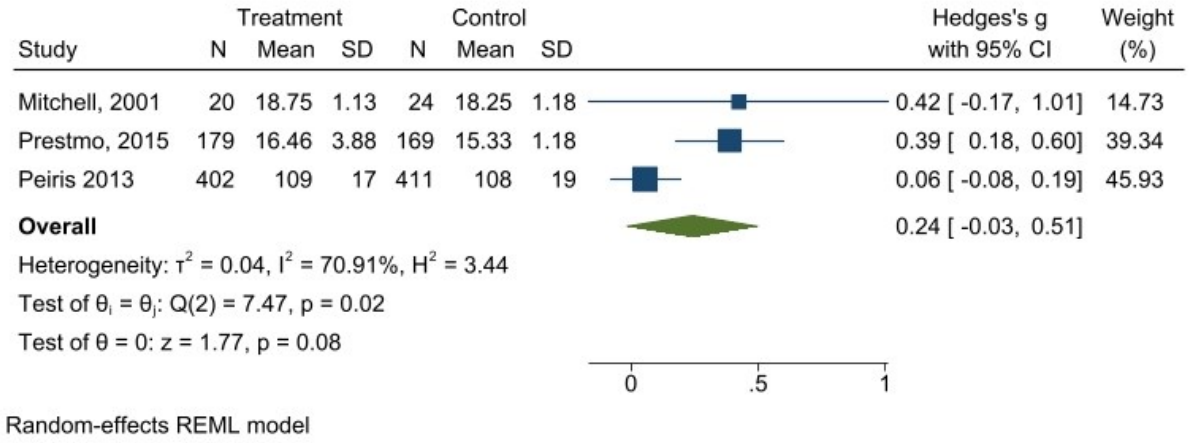


INPATIENT REHABILITATION VERSUS COMPARATOR ON ACTIVITIES OF DAILY LIVING AT FOLLOW UP

Systematic review	Randomized controlled trial	Population	Intervention	Comparator	Outcome measure	Length of follow up
Scrivener 2015	Said 2012	Older adult	Endurance exercise; Repeated practice activities (+/- increasing demands)	Usual care (Australia). Physiotherapy 1-2 sessions on weekdays.	Barthel Index	3 months
Heldmann 2019	Prestmo 2015	Hip fracture	Repeated practice activities (+/- increasing demands); Goals and planning; Team meetings & care planning; Discharge planning; Increased medical care; Nutritional intervention; Early intervention	Usual care (Norway). Physiotherapy according to guidelines. No occupational therapists.	Barthel Index	12 months
Peiris 2018	Peiris 2013	medical admission	Repeated exercise rehabilitation	Usual care (Australia). Physiotherapy weekdays.	Functional Independence Measure score	12 months
Peck 2020	Resnick 2016	orthopaedic trauma	Repeated practice activities (+/- increasing demands); Goals and planning; Feedback and monitoring; Shaping knowledge; Antecedents; Increased medical care	Usual care (USA), plus education	Barthel Index	1 month
Handoll 2011	Mitchell 2001	Hip fracture	Strengthening exercise; Repeated practice functions (+/-increasing demands)	Usual care (UK). 20 minutes physiotherapy per weekday.	Barthel Index (disability) 20-point scale	16 weeks

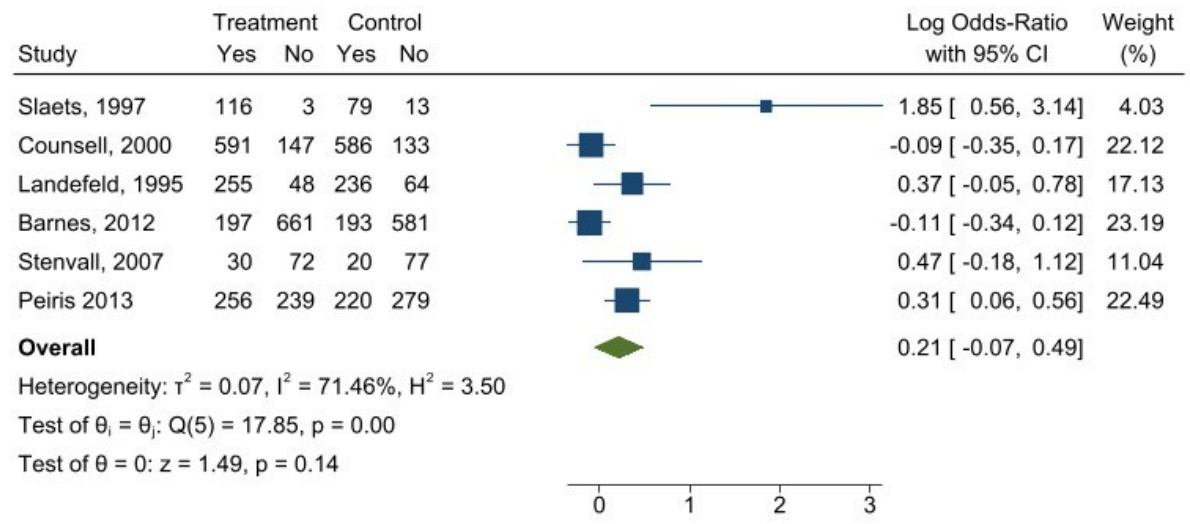


With removal of RCT from systematic review of low or critically low quality



INPATIENT REHABILITATION VERSUS COMPARATOR ON IMPROVED ACTIVITIES OF DAILY LIVING AFTER INPATIENT REHABILITATION.

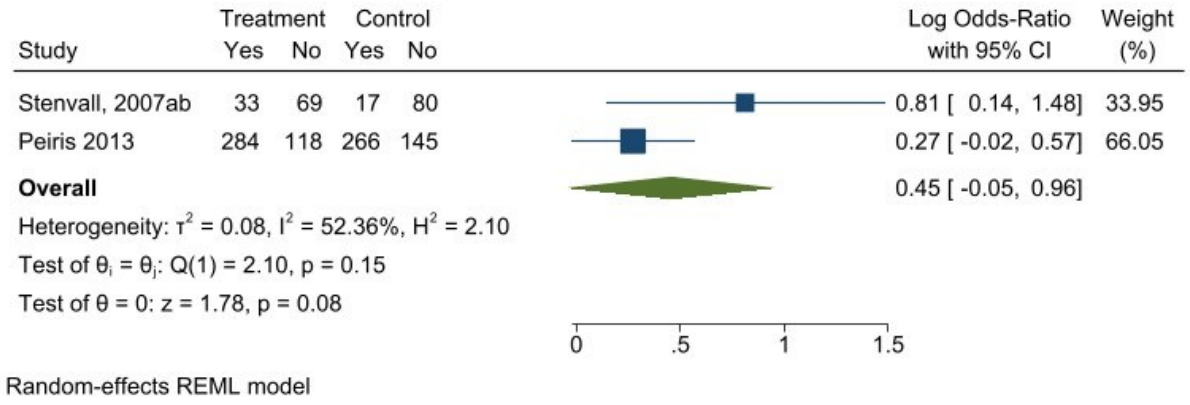
Systematic review	Randomized controlled trial	Population	Intervention	Comparator	Outcome measure
de Morton 2007	Slaets 1997	Medical admission	Repeated exercise rehabilitation; Team meetings & care planning; Increased medical care	Usual care (The Netherlands). Services provided by physicians and nurses.	SIVIS (Health Care Information Center Foundation) dependency scale
Smith 2020b	Counsell 2000	Medical admission	Repeated practice activities (+/- increasing demands); Antecedents; Team meetings & care planning; Discharge planning; Increased medical care; Nutritional intervention	Usual care (USA). Medical care.	modified Katz Activities of Daily Living Index
Smith 2020b	Landefeld 1995	Medical admission	Repeated practice activities (+/- increasing demands); Antecedents; Team meetings & care planning; Discharge planning; Increased medical care; Nutritional intervention	Usual care (USA). Physiotherapy.	Katz Activities of Daily Living Index
Heldmann 2019	Barnes 2012	Medical admission	Repeated practice activities (+/- increasing demands); Antecedents; Team meetings & care planning; Discharge planning; Increased medical care; Nutritional intervention	Usual care (USA). Physiotherapy if referred.	Katz Activities of Daily Living Index
Heldmann 2019	Stenvall 2007	Hip fracture	Endurance exercise; Repeated practice activities (+/- increasing demands); Goals and planning; Shaping knowledge; Team meetings & care planning; Increased medical care; Nutritional intervention; Early intervention	Usual care (Sweden). Exercise rehabilitation with daily physiotherapy and occupational therapy as needed.	Less dependent, based on Katz Index
Peiris 2018	Peiris 2013	Medical admission	Repeated exercise rehabilitation	Usual care (Australia). Physiotherapy weekdays.	Functional Independence Measure (minimally clinically important difference)



Random-effects REML model

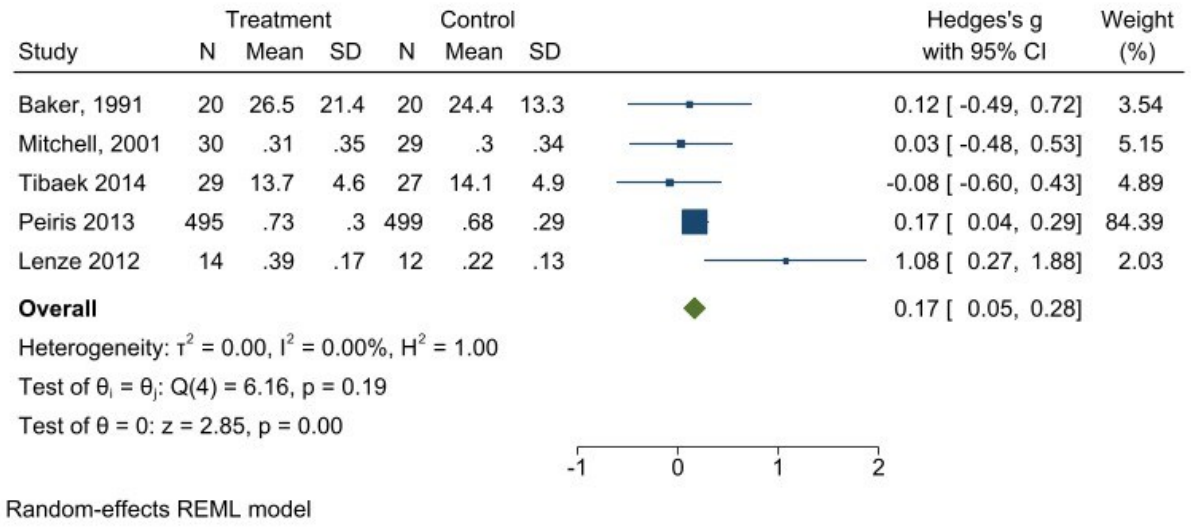
INPATIENT REHABILITATION VERSUS COMPARATOR ON IMPROVED ACTIVITIES OF DAILY LIVING AT FOLLOW UP

Systematic review	Randomized controlled trial	Population	Intervention	Comparator	Outcome measure	Length of follow up
Heldmann 2019	Stenvall 2007	Hip fracture	Endurance exercise; Repeated practice activities (+/- increasing demands); Goals and planning; Shaping knowledge; Team meetings & care planning; Increased medical care; Nutritional intervention; Early intervention	Usual care (Sweden). Exercise rehabilitation with daily physiotherapy and occupational therapy as needed.	Less dependent, based on Katz Index	12 months
Peiris 2018	Peiris 2013	Medical admission	Repeated exercise rehabilitation	Usual care (Australia). Physiotherapy weekdays.	Functional Independence Measure (minimally clinically important difference)	12 months



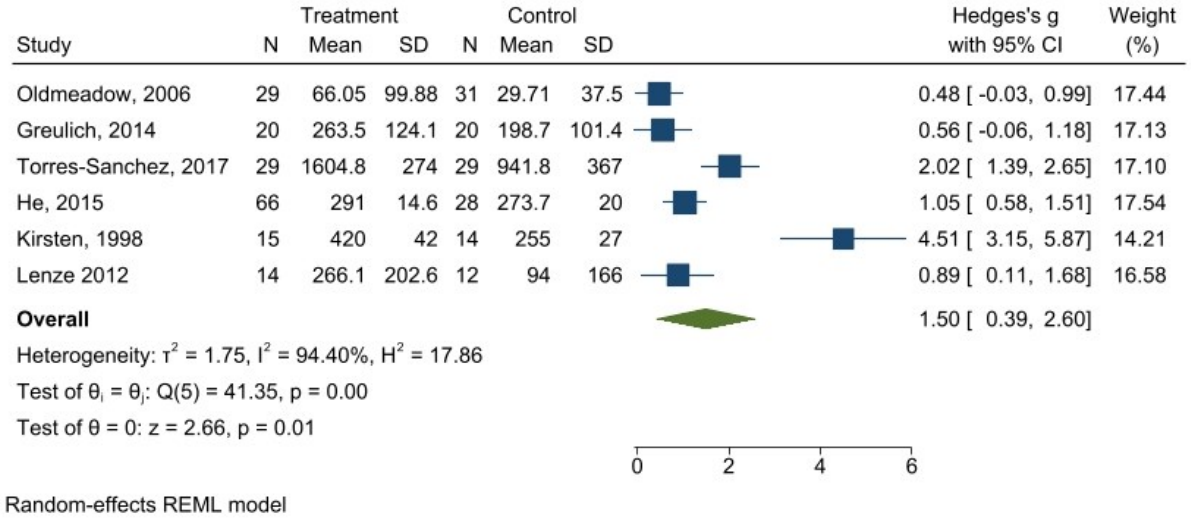
INPATIENT REHABILITATION VERSUS COMPARATOR ON WALKING SPEED AFTER INPATIENT REHABILITATION.

Systematic review	Randomized controlled trial	Population	Intervention	Comparator	Outcome measure
Handoll 2011	Baker 1991	Hip fracture	Endurance exercise; Antecedents	Usual care (Australia) including conventional gait training with ambulatory aids.	metres/minute
Handoll 2011	Mitchell 2001	Hip fracture	Strengthening exercise; Repeated practice functions (+/- increasing demands)	Usual care (UK). 20 minutes physiotherapy per weekday.	metres/second
Martinez-Velilla 2016	Tibaek 2014	Older adult	Strengthening exercise	Usual care (Denmark)	10 metre walk test (seconds)
Peiris 2018	Peiris 2013	Medical admission	Repeated exercise rehabilitation	Usual care (Australia). Physiotherapy weekdays.	10-metre walk test (metres/seconds)
Smith 2020b	Lenze 2012	Medical admission	Repeated exercise rehabilitation; Goals and planning; Feedback and monitoring	Usual care (USA). Physiotherapy and occupational therapy.	Gait Speed (metres/seconds)



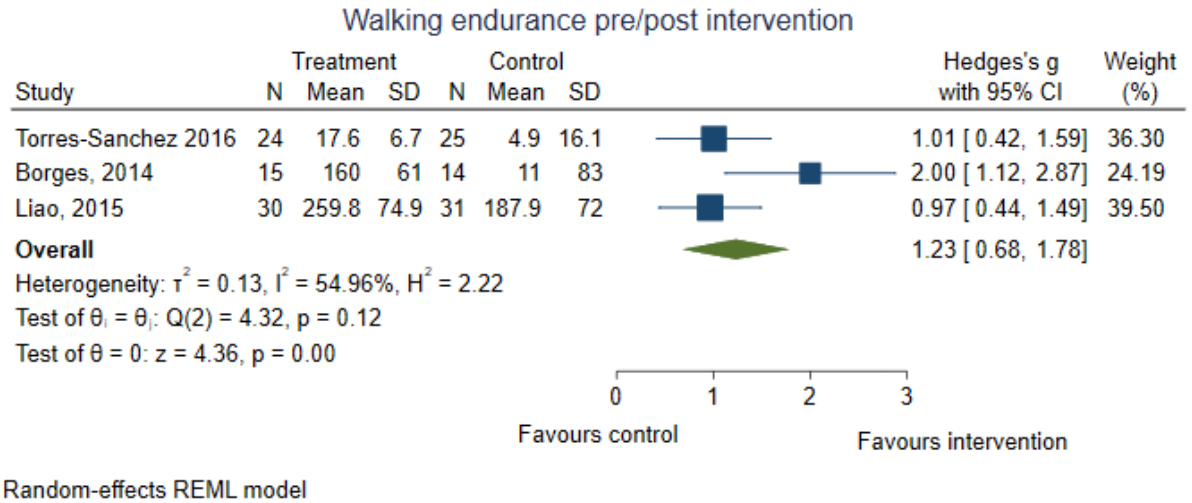
INPATIENT REHABILITATION VERSUS COMPARATOR ON WALKING ENDURANCE AFTER INPATIENT REHABILITATION.

Systematic review	Randomized controlled trial	Population	Intervention	Comparator	Outcome measure
Heldmann 2019	Oldmeadow 2006	Hip fracture	Early intervention	Delayed assisted ambulation to post op day 3 or 4	Mean walking distance at 7 days (metres)
Machado 2020	Greulich 2014	COPD	Energy applied to soft tissue; Early intervention	Usual care (Germany). 20 minutes physiotherapy.	6-minute walk test (metres)
Machado 2020	Torres-Sanchez 2017	COPD	Endurance exercise; Shaping knowledge	Usual care (Spain). Medical care alone.	Steps per day
Machado 2020	He 2015	COPD	Strengthening exercise; Endurance exercise; Energy applied to soft tissue; Breathing related exercise/training; Shaping knowledge; Natural consequences	Usual care (China)	6-minute walk test (metres)
Machado 2020	Kirsten 1998	COPD	Endurance exercise	Usual care (Germany). No regular exercise, walking assessments on 4 days.	6-minute walk test (metres)
Smith 2020b	Lenze 2012	Medical admission	Repeated exercise rehabilitation; Goals and planning; Feedback and monitoring	Usual care (USA). Physiotherapy and occupational therapy.	6-min walk (feet)



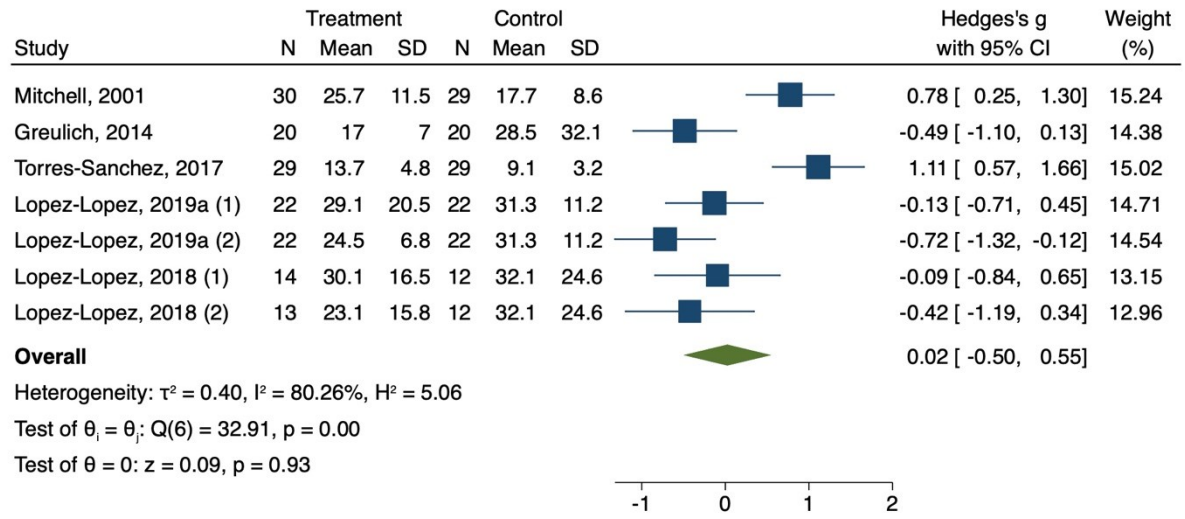
INPATIENT REHABILITATION VERSUS COMPARATOR ON WALKING ENDURANCE PRE/POST INTERVENTION

Systematic review	Randomized controlled trial	Population	Intervention	Comparator	Outcome measure
Machado 2020	Torres-Sanchez 2016	COPD	Endurance exercise; Shaping knowledge	Usual care (Spain). Medical care alone.	2-minutes step in place test (number of repetitions)
Machado 2020	Borges 2014	COPD	Repeated practice functions (+/-increasing demands); Shaping knowledge; Comparison of behavior	Usual care (Brazil). Chest physiotherapy and advice re physical activity.	Change in 6-minute walk test
Machado 2020	Liao 2015	COPD	Endurance exercise; Breathing related exercise/ training; Shaping knowledge; Natural consequences; Nutritional intervention	Usual care (Taiwan). Health education, monitoring of vital signs and symptoms, assessing nutritional status, and nasal oxygen therapy	Change in 6-minute walk test



INPATIENT REHABILITATION VERSUS COMPARATOR ON LOWER LIMB STRENGTH AFTER INPATIENT REHABILITATION.

Systematic review	Randomized controlled trial	Population	Intervention	Comparator	Outcome measure
Handoll 2011	Mitchell 2001	Hip fracture	Strengthening exercise; Repeated practice functions (+/-increasing demands)	Usual care (UK). 20 minutes physiotherapy per weekday.	Nottingham Power Rig leg extensor power (watts)
Machado 2020	Greulich 2014	COPD	Energy applied to soft tissue; Early intervention	Usual care (Germany). 20 minutes physiotherapy.	Chair rising test
Machado 2020	Torres-Sanchez 2017	COPD	Endurance exercise; Shaping knowledge	Usual care (Spain). Medical care alone.	30-second sit to stand (number of repetitions)
Machado 2020	Lopez-Lopez 2019a (1)	COPD	Endurance exercise; Energy applied to soft tissue; Goals and planning; Feedback and monitoring	Usual care (Spain). Medical care alone.	5-times sit to stand
Machado 2020	Lopez-Lopez 2019a (2)	COPD	Endurance exercise; Energy applied to soft tissue; Goals and planning; Feedback and monitoring	Usual care (Spain). Medical care alone.	5-times sit to stand
Machado 2020	Lopez-Lopez 2018 (1)	COPD	Energy applied to soft tissue	Usual care (Spain). Medical care alone.	5-times sit to stand
Maranesi 2020	Lopez-Lopez 2018 (2)	COPD	Exercise scheduling for strengthening	Usual care (Spain). Medical care alone.	5-times sit to stand

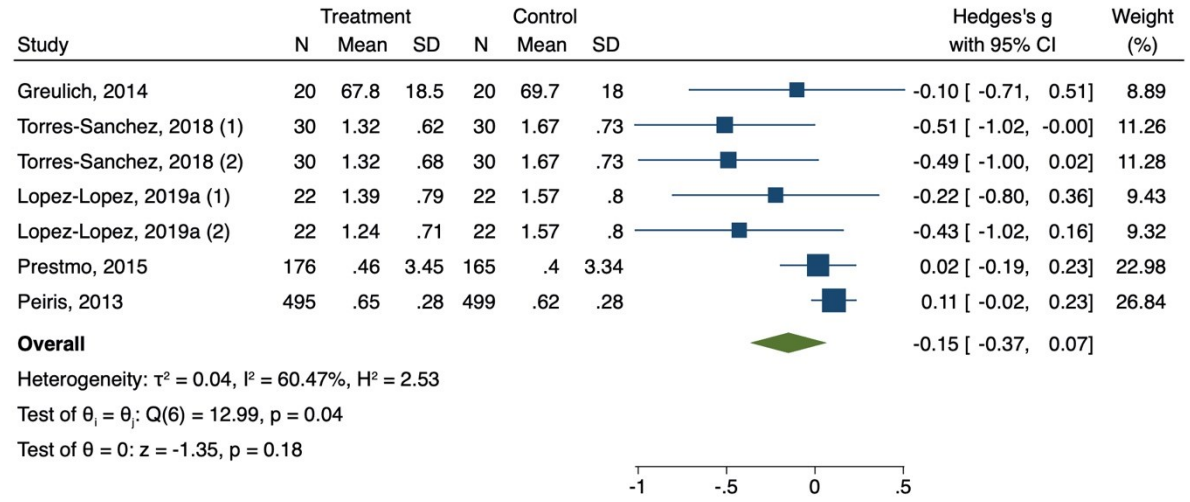


INPATIENT REHABILITATION VERSUS COMPARATOR ON HEALTH-RELATED QUALITY OF LIFE AFTER INPATIENT REHABILITATION.

Systematic review	Randomized controlled trial	Population	Intervention	Comparator	Outcome measure
Heldmann 2019	Prestmo 2015	Hip fracture	Repeated practice activities (+/- increasing demands); Goals and planning; Team meetings & care planning; Discharge planning; Increased medical care; Nutritional intervention; Early intervention	Usual care (Norway). Physiotherapy according to guidelines. No occupational therapists.	EQ-5D
Machado 2020	Greulich 2014	COPD	Energy applied to soft tissue; Early intervention	Usual care (Germany). 20 minutes physiotherapy.	St George's Respiratory Questionnaire
Machado 2020	Torres-Sanchez 2018 (1)	COPD	Breathing related exercise/ training; Repeated practice functions (+/-increasing demands); Feedback and monitoring	Usual care (Spain). Medical care alone.	EQ-5D
Machado 2020	Torres-Sanchez 2018 (2)	COPD	Exercise scheduling for strengthening; Feedback and monitoring	Usual care (Spain). Medical care alone.	EQ-5D
Machado 2020	Lopez-Lopez 2019a (1)	COPD	Endurance exercise; Energy applied to soft tissue; Goals and planning; Feedback and monitoring	Usual care (Spain). Medical care alone.	EQ-5D

Machado 2020	Lopez-Lopez 2019a (2)	COPD	Endurance exercise; Energy applied to soft tissue; Goals and planning; Feedback and monitoring	Usual care (Spain). Medical care alone.	EQ-5D
Peiris 2018	Peiris 2013	Medical admission	Repeated exercise rehabilitation	Usual care (Australia). Physiotherapy weekdays.	EQ-5D

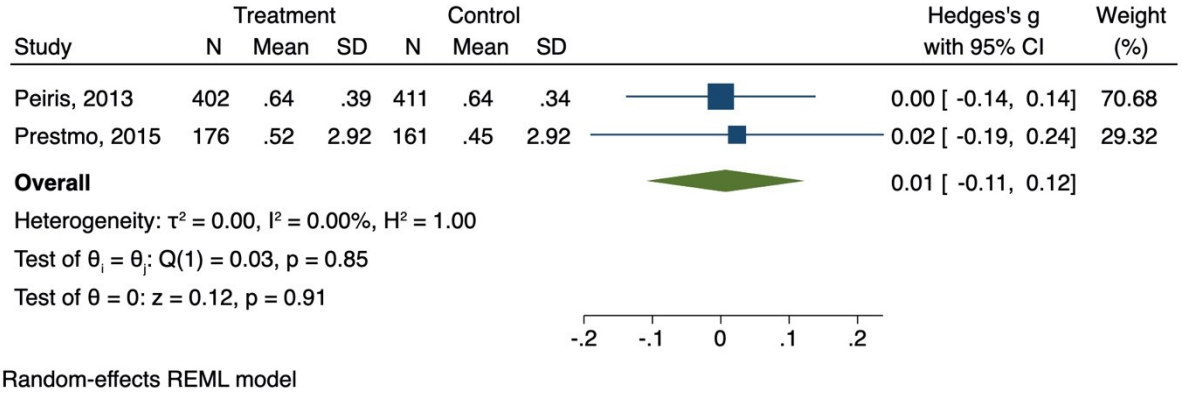
EQ-5D = EuroQol 5 dimensions



INPATIENT REHABILITATION VERSUS COMPARATOR ON HEALTH-RELATED QUALITY OF LIFE AT FOLLOW UP

Systematic review	Randomized controlled trial	Population	Intervention	Comparator	Outcome measure	Length of follow up
Heldmann 2019	Prestmo 2015	Hip fracture	Repeated practice activities (+/- increasing demands); Goals and planning; Team meetings & care planning; Discharge planning; Increased medical care; Nutritional intervention; Early intervention	Usual care (Norway). Physiotherapy according to guidelines. No occupational therapists.	EQ-5D	12 months
Peiris 2018	Peiris 2013	Medical admission	Repeated exercise rehabilitation	Usual care (Australia). Physiotherapy weekdays.	EQ-5D	12 months

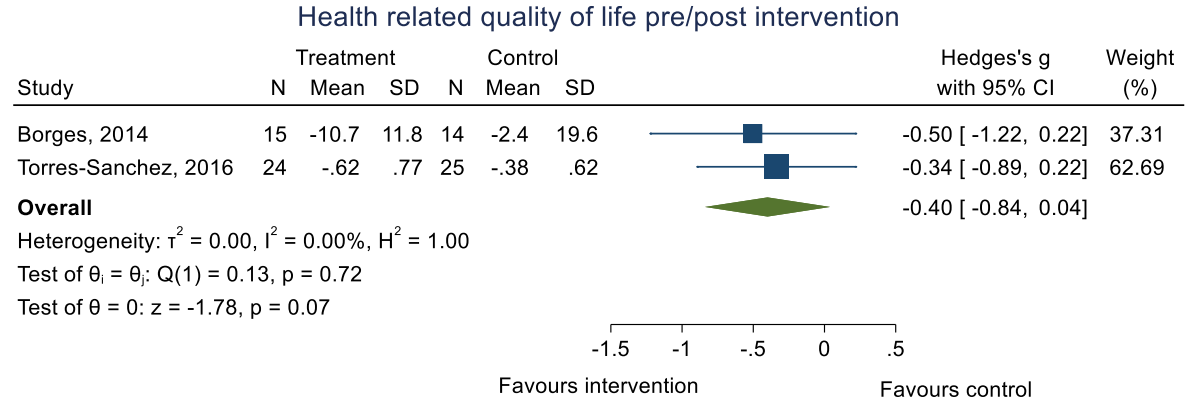
EQ-5D = EuroQol 5 dimensions



INPATIENT REHABILITATION VERSUS COMPARATOR ON HEALTH-RELATED QUALITY OF LIFE PRE-POST INTERVENTION CHANGE SCORES

Systematic review	Randomized controlled trial	Population	Intervention	Comparator	Outcome measure
Machado 2020	Borges 2014	COPD	Repeated practice functions (+/-increasing demands); Shaping knowledge; Comparison of behavior	Usual care (Brazil). Chest physiotherapy and advice re physical activity.	St George's Respiratory Questionnaire
Machado 2020	Torres-Sanchez 2016	COPD	Exercise scheduling for strengthening; Breathing related exercise/ training; Repeated practice functions (+/-increasing demands); Feedback and monitoring; Shaping knowledge	Usual care (Spain). Medical care alone.	EQ-5D

EQ-5D = EuroQol 5 dimensions



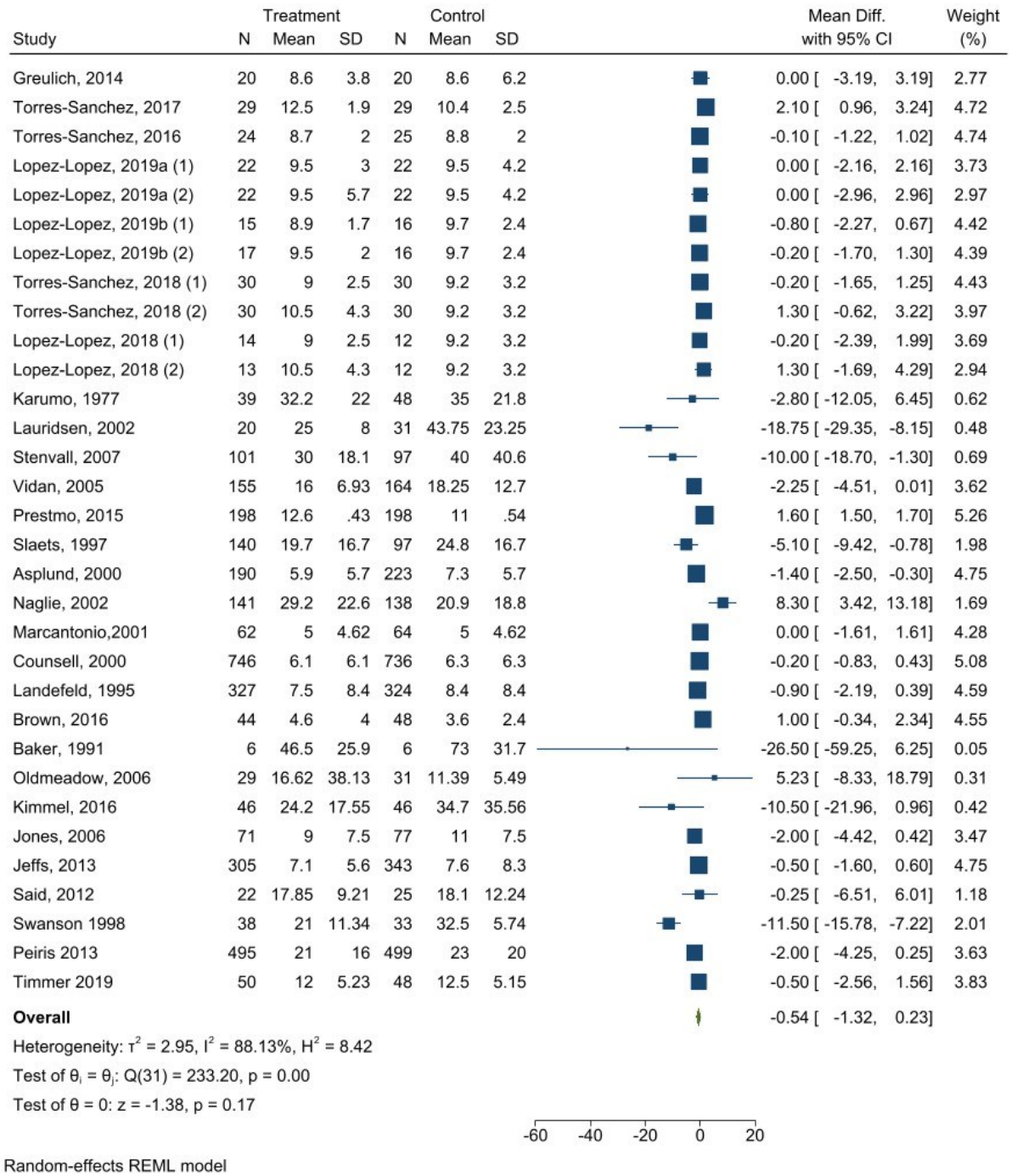
Random-effects REML model

INPATIENT REHABILITATION VERSUS COMPARATOR ON LENGTH OF STAY

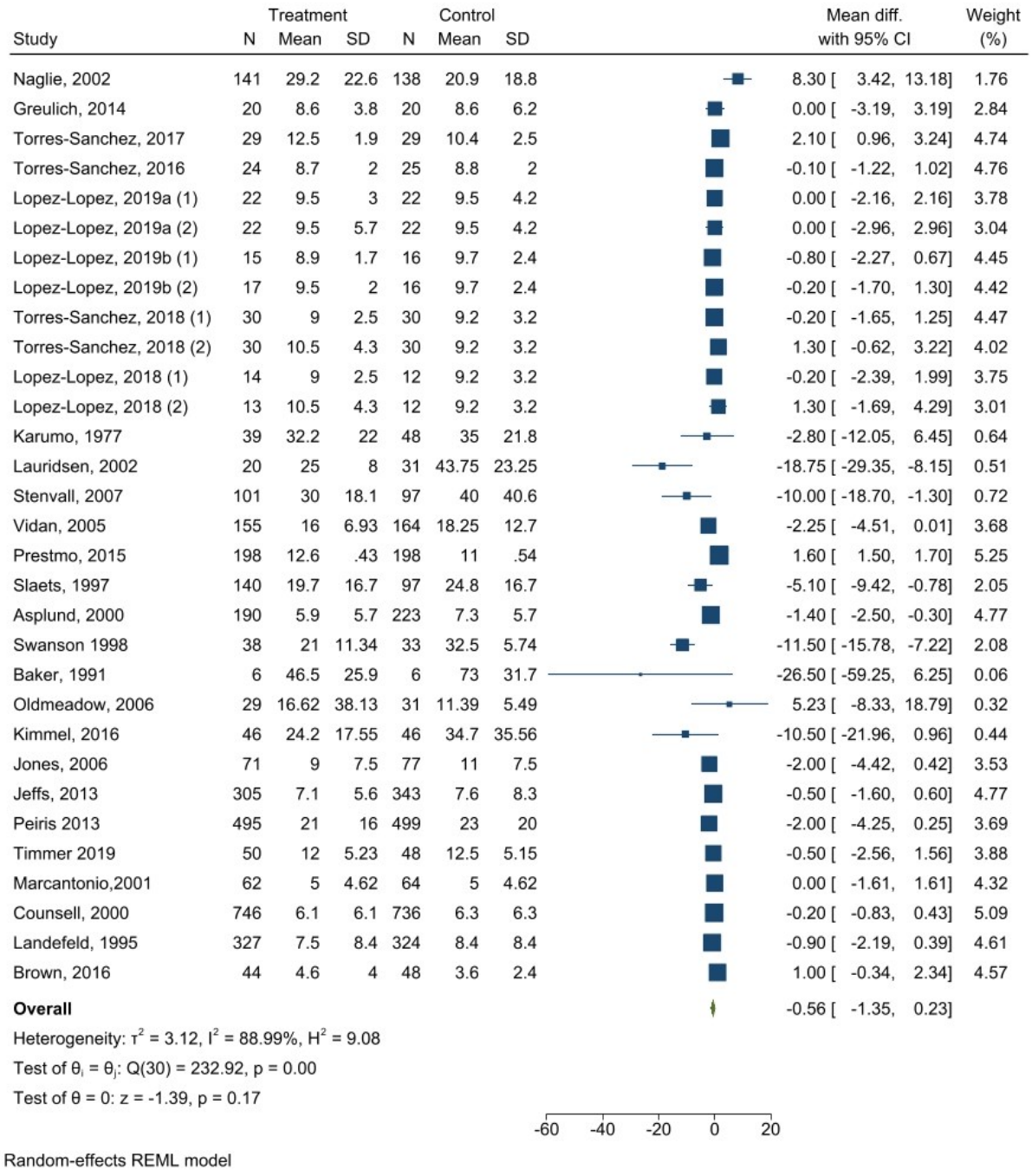
Systematic review	Randomized controlled trial	Population	Intervention	Comparator
de Morton 2007	Slaets 1997	Medical admission	Repeated exercise rehabilitation; Team meetings & care planning; Increased medical care	Usual care (The Netherlands). Services provided by physicians and nurses.
Handoll 2011	Karumo 1977	Hip fracture	Repeated practice activities (+/- increasing demands); Repeated exercise rehabilitation	Usual care (Finland)
Handoll 2011	Lauridsen 2002	Hip fracture	Repeated practice functions (+/- increasing demands); Repeated practice activities (+/- increasing demands)	Usual care (Denmark). Physiotherapy 15-30 minutes per weekday.
Handoll 2011	Baker 1991	Hip fracture	Endurance exercise; Antecedents	Usual care (Australia) including conventional gait training with ambulatory aids.
Heldmann 2019	Asplund 2000	Medical admission	Early intervention; Discharge planning; Increased medical care	Usual care (Sweden). Physiotherapy and occupational therapy not routinely available.
Smith 2020b	Counsell 2000	Medical admission	Repeated practice activities (+/- increasing demands); Antecedents; Team meetings & care planning; Discharge planning; Increased medical care; Nutritional intervention	Usual care (USA). Medical care.
Heldmann 2019	Jones 2006	Medical admission	Exercise scheduling for strengthening; Repeated practice activities (+/- increasing demands)	Usual care (Australia). Standard physiotherapy.
Smith 2020b	Landefeld 1995	Medical admission	Repeated practice activities (+/- increasing demands); Antecedents; Team meetings & care planning; Discharge planning; Increased medical care; Nutritional intervention	Usual care (USA). Physiotherapy.
Heldmann 2019	Naglie 2002	Hip fracture	Repeated practice activities (+/- increasing demands); Feedback and monitoring; Shaping knowledge; Team meetings & care planning; Discharge planning; Increased medical care; Early intervention; Home visit	Usual care (Canada). Physiotherapy if referred. Occupational therapy rarely.
Heldmann 2019	Stenvall 2007	Hip fracture	Endurance exercise; Repeated practice activities (+/- increasing demands); Goals and planning; Shaping knowledge; Team meetings & care planning; Increased medical care; Nutritional intervention; Early intervention	Usual care (Sweden). Exercise rehabilitation with daily physiotherapy and occupational

				therapy as needed.
Heldmann 2019	Vidan 2005	Hip fracture	Repeated exercise rehabilitation; Antecedents; Team meetings & care planning; Increased medical care	Usual care (Spain) Physiotherapy. Occupational therapy not available.
Heldmann 2019	Oldmeadow 2006	Hip fracture	Early intervention	Delayed assisted ambulation to post op day 3 or 4
Heldmann 2019	Brown 2016	Medical admission	Endurance exercise; Goals and planning; Feedback and monitoring	Usual care (USA). Allied health if referred.
Heldmann 2019	Jeffs 2013	Medical admission	Exercise scheduling for strengthening; Feedback and monitoring; Shaping knowledge; Cognitive orientation exercise	Usual care (Australia). Allied health if referred.
Heldmann 2019	Kimmel 2016	Hip fracture	Repeated exercise rehabilitation	Usual care (Australia). Daily physiotherapy.
Heldmann 2019	Prestmo 2015	Hip fracture	Repeated practice activities (+/- increasing demands); Goals and planning; Team meetings & care planning; Discharge planning; Increased medical care; Nutritional intervention; Early intervention	Usual care (Norway). Physiotherapy according to guidelines. No occupational therapists.
Machado 2020	Greulich 2014	COPD	Energy applied to soft tissue; Early intervention	Usual care (Germany). 20 minutes physiotherapy.
Machado 2020	Torres-Sanchez 2017	COPD	Endurance exercise; Shaping knowledge	Usual care (Spain). Medical care alone.
Machado 2020	Torres-Sanchez 2016	COPD	Exercise scheduling for strengthening; Breathing related exercise/ training; Repeated practice functions (+/-increasing demands); Feedback and monitoring; Shaping knowledge	Usual care (Spain). Medical care alone.
Machado 2020	Lopez-Lopez 2019a (1)	COPD	Endurance exercise; Energy applied to soft tissue; Goals and planning; Feedback and monitoring	Usual care (Spain). Medical care alone.
Machado 2020	Lopez-Lopez 2019a (2)	COPD	Endurance exercise; Energy applied to soft tissue; Goals and planning; Feedback and monitoring	Usual care (Spain). Medical care alone.
Machado 2020	Lopez-Lopez 2019b (1)	COPD	Energy applied to soft tissue; Repeated practice functions (+/-increasing demands)	Usual care (Spain). Medical care alone.
Machado 2020	Lopez-Lopez 2019b (2)	COPD	Energy applied to soft tissue; Breathing related exercise/ training; Repeated practice functions (+/-increasing demands); Goals and planning; Feedback and monitoring; Shaping knowledge; Natural consequences	Usual care (Spain). Medical care alone.
Machado 2020	Torres-Sanchez 2018 (1)	COPD	Breathing related exercise/ training; Repeated practice functions (+/-increasing demands); Feedback and monitoring	Usual care (Spain). Medical care alone.

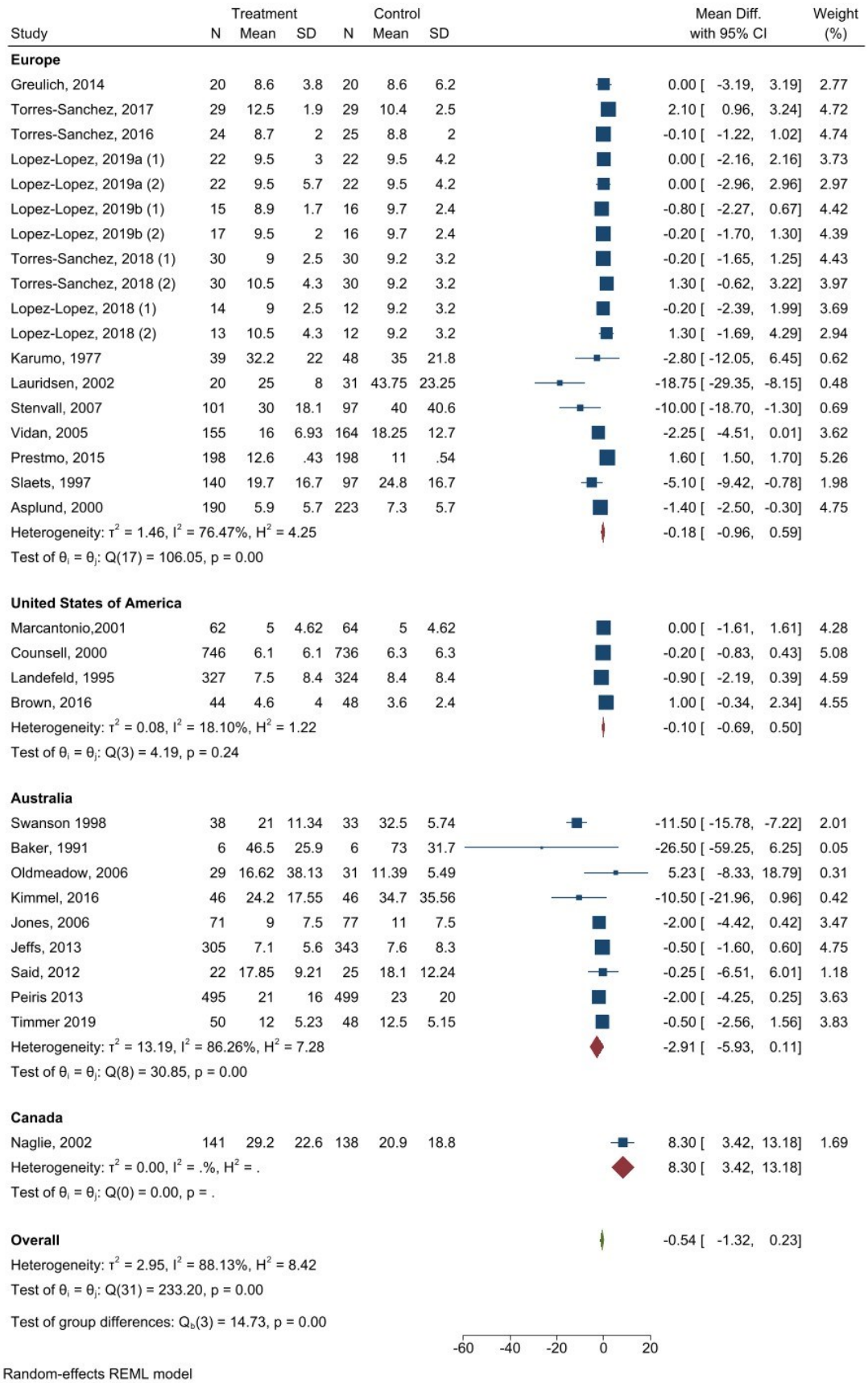
Machado 2020	Torres-Sanchez 2018 (2)	COPD	Exercise scheduling for strengthening; Feedback and monitoring	Usual care (Spain). Medical care alone.
Machado 2020	Lopez-Lopez 2018 (1)	COPD	Energy applied to soft tissue	Usual care (Spain). Medical care alone.
Machado 2020	Lopez-Lopez 2018 (2)	COPD	Exercise scheduling for strengthening	Usual care (Spain). Medical care alone.
Scrivener 2015	Said 2012	Older adult	Endurance exercise; Repeated practice activities (+/- increasing demands)	Usual care (Australia). Physiotherapy 1-2 sessions on weekdays.
Smith 2020	Marcantonio 2001	Hip fracture	Antecedents; Increased medical care; Nutritional intervention; Early intervention	Usual care (USA). Medical care.
Bachmann 2010	Swanson 1998	Hip fracture	Repeated exercise rehabilitation; Team meetings & care planning; Discharge planning; Increased medical care; Early intervention; Home visit	Usual care (Australia). Physiotherapy. Occupational therapy on referral.
Peiris 2018	Peiris 2013	Medical admission	Repeated exercise rehabilitation	Usual care (Australia). Physiotherapy weekdays.
Smith 2020b	Timmer 2019	Medical admission	Repeated practice activities (+/- increasing demands); Goals and planning; Feedback and monitoring; Social support; Shaping knowledge; Natural consequences	Usual care (Australia) plus a brief activity pacing education. Physiotherapy and occupational therapy.


Study | Treatment N Mean SD | Control N Mean SD | Mean Diff. with 95% CI | Weight (%)
Greulich, 2014 20 8.6 3.8 20 8.6 6.2 0.00 [-3.19, 3.19] 2.77
Torres-Sanchez, 2017 29 12.5 1.9 29 10.4 2.5 2.10 [0.96, 3.24] 4.72
Torres-Sanchez, 2016 24 8.7 2 25 8.8 2 -0.10 [-1.22, 1.02] 4.74
Lopez-Lopez, 2019a (1) 22 9.5 3 22 9.5 4.2 0.00 [-2.16, 2.16] 3.73
Lopez-Lopez, 2019a (2) 22 9.5 5.7 22 9.5 4.2 0.00 [-2.96, 2.96] 2.97
Lopez-Lopez, 2019b (1) 15 8.9 1.7 16 9.7 2.4 -0.80 [-2.27, 0.67] 4.42
Lopez-Lopez, 2019b (2) 17 9.5 2 16 9.7 2.4 -0.20 [-1.70, 1.30] 4.39
Torres-Sanchez, 2018 (1) 30 9 2.5 30 9.2 3.2 -0.20 [-1.65, 1.25] 4.43
Torres-Sanchez, 2018 (2) 30 10.5 4.3 30 9.2 3.2 1.30 [-0.62, 3.22] 3.97
Lopez-Lopez, 2018 (1) 14 9 2.5 12 9.2 3.2 -0.20 [-2.39, 1.99] 3.69
Lopez-Lopez, 2018 (2) 13 10.5 4.3 12 9.2 3.2 1.30 [-1.69, 4.29] 2.94
Karumo, 1977 39 32.2 22 48 35 21.8 -2.80 [-12.05, 6.45] 0.62
Lauridsen, 2002 20 25 8 31 43.75 23.25 -18.75 [-29.35, -8.15] 0.48
Stenvall, 2007 101 30 18.1 97 40 40.6 -10.00 [-18.70, -1.30] 0.69
Vidan, 2005 155 16 6.93 164 18.25 12.7 -2.25 [-4.51, 0.01] 3.62
Prestmo, 2015 198 12.6 .43 198 11 .54 1.60 [1.50, 1.70] 5.26
Slaets, 1997 140 19.7 16.7 97 24.8 16.7 -5.10 [-9.42, -0.78] 1.98
Asplund, 2000 190 5.9 5.7 223 7.3 5.7 -1.40 [-2.50, -0.30] 4.75
Naglie, 2002 141 29.2 22.6 138 20.9 18.8 8.30 [3.42, 13.18] 1.69
Marcantonio,2001 62 5 4.62 64 5 4.62 0.00 [-1.61, 1.61] 4.28
Counsell, 2000 746 6.1 6.1 736 6.3 6.3 -0.20 [-0.83, 0.43] 5.08
Landefeld, 1995 327 7.5 8.4 324 8.4 8.4 -0.90 [-2.19, 0.39] 4.59
Brown, 2016 44 4.6 4 48 3.6 2.4 1.00 [-0.34, 2.34] 4.55
Baker, 1991 6 46.5 25.9 6 73 31.7 -26.50 [-59.25, 6.25] 0.05
Oldmeadow, 2006 29 16.62 38.13 31 11.39 5.49 5.23 [-8.33, 18.79] 0.31
Kimmel, 2016 46 24.2 17.55 46 34.7 35.56 -10.50 [-21.96, 0.96] 0.42
Jones, 2006 71 9 7.5 77 11 7.5 -2.00 [-4.42, 0.42] 3.47
Jeffs, 2013 305 7.1 5.6 343 7.6 8.3 -0.50 [-1.60, 0.60] 4.75
Said, 2012 22 17.85 9.21 25 18.1 12.24 -0.25 [-6.51, 6.01] 1.18
Swanson 1998 38 21 11.34 33 32.5 5.74 -11.50 [-15.78, -7.22] 2.01
Peiris 2013 495 21 16 499 23 20 -2.00 [-4.25, 0.25] 3.63
Timmer 2019 50 12 5.23 48 12.5 5.15 -0.50 [-2.56, 1.56] 3.83
Overall -0.54 [-1.32, 0.23]
Heterogeneity: τ^2 = 2.95, I^2 = 88.13%, H^2 = 8.42
Test of $\theta_i = \theta_j$: Q(31) = 233.20, p = 0.00
Test of θ = 0: z = -1.38, p = 0.17
-60 -40 -20 0 20
Random-effects REML model

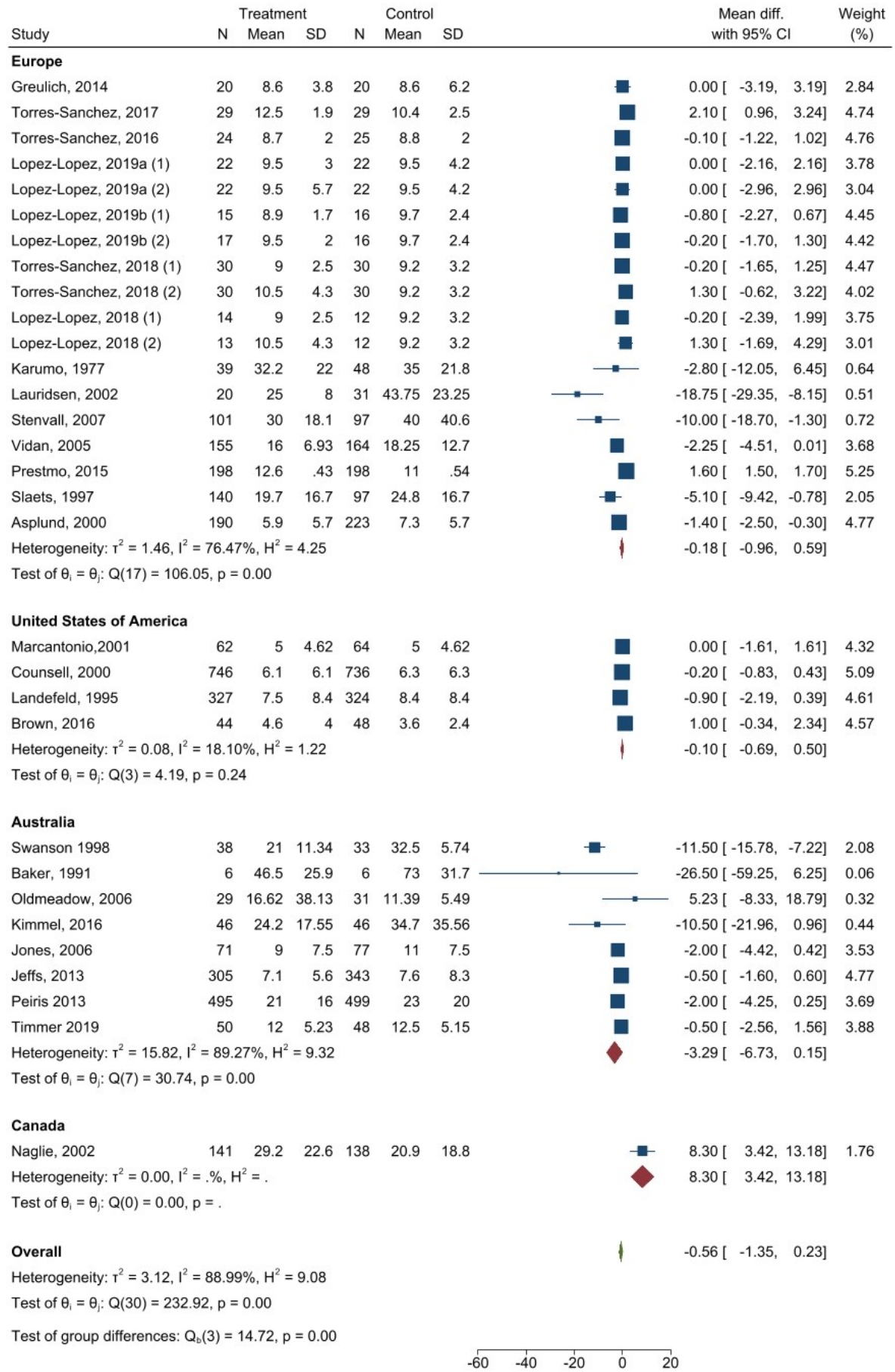
With removal of RCT from systematic review of low quality



By region

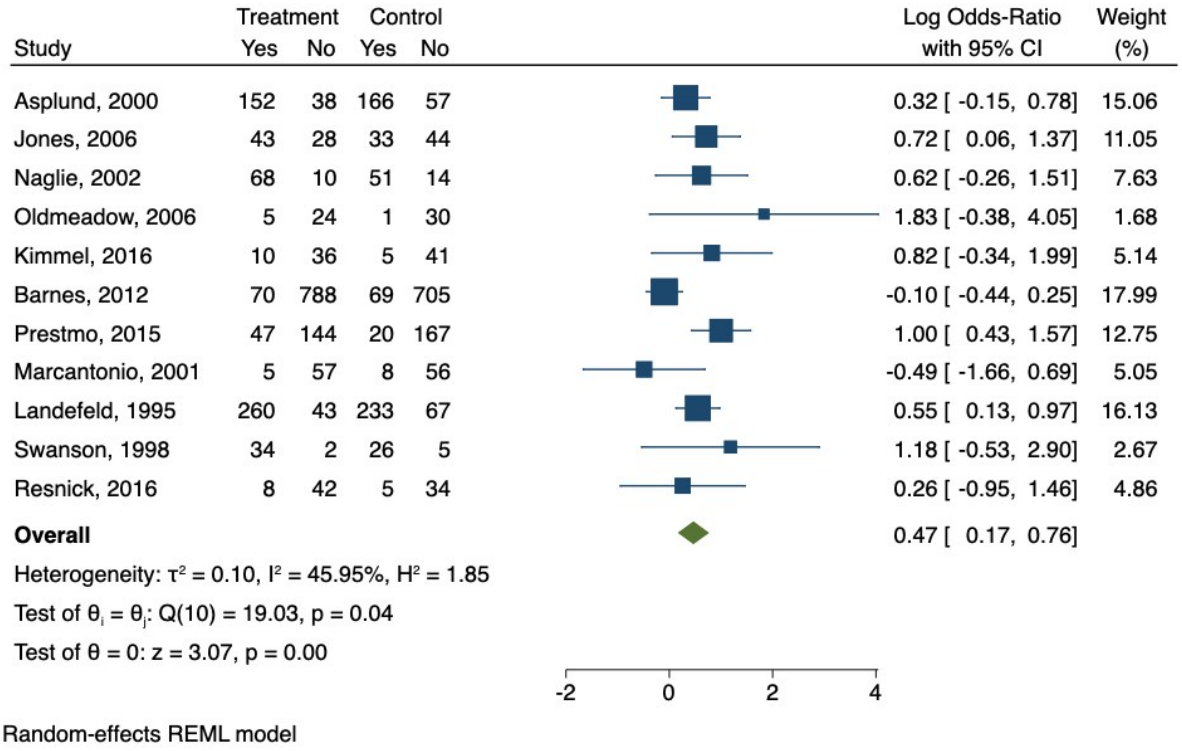

Study
Treatment N Mean SD
Control N Mean SD
Mean Diff. with 95% CI
Weight (%)
Europe
Greulich, 2014 20 8.6 3.8 20 8.6 6.2 0.00 [-3.19, 3.19] 2.77
Torres-Sanchez, 2017 29 12.5 1.9 29 10.4 2.5 2.10 [0.96, 3.24] 4.72
Torres-Sanchez, 2016 24 8.7 2 25 8.8 2 -0.10 [-1.22, 1.02] 4.74
Lopez-Lopez, 2019a (1) 22 9.5 3 22 9.5 4.2 0.00 [-2.16, 2.16] 3.73
Lopez-Lopez, 2019a (2) 22 9.5 5.7 22 9.5 4.2 0.00 [-2.96, 2.96] 2.97
Lopez-Lopez, 2019b (1) 15 8.9 1.7 16 9.7 2.4 -0.80 [-2.27, 0.67] 4.42
Lopez-Lopez, 2019b (2) 17 9.5 2 16 9.7 2.4 -0.20 [-1.70, 1.30] 4.39
Torres-Sanchez, 2018 (1) 30 9 2.5 30 9.2 3.2 -0.20 [-1.65, 1.25] 4.43
Torres-Sanchez, 2018 (2) 30 10.5 4.3 30 9.2 3.2 1.30 [-0.62, 3.22] 3.97
Lopez-Lopez, 2018 (1) 14 9 2.5 12 9.2 3.2 -0.20 [-2.39, 1.99] 3.69
Lopez-Lopez, 2018 (2) 13 10.5 4.3 12 9.2 3.2 1.30 [-1.69, 4.29] 2.94
Karumo, 1977 39 32.2 22 48 35 21.8 -2.80 [-12.05, 6.45] 0.62
Lauridsen, 2002 20 25 8 31 43.75 23.25 -18.75 [-29.35, -8.15] 0.48
Stenvall, 2007 101 30 18.1 97 40 40.6 -10.00 [-18.70, -1.30] 0.69
Vidan, 2005 155 16 6.93 164 18.25 12.7 -2.25 [-4.51, 0.01] 3.62
Prestmo, 2015 198 12.6 .43 198 11 .54 1.60 [1.50, 1.70] 5.26
Slaets, 1997 140 19.7 16.7 97 24.8 16.7 -5.10 [-9.42, -0.78] 1.98
Asplund, 2000 190 5.9 5.7 223 7.3 5.7 -1.40 [-2.50, -0.30] 4.75
Heterogeneity: τ^2 = 1.46, I^2 = 76.47%, H^2 = 4.25 -0.18 [-0.96, 0.59]
Test of $\theta_i = \theta_j$: Q(17) = 106.05, p = 0.00
United States of America
Marcantonio,2001 62 5 4.62 64 5 4.62 0.00 [-1.61, 1.61] 4.28
Counsell, 2000 746 6.1 6.1 736 6.3 6.3 -0.20 [-0.83, 0.43] 5.08
Landefeld, 1995 327 7.5 8.4 324 8.4 8.4 -0.90 [-2.19, 0.39] 4.59
Brown, 2016 44 4.6 4 48 3.6 2.4 1.00 [-0.34, 2.34] 4.55
Heterogeneity: τ^2 = 0.08, I^2 = 18.10%, H^2 = 1.22 -0.10 [-0.69, 0.50]
Test of $\theta_i = \theta_j$: Q(3) = 4.19, p = 0.24
Australia
Swanson 1998 38 21 11.34 33 32.5 5.74 -11.50 [-15.78, -7.22] 2.01
Baker, 1991 6 46.5 25.9 6 73 31.7 -26.50 [-59.25, 6.25] 0.05
Oldmeadow, 2006 29 16.62 38.13 31 11.39 5.49 5.23 [-8.33, 18.79] 0.31
Kimmel, 2016 46 24.2 17.55 46 34.7 35.56 -10.50 [-21.96, 0.96] 0.42
Jones, 2006 71 9 7.5 77 11 7.5 -2.00 [-4.42, 0.42] 3.47
Jeffs, 2013 305 7.1 5.6 343 7.6 8.3 -0.50 [-1.60, 0.60] 4.75
Said, 2012 22 17.85 9.21 25 18.1 12.24 -0.25 [-6.51, 6.01] 1.18
Peiris 2013 495 21 16 499 23 20 -2.00 [-4.25, 0.25] 3.63
Timmer 2019 50 12 5.23 48 12.5 5.15 -0.50 [-2.56, 1.56] 3.83
Heterogeneity: τ^2 = 13.19, I^2 = 86.26%, H^2 = 7.28 -2.91 [-5.93, 0.11]
Test of $\theta_i = \theta_j$: Q(8) = 30.85, p = 0.00
Canada
Naglie, 2002 141 29.2 22.6 138 20.9 18.8 8.30 [3.42, 13.18] 1.69
Heterogeneity: τ^2 = 0.00, I^2 = .%, H^2 = . 8.30 [3.42, 13.18]
Test of $\theta_i = \theta_j$: Q(0) = 0.00, p = .
Overall -0.54 [-1.32, 0.23]
Heterogeneity: τ^2 = 2.95, I^2 = 88.13%, H^2 = 8.42
Test of $\theta_i = \theta_j$: Q(31) = 233.20, p = 0.00
Test of group differences: $Q_b(3)$ = 14.73, p = 0.00
-60 -40 -20 0 20
Random-effects REML model

With removal of RCT from systematic review of low quality

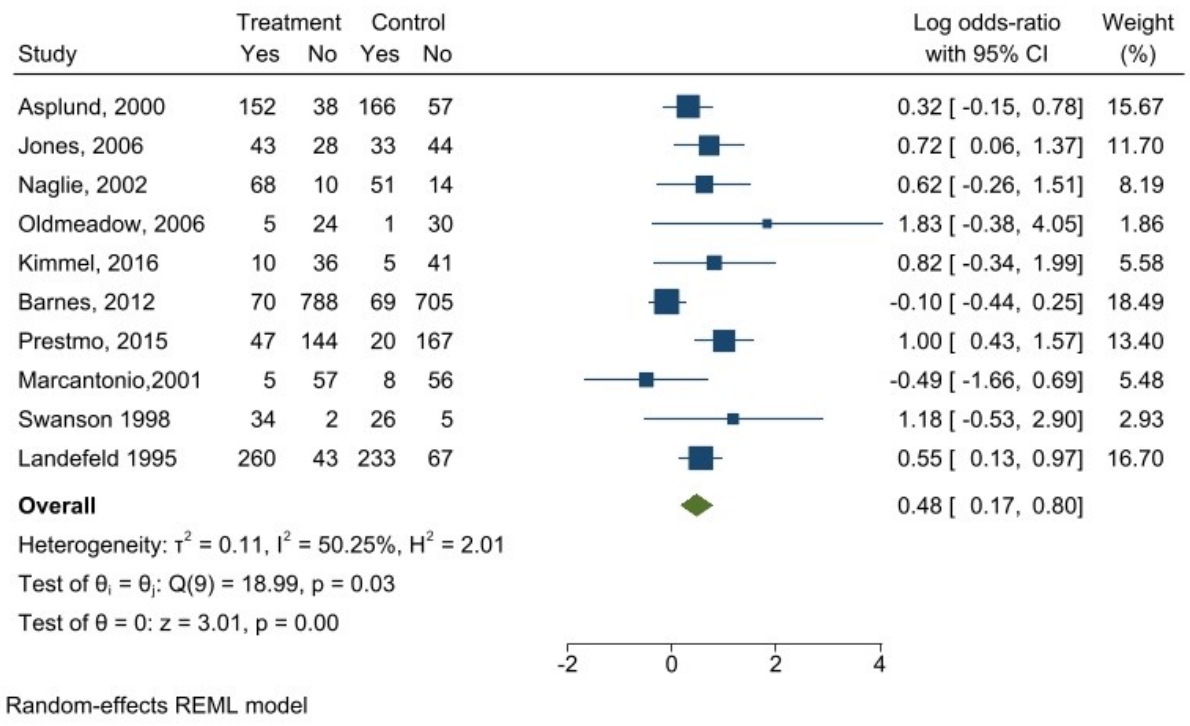

Study
Treatment N Mean SD
Control N Mean SD
Mean diff. with 95% CI
Weight (%)
Europe
Greulich, 2014 20 8.6 3.8 20 8.6 6.2 0.00 [-3.19, 3.19] 2.84
Torres-Sanchez, 2017 29 12.5 1.9 29 10.4 2.5 2.10 [0.96, 3.24] 4.74
Torres-Sanchez, 2016 24 8.7 2 25 8.8 2 -0.10 [-1.22, 1.02] 4.76
Lopez-Lopez, 2019a (1) 22 9.5 3 22 9.5 4.2 0.00 [-2.16, 2.16] 3.78
Lopez-Lopez, 2019a (2) 22 9.5 5.7 22 9.5 4.2 0.00 [-2.96, 2.96] 3.04
Lopez-Lopez, 2019b (1) 15 8.9 1.7 16 9.7 2.4 -0.80 [-2.27, 0.67] 4.45
Lopez-Lopez, 2019b (2) 17 9.5 2 16 9.7 2.4 -0.20 [-1.70, 1.30] 4.42
Torres-Sanchez, 2018 (1) 30 9 2.5 30 9.2 3.2 -0.20 [-1.65, 1.25] 4.47
Torres-Sanchez, 2018 (2) 30 10.5 4.3 30 9.2 3.2 1.30 [-0.62, 3.22] 4.02
Lopez-Lopez, 2018 (1) 14 9 2.5 12 9.2 3.2 -0.20 [-2.39, 1.99] 3.75
Lopez-Lopez, 2018 (2) 13 10.5 4.3 12 9.2 3.2 1.30 [-1.69, 4.29] 3.01
Karumo, 1977 39 32.2 22 48 35 21.8 -2.80 [-12.05, 6.45] 0.64
Lauridsen, 2002 20 25 8 31 43.75 23.25 -18.75 [-29.35, -8.15] 0.51
Stenvall, 2007 101 30 18.1 97 40 40.6 -10.00 [-18.70, -1.30] 0.72
Vidan, 2005 155 16 6.93 164 18.25 12.7 -2.25 [-4.51, 0.01] 3.68
Prestmo, 2015 198 12.6 .43 198 11 .54 1.60 [1.50, 1.70] 5.25
Slaets, 1997 140 19.7 16.7 97 24.8 16.7 -5.10 [-9.42, -0.78] 2.05
Asplund, 2000 190 5.9 5.7 223 7.3 5.7 -1.40 [-2.50, -0.30] 4.77
Heterogeneity: τ^2 = 1.46, I^2 = 76.47%, H^2 = 4.25 -0.18 [-0.96, 0.59]
Test of $\theta_i = \theta_j$: Q(17) = 106.05, p = 0.00
United States of America
Marcantonio,2001 62 5 4.62 64 5 4.62 0.00 [-1.61, 1.61] 4.32
Counsell, 2000 746 6.1 6.1 736 6.3 6.3 -0.20 [-0.83, 0.43] 5.09
Landefeld, 1995 327 7.5 8.4 324 8.4 8.4 -0.90 [-2.19, 0.39] 4.61
Brown, 2016 44 4.6 4 48 3.6 2.4 1.00 [-0.34, 2.34] 4.57
Heterogeneity: τ^2 = 0.08, I^2 = 18.10%, H^2 = 1.22 -0.10 [-0.69, 0.50]
Test of $\theta_i = \theta_j$: Q(3) = 4.19, p = 0.24
Australia
Swanson 1998 38 21 11.34 33 32.5 5.74 -11.50 [-15.78, -7.22] 2.08
Baker, 1991 6 46.5 25.9 6 73 31.7 -26.50 [-59.25, 6.25] 0.06
Oldmeadow, 2006 29 16.62 38.13 31 11.39 5.49 5.23 [-8.33, 18.79] 0.32
Kimmel, 2016 46 24.2 17.55 46 34.7 35.56 -10.50 [-21.96, 0.96] 0.44
Jones, 2006 71 9 7.5 77 11 7.5 -2.00 [-4.42, 0.42] 3.53
Jeffs, 2013 305 7.1 5.6 343 7.6 8.3 -0.50 [-1.60, 0.60] 4.77
Peiris 2013 495 21 16 499 23 20 -2.00 [-4.25, 0.25] 3.69
Timmer 2019 50 12 5.23 48 12.5 5.15 -0.50 [-2.56, 1.56] 3.88
Heterogeneity: τ^2 = 15.82, I^2 = 89.27%, H^2 = 9.32 -3.29 [-6.73, 0.15]
Test of $\theta_i = \theta_j$: Q(7) = 30.74, p = 0.00
Canada
Naglie, 2002 141 29.2 22.6 138 20.9 18.8 8.30 [3.42, 13.18] 1.76
Heterogeneity: τ^2 = 0.00, I^2 = .%, H^2 = . 8.30 [3.42, 13.18]
Test of $\theta_i = \theta_j$: Q(0) = 0.00, p = .
Overall -0.56 [-1.35, 0.23]
Heterogeneity: τ^2 = 3.12, I^2 = 88.99%, H^2 = 9.08
Test of $\theta_i = \theta_j$: Q(30) = 232.92, p = 0.00
Test of group differences: $Q_b(3)$ = 14.72, p = 0.00
-60 -40 -20 0 20
Random-effects REML model

INPATIENT REHABILITATION VERSUS COMPARATOR ON DISCHARGE DESTINATION OF HOME AFTER INPATIENT REHABILITATION.

Systematic review	Randomized controlled trial	Population	Intervention	Comparator
Heldmann 2019	Asplund 2000	Medical admission	Early intervention; Discharge planning; Increased medical care	Usual care (Sweden). Physiotherapy and occupational therapy not routinely available.
Heldmann 2019	Jones 2006	Medical admission	Exercise scheduling for strengthening; Repeated practice activities (+/- increasing demands)	Usual care (Australia). Standard physiotherapy.
Smith 2020b	Landefeld 1995	Medical admission	Repeated practice activities (+/- increasing demands); Antecedents; Team meetings & care planning; Discharge planning; Increased medical care; Nutritional intervention	Usual care (USA). Physiotherapy.
Heldmann 2019	Naglie 2002	Hip fracture	Repeated practice activities (+/- increasing demands); Feedback and monitoring; Shaping knowledge; Team meetings & care planning; Discharge planning; Increased medical care; Early intervention; Home visit	Usual care (Canada). Physiotherapy if referred. Occupational therapy rarely.
Heldmann 2019	Oldmeadow 2006	Hip fracture	Early intervention	Delayed ambulation to post op day 3 or 4
Heldmann 2019	Kimmel 2016	Hip fracture	Repeated exercise rehabilitation	Usual care (Australia). Daily physiotherapy.
Heldmann 2019	Barnes 2012	Medical admission	Repeated practice activities (+/- increasing demands); Antecedents; Team meetings & care planning; Discharge planning; Increased medical care; Nutritional intervention	Usual care (USA). Physiotherapy if referred.
Heldmann 2019	Prestmo 2015	Hip fracture	Repeated practice activities (+/- increasing demands); Goals and planning; Team meetings & care planning; Discharge planning; Increased medical care; Nutritional intervention; Early intervention	Usual care (Norway). Physiotherapy according to guidelines. No occupational therapists.
Smith 2020	Marcantonio 2001	Hip fracture	Antecedents; Increased medical care; Nutritional intervention; Early intervention	Usual care (USA). Medical care.
Bachmann 2010	Swanson 1998	Hip fracture	Repeated exercise rehabilitation; Team meetings & care planning; Discharge planning; Increased medical care; Early intervention; Home visit	Usual care (Australia). Physiotherapy. Occupational therapy on referral.
Peck 2020	Resnick 2016	Orthopaedic trauma	Repeated practice activities (+/- increasing demands); Goals and planning; Feedback and monitoring; Shaping knowledge; Antecedents; Increased medical care	Usual care (USA), plus education

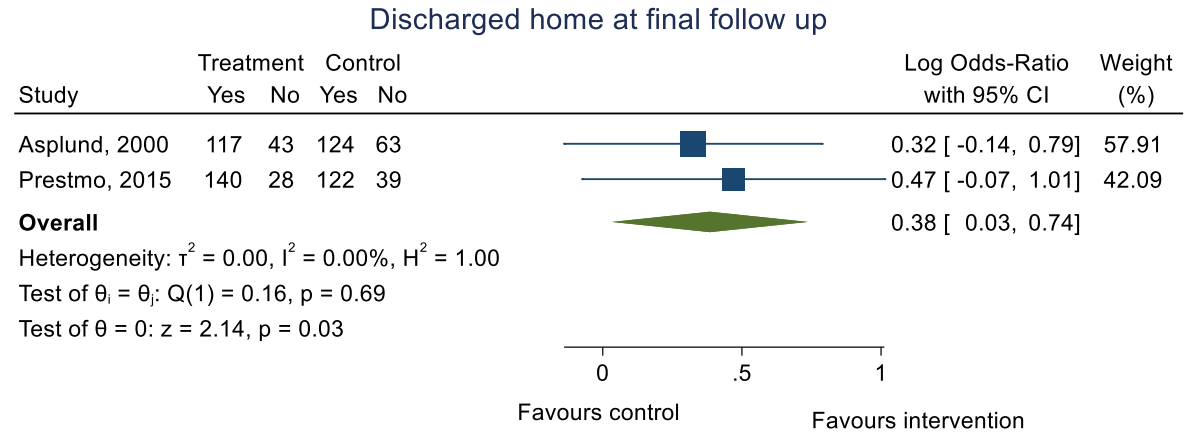


With removal of RCT from systematic review of critically low quality


Study
Treatment Yes No
Control Yes No
Log odds-ratio with 95% CI
Weight (%)
Asplund, 2000 152 38 166 57 0.32 [-0.15, 0.78] 15.67
Jones, 2006 43 28 33 44 0.72 [0.06, 1.37] 11.70
Naglie, 2002 68 10 51 14 0.62 [-0.26, 1.51] 8.19
Oldmeadow, 2006 5 24 1 30 1.83 [-0.38, 4.05] 1.86
Kimmel, 2016 10 36 5 41 0.82 [-0.34, 1.99] 5.58
Barnes, 2012 70 788 69 705 -0.10 [-0.44, 0.25] 18.49
Prestmo, 2015 47 144 20 167 1.00 [0.43, 1.57] 13.40
Marcantonio,2001 5 57 8 56 -0.49 [-1.66, 0.69] 5.48
Swanson 1998 34 2 26 5 1.18 [-0.53, 2.90] 2.93
Landefeld 1995 260 43 233 67 0.55 [0.13, 0.97] 16.70
Overall 0.48 [0.17, 0.80]
Heterogeneity: τ^2 = 0.11, I^2 = 50.25%, H^2 = 2.01
Test of $\theta_i = \theta_j$: Q(9) = 18.99, p = 0.03
Test of θ = 0: z = 3.01, p = 0.00
-2
0
2
4
Random-effects REML model

INPATIENT REHABILITATION VERSUS COMPARATOR ON FINAL DESTINATION OF HOME

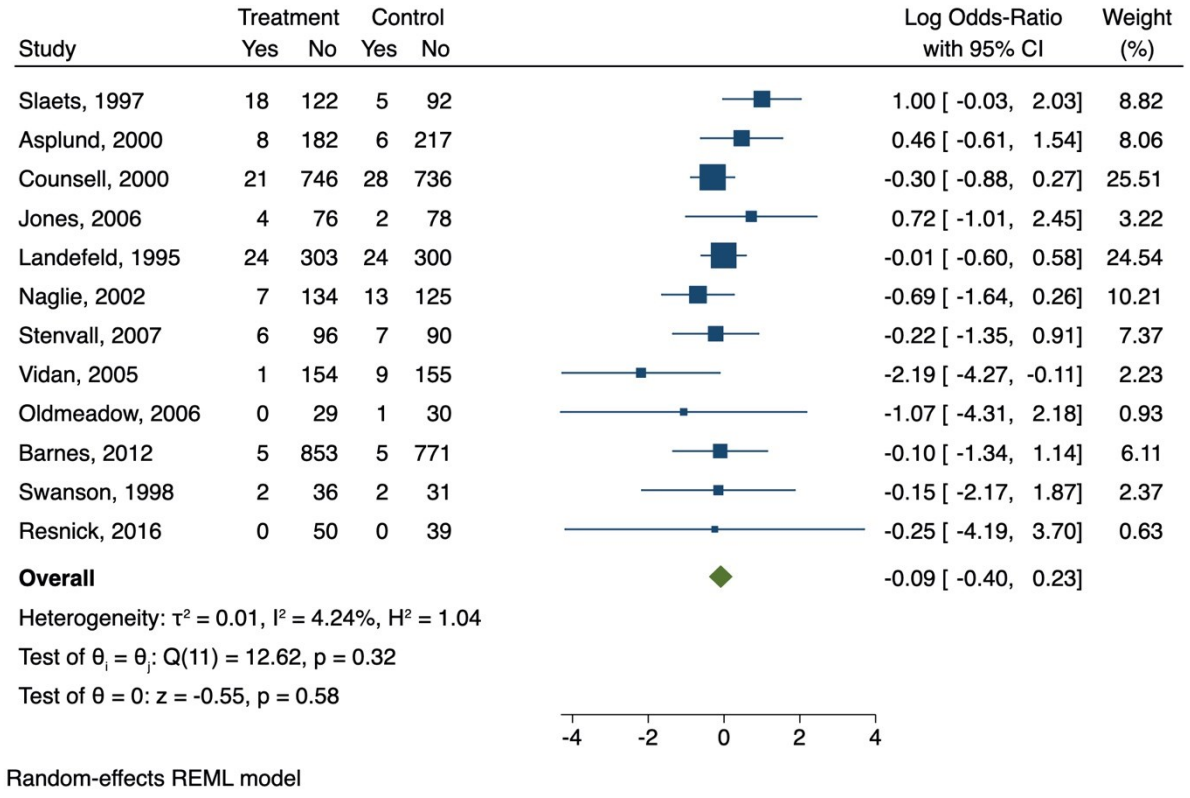
Systematic review	Randomized controlled trial	Population	Intervention	Comparator	Length of follow up
Heldmann 2019	Asplund 2000	Medical admission	Early intervention; Discharge planning; Increased medical care	Usual care (Sweden). Physiotherapy and occupational therapy not routinely available.	3 months
Heldmann 2019	Prestmo 2015	Hip fracture	Repeated practice activities (+/- increasing demands); Goals and planning; Team meetings & care planning; Discharge planning; Increased medical care; Nutritional intervention; Early intervention	Usual care (Norway). Physiotherapy according to guidelines. No occupational therapists.	12 months



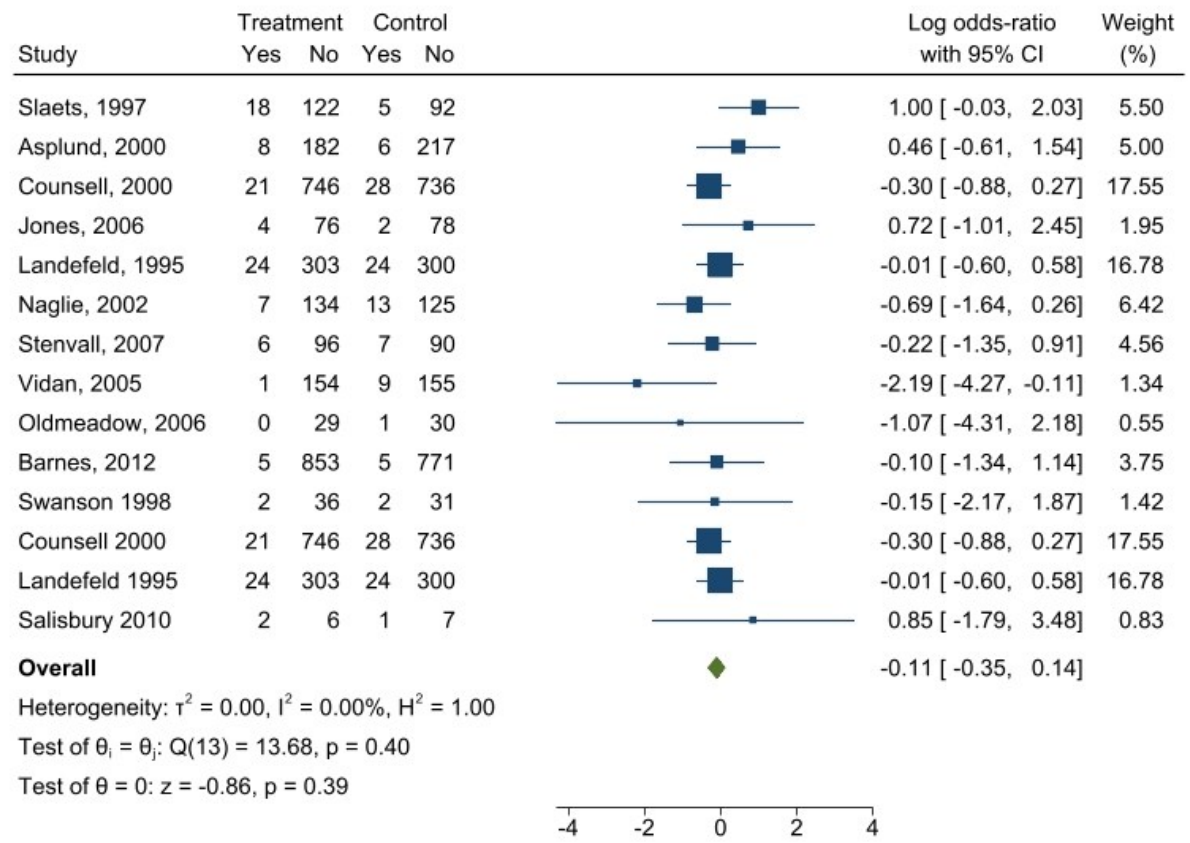
INPATIENT REHABILITATION VERSUS COMPARATOR ON MORTALITY AFTER INPATIENT REHABILITATION.

Systematic review	Randomized controlled trial	Population	Intervention	Comparator
de Morton 2007	Slaets 1997	Medical admission	Repeated exercise rehabilitation; Team meetings & care planning; Increased medical care;	Usual care (The Netherlands). Services provided by physicians and nurses.
Heldmann 2019	Asplund 2000	Medical admission	Early intervention; Discharge planning; Increased medical care	Usual care (Sweden). Physiotherapy and occupational therapy not routinely available.
Smith 2020b	Counsell 2000	Medical admission	Repeated practice activities (+/- increasing demands); Antecedents; Team meetings & care planning; Discharge planning; Increased medical care; Nutritional intervention	Usual care (USA). Medical care.
Heldmann 2019	Jones 2006	Medical admission	Exercise scheduling for strengthening; Repeated practice activities (+/- increasing demands)	Usual care (Australia). Standard physiotherapy.
Smith 2020b	Landefeld 1995	Medical admission	Repeated practice activities (+/- increasing demands); Antecedents; Team meetings & care planning; Discharge planning; Increased medical care; Nutritional intervention	Usual care (USA). Physiotherapy.
Heldmann 2019	Naglie 2002	Hip fracture	Repeated practice activities (+/- increasing demands); Feedback and monitoring; Shaping knowledge; Team meetings & care planning; Discharge planning; Increased medical care; Early intervention; Home visit	Usual care (Canada). Physiotherapy if referred. Occupational therapy rarely.
Heldmann 2019	Stenvall 2007	Hip fracture	Endurance exercise; Repeated practice activities (+/- increasing demands); Goals and planning; Shaping knowledge; Team meetings & care planning; Increased medical care; Nutritional intervention; Early intervention	Usual care (Sweden). Exercise rehabilitation with daily physiotherapy and occupational therapy as needed.
Heldmann 2019	Vidan 2005	Hip fracture	Repeated exercise rehabilitation; Antecedents; Team meetings & care planning; Increased medical care	Usual care (Spain) Physiotherapy. Occupational therapy not available.
Heldmann 2019	Oldmeadow 2006	Hip fracture	Early intervention	Delayed ambulation to post op day 3 or 4
Heldmann 2019	Barnes 2012	Medical admission	Repeated practice activities (+/- increasing demands); Antecedents; Team meetings & care planning; Discharge	Usual care (USA). Physiotherapy if referred.

			planning; Increased medical care; Nutritional intervention	
Bachmann 2010	Swanson 1998	Hip fracture	Repeated exercise rehabilitation; Team meetings & care planning; Discharge planning; Increased medical care; Early intervention; Home visit	Usual care (Australia). Physiotherapy. Occupational therapy on referral.
Peck 2020	Resnick 2016	Orthopaedic trauma	Repeated practice activities (+/- increasing demands); Goals and planning; Feedback and monitoring; Shaping knowledge; Antecedents; Increased medical care	Usual care (USA), plus education



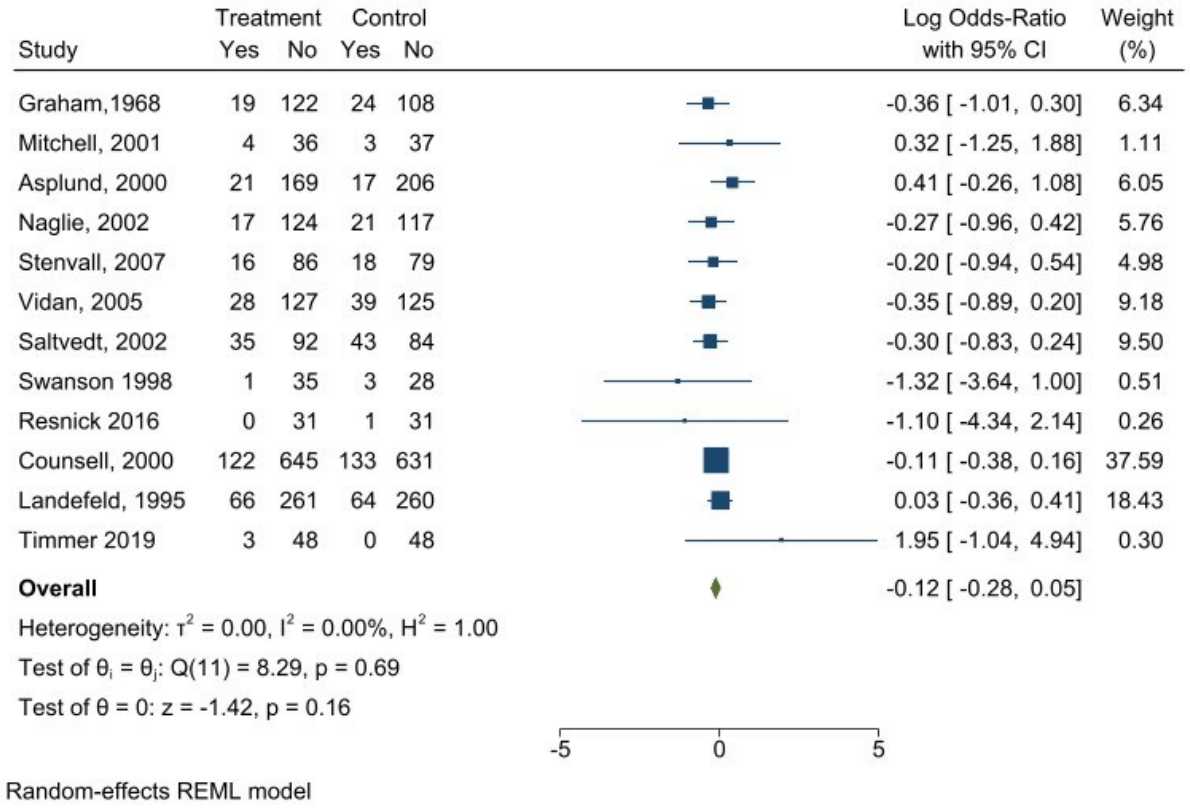
With removal of RCT from systematic review of critically low quality


Study
Treatment Yes No
Control Yes No
Log odds-ratio with 95% CI
Weight (%)
Slaets, 1997 18 122 5 92 1.00 [-0.03, 2.03] 5.50
Asplund, 2000 8 182 6 217 0.46 [-0.61, 1.54] 5.00
Counsell, 2000 21 746 28 736 -0.30 [-0.88, 0.27] 17.55
Jones, 2006 4 76 2 78 0.72 [-1.01, 2.45] 1.95
Landefeld, 1995 24 303 24 300 -0.01 [-0.60, 0.58] 16.78
Naglie, 2002 7 134 13 125 -0.69 [-1.64, 0.26] 6.42
Stenvall, 2007 6 96 7 90 -0.22 [-1.35, 0.91] 4.56
Vidan, 2005 1 154 9 155 -2.19 [-4.27, -0.11] 1.34
Oldmeadow, 2006 0 29 1 30 -1.07 [-4.31, 2.18] 0.55
Barnes, 2012 5 853 5 771 -0.10 [-1.34, 1.14] 3.75
Swanson 1998 2 36 2 31 -0.15 [-2.17, 1.87] 1.42
Counsell 2000 21 746 28 736 -0.30 [-0.88, 0.27] 17.55
Landefeld 1995 24 303 24 300 -0.01 [-0.60, 0.58] 16.78
Salisbury 2010 2 6 1 7 0.85 [-1.79, 3.48] 0.83
Overall -0.11 [-0.35, 0.14]
Heterogeneity: τ^2 = 0.00, I^2 = 0.00%, H^2 = 1.00
Test of $\theta_i = \theta_j$: Q(13) = 13.68, p = 0.40
Test of θ = 0: z = -0.86, p = 0.39
-4
-2
0
2
4
Random-effects REML model

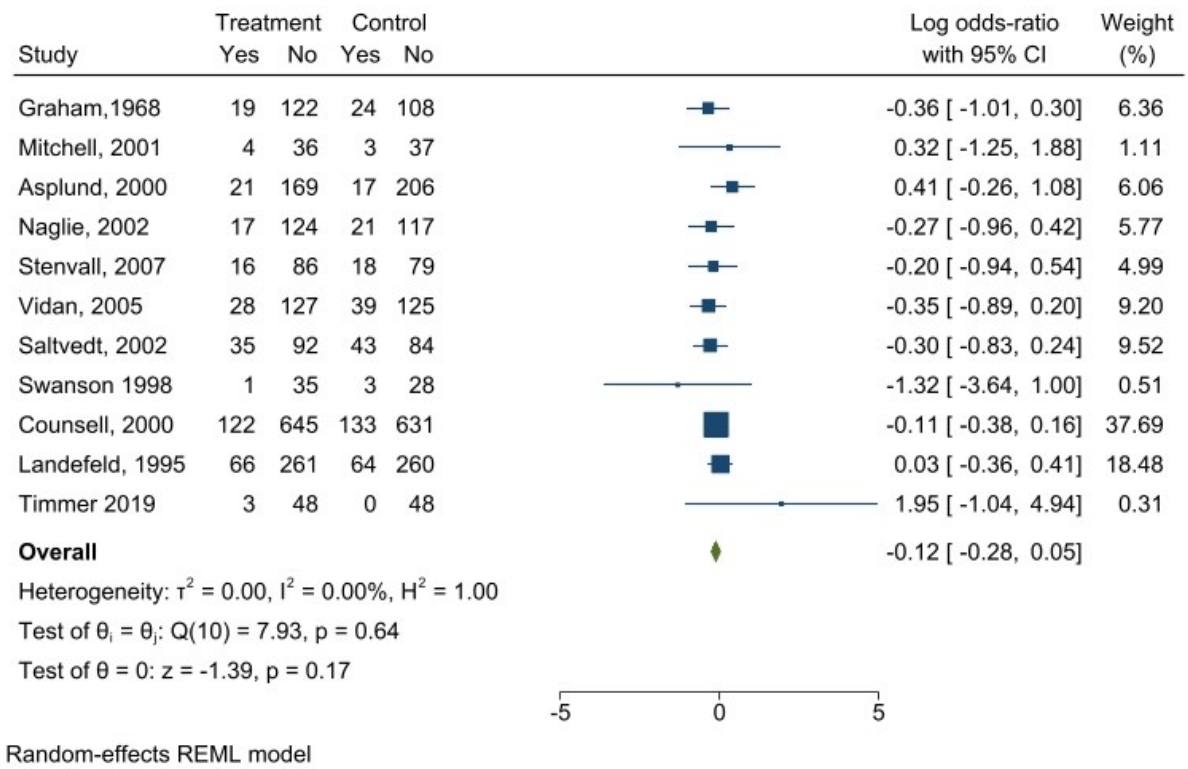
INPATIENT REHABILITATION VERSUS COMPARATOR ON MORTALITY AT FOLLOW UP

Systematic review	Randomized controlled trial	Population	Intervention	Comparator	Length of follow up
Handoll 2011	Graham 1968	Hip fracture	Endurance exercise; Early intervention	Delayed weight bearing until 12 weeks after surgery	12 months
Handoll 2011	Mitchell 2001	Hip fracture	Strengthening exercise; Repeated practice functions (+/-increasing demands)	Usual care (UK). 20 minutes physiotherapy per weekday.	16 weeks
Heldmann 2019	Asplund 2000	Medical admission	Early intervention; Discharge planning; Increased medical care	Usual care (Sweden). Physiotherapy and occupational therapy not routinely available.	3 months
Smith 2020b	Counsell 2000	Medical admission	Repeated practice activities (+/- increasing demands); Antecedents; Team meetings & care planning; Discharge planning; Increased medical care; Nutritional intervention	Usual care (USA). Medical care.	3 months
Smith 2020b	Landefeld 1995	Medical admission	Repeated practice activities (+/- increasing demands); Antecedents; Team meetings & care planning; Discharge planning; Increased medical care; Nutritional intervention	Usual care (USA). Physiotherapy.	3 months
Heldmann 2019	Naglie 2002	Hip fracture	Repeated practice activities (+/- increasing demands); Feedback and monitoring; Shaping knowledge; Team meetings & care planning; Discharge planning; Increased medical care; Early intervention; Home visit	Usual care (Canada). Physiotherapy if referred. Occupational therapy rarely.	6 months
Heldmann 2019	Stenvall 2007	Hip fracture	Endurance exercise; Repeated practice activities (+/- increasing demands); Goals and planning; Shaping knowledge; Team meetings & care planning; Increased medical care; Nutritional intervention; Early intervention	Usual care (Sweden). Exercise rehabilitation with daily physiotherapy and occupational therapy as needed.	12 months
Heldmann 2019	Vidan 2005	Hip fracture	Repeated exercise rehabilitation; Antecedents; Team meetings & care planning; Increased medical care	Usual care (Spain) Physiotherapy. Occupational therapy not available.	12 months

Martinez-Velilla, 2016	Saltvedt 2002	Medical admission	Shaping knowledge; Antecedents; Team meetings & care planning; Discharge planning; Increased medical care; Early intervention; Home visit	Usual care (Norway), Allied health if referred.	12 months
Smith 2020b	Timmer 2019	Medical A admission	Repeated practice activities (+/- increasing demands); Goals and planning; Feedback and monitoring; Social support; Shaping knowledge; Natural consequences	Usual care (Australia) plus a brief activity pacing education. Physiotherapy and occupational therapy.	3 months
Bachmann 2010	Swanson 1998	Hip fracture	Repeated exercise rehabilitation; Team meetings & care planning; Discharge planning; Increased medical care; Early intervention; Home visit	Usual care (Australia). Physiotherapy. Occupational therapy on referral.	6 months
Peck 2020	Resnick 2016	Orthopaedic trauma	Repeated practice activities (+/- increasing demands); Goals and planning; Feedback and monitoring; Shaping knowledge; Antecedents; Increased medical care	Usual care (USA), plus education	1 month



With removal of RCT from systematic review of critically low quality

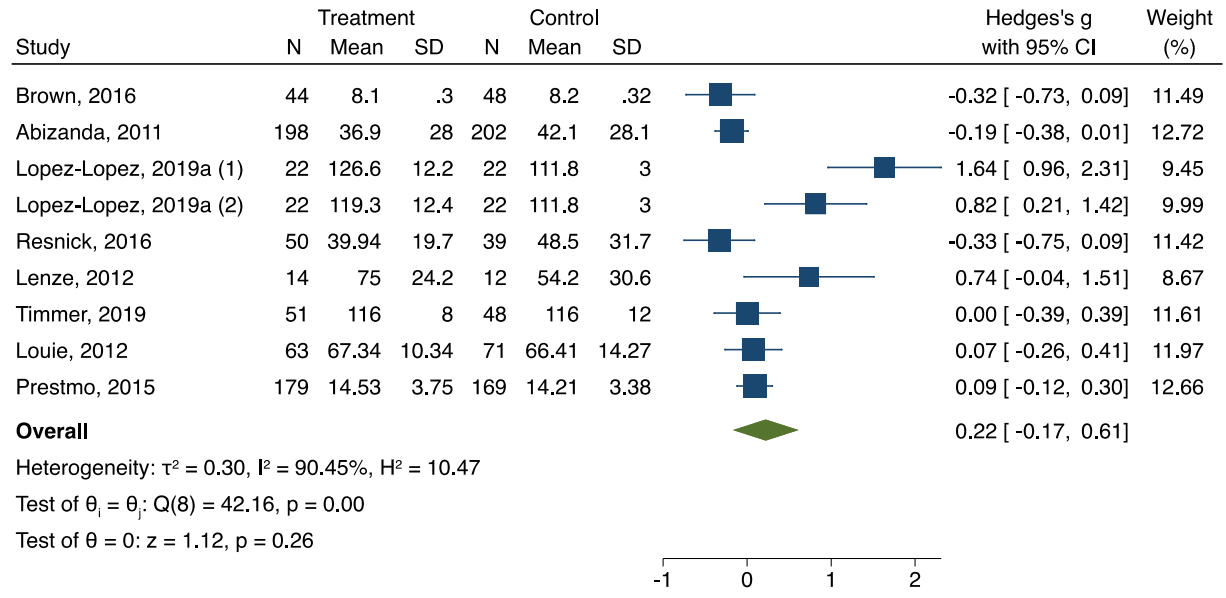

Study
Treatment Yes No
Control Yes No
Log odds-ratio with 95% CI
Weight (%)
Graham,1968 19 122 24 108 -0.36 [-1.01, 0.30] 6.36
Mitchell, 2001 4 36 3 37 0.32 [-1.25, 1.88] 1.11
Asplund, 2000 21 169 17 206 0.41 [-0.26, 1.08] 6.06
Naglie, 2002 17 124 21 117 -0.27 [-0.96, 0.42] 5.77
Stenvall, 2007 16 86 18 79 -0.20 [-0.94, 0.54] 4.99
Vidan, 2005 28 127 39 125 -0.35 [-0.89, 0.20] 9.20
Saltvedt, 2002 35 92 43 84 -0.30 [-0.83, 0.24] 9.52
Swanson 1998 1 35 3 28 -1.32 [-3.64, 1.00] 0.51
Counsell, 2000 122 645 133 631 -0.11 [-0.38, 0.16] 37.69
Landefeld, 1995 66 261 64 260 0.03 [-0.36, 0.41] 18.48
Timmer 2019 3 48 0 48 1.95 [-1.04, 4.94] 0.31
Overall -0.12 [-0.28, 0.05]
Heterogeneity: τ^2 = 0.00, I^2 = 0.00%, H^2 = 1.00
Test of $\theta_i = \theta_j$: Q(10) = 7.93, p = 0.64
Test of θ = 0: z = -1.39, p = 0.17
-5
0
5
Random-effects REML model

SUPPLEMENTARY FILE 6

LIST OF META-ANALYSES

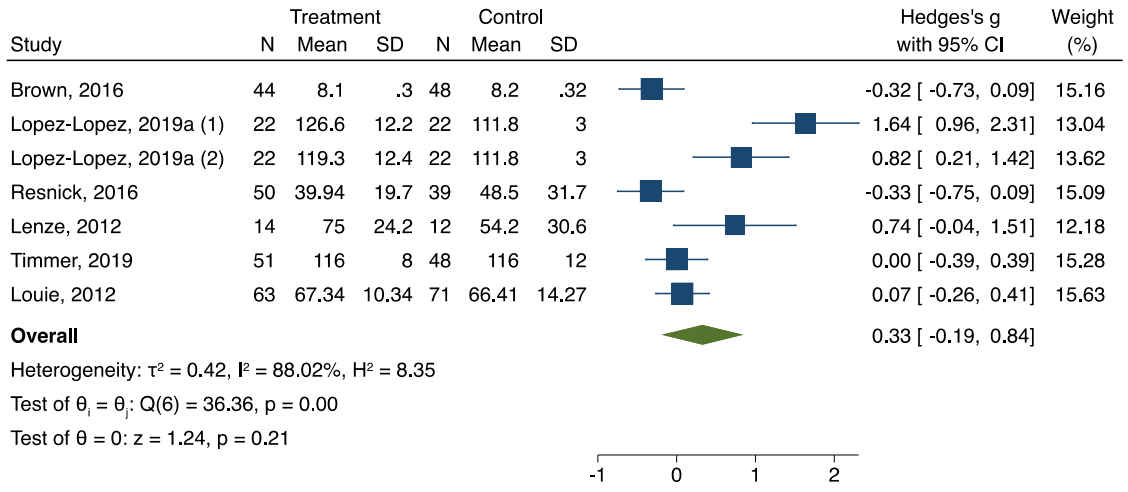
1. Inpatient rehabilitation vs. comparator on activities of daily living after inpatient rehabilitation.
    a. Subgroup with ‘goals and planning’
    b. Subgroup with ‘feedback and monitoring’
    c. Subgroup with ‘repeated practice activities’
    d. Subgroup with ‘endurance exercise’
    e. Subgroup with ‘shaping knowledge’
    f. Subgroup with ‘increased medical care’
    g. Subgroup with ‘strengthening exercise’
    h. Subgroup with ‘energy applied to soft tissue’
    i. Subgroup with ‘repeated exercise rehabilitation’
    j. Subgroup with ‘nutritional intervention’
    k. Subgroup with ‘natural consequences’, ‘social support’
    l. Subgroup with ‘antecedents’
    m. Subgroup with ‘early intervention’
2. Inpatient rehabilitation vs. comparator on walking speed at end of intervention
    a. Subgroup with ‘strengthening exercise’
    b. Subgroup with ‘goals and planning’
    c. Subgroup with ‘repeated exercise rehabilitation’
3. Inpatient rehabilitation vs. comparator on walking endurance at end of intervention
    a. Subgroup with ‘endurance exercise’
    b. Subgroup with ‘energy applied to soft tissue’
    c. Subgroup with ‘shaping knowledge’
    d. Subgroup with ‘early intervention’
    e. Subgroup with ‘strengthening exercise’
    f. Subgroup with ‘goals and planning’
4. Inpatient rehabilitation vs. comparator on walking endurance pre/post intervention
    a. Subgroup with ‘endurance exercise’
5. Inpatient rehabilitation vs. comparator on discharge destination of home at intervention end (overall and by diagnosis).
    a. Subgroup with ‘increased medical care’
    b. Subgroup with ‘early intervention’
    c. Subgroup with ‘repeated practice activities (+/- increasing demands)’
    d. Subgroup with ‘team meetings & care planning’
    e. Subgroup with ‘discharge planning’
    f. Subgroup with ‘antecedents’
    g. Subgroup with ‘nutritional intervention’
    d. Subgroup with ‘goals and planning’
    e. Subgroup with ‘repeated exercise rehabilitation’

INPATIENT REHABILITATION VERSUS COMPARATOR ON ACTIVITIES OF DAILY LIVING AFTER INPATIENT REHABILITATION FOR SUBGROUP WITH 'GOALS AND PLANNING'



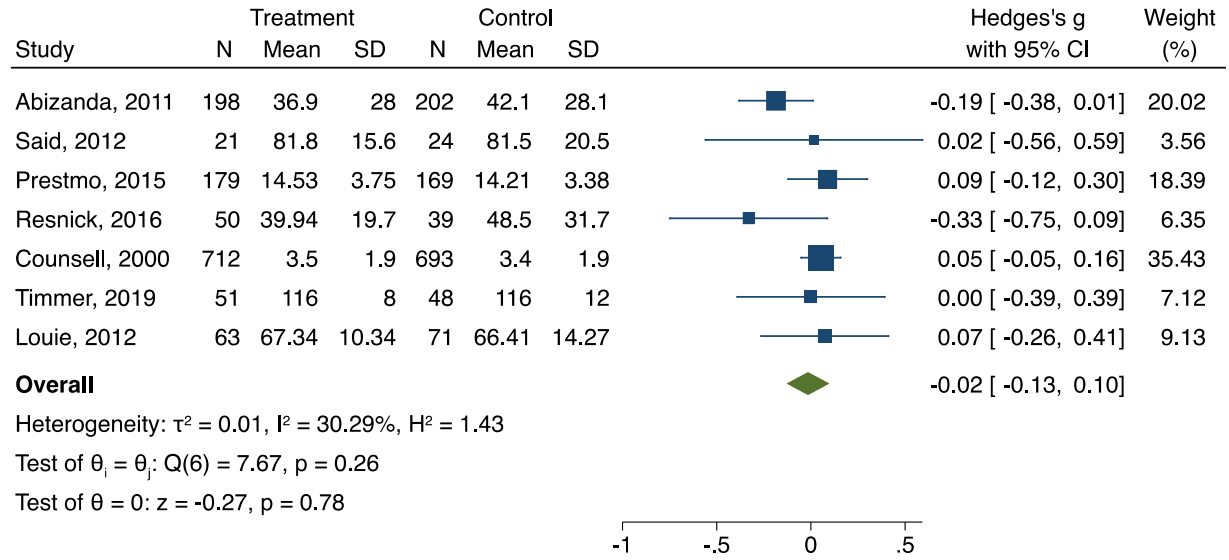
Random-effects REML model

INPATIENT REHABILITATION VERSUS COMPARATOR ON ACTIVITIES OF DAILY LIVING AFTER INPATIENT REHABILITATION FOR SUBGROUP WITH 'FEEDBACK AND MONITORING'



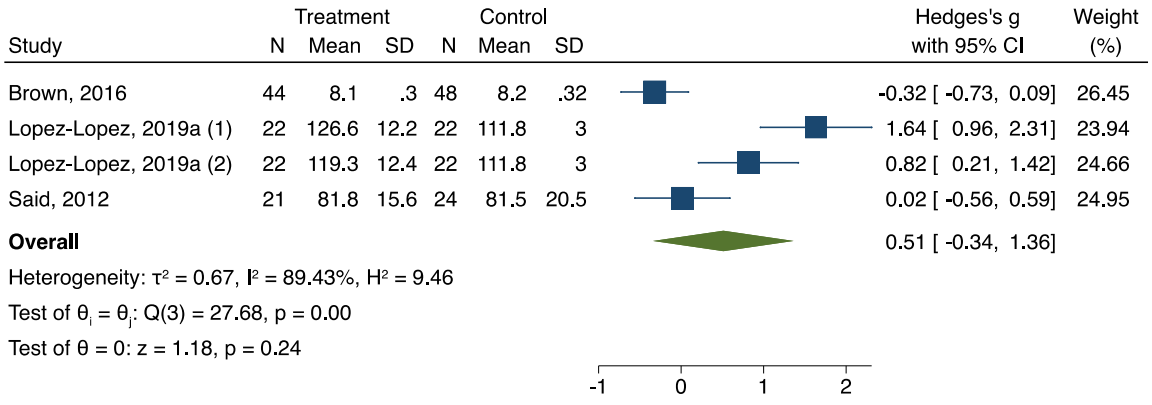
Random-effects REML model

INPATIENT REHABILITATION VERSUS COMPARATOR ON ACTIVITIES OF DAILY LIVING AFTER INPATIENT REHABILITATION FOR SUBGROUP WITH 'REPEATED PRACTICE ACTIVITIES'



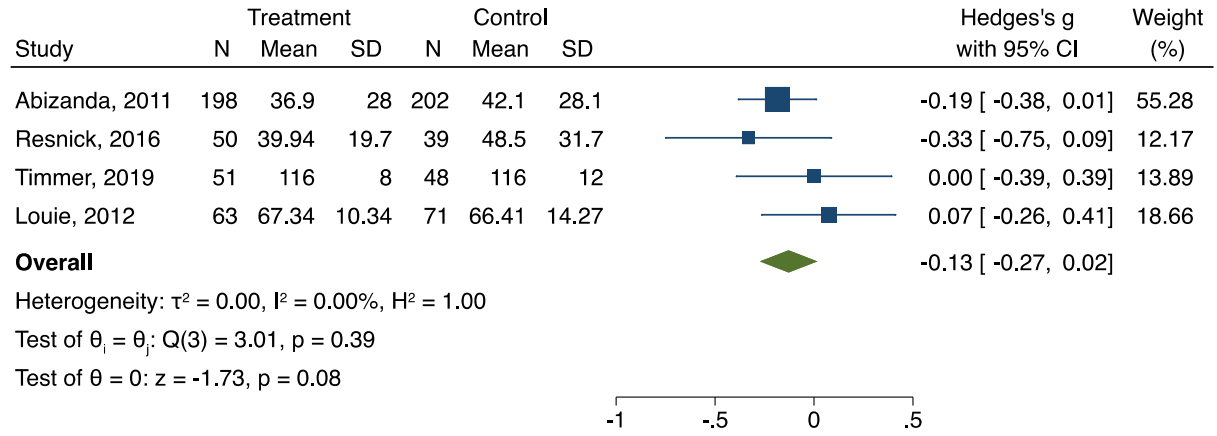
Random-effects REML model

INPATIENT REHABILITATION VERSUS COMPARATOR ON ACTIVITIES OF DAILY LIVING AFTER INPATIENT REHABILITATION FOR SUBGROUP WITH 'ENDURANCE EXERCISE'



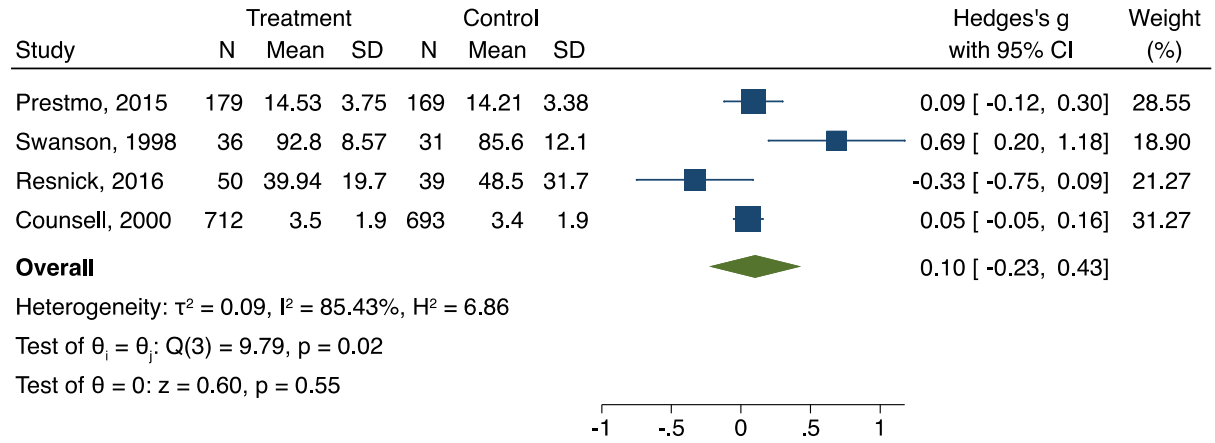
Random-effects REML model

INPATIENT REHABILITATION VERSUS COMPARATOR ON ACTIVITIES OF DAILY LIVING AFTER INPATIENT REHABILITATION FOR SUBGROUP WITH 'SHAPING KNOWLEDGE'



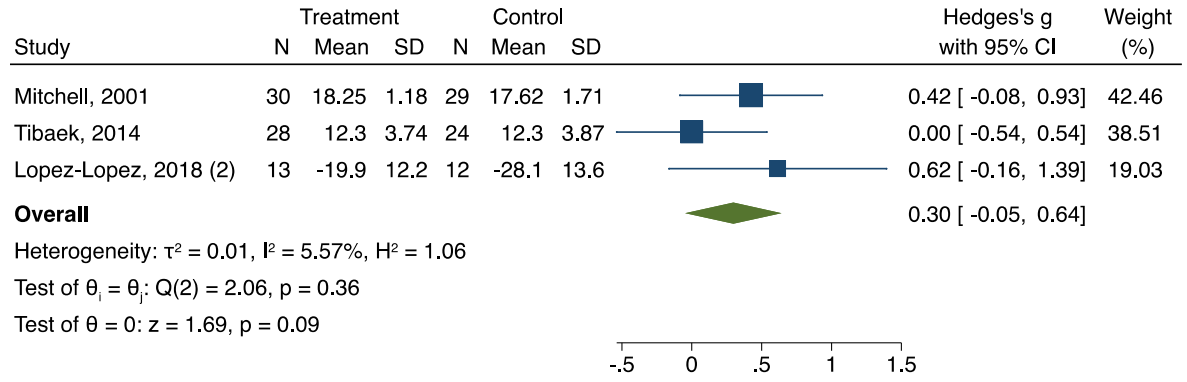
Random-effects REML model

INPATIENT REHABILITATION VERSUS COMPARATOR ON ACTIVITIES OF DAILY LIVING AFTER INPATIENT REHABILITATION FOR SUBGROUP WITH 'INCREASED MEDICAL CARE'



Random-effects REML model

INPATIENT REHABILITATION VERSUS COMPARATOR ON ACTIVITIES OF DAILY LIVING AFTER INPATIENT REHABILITATION FOR SUBGROUP WITH 'STRENGTHENING EXERCISE'



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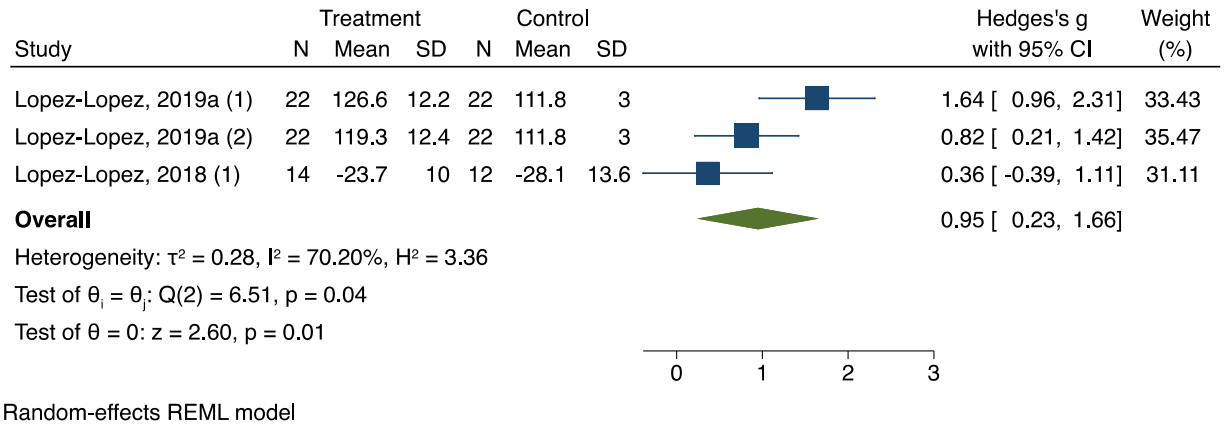
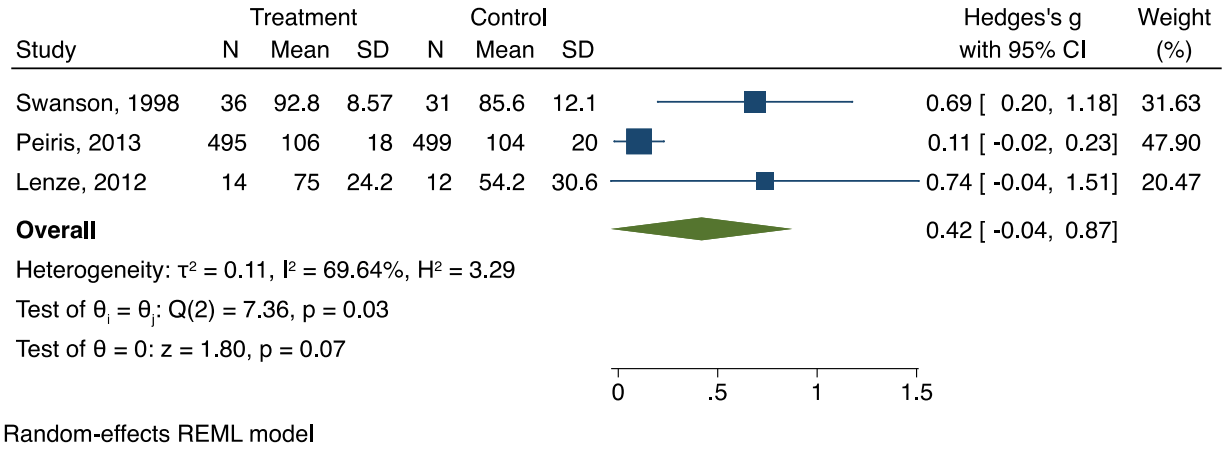
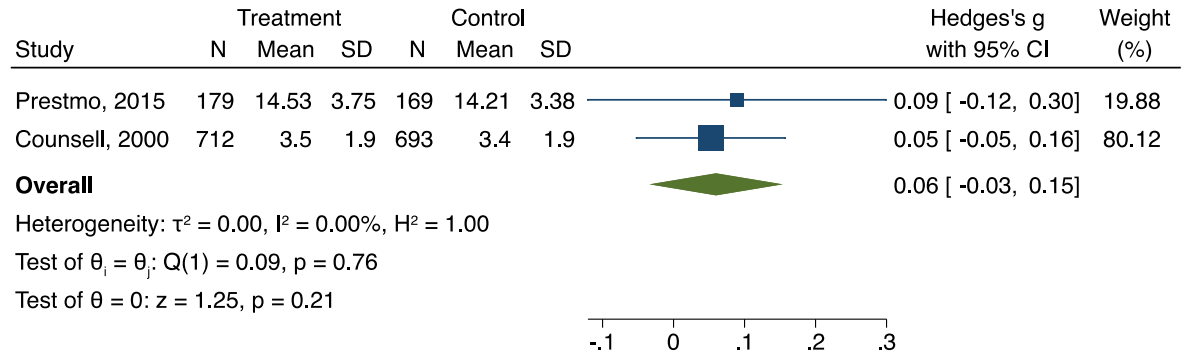


INPATIENT REHABILITATION VERSUS COMPARATOR ON ACTIVITIES OF DAILY LIVING AFTER INPATIENT REHABILITATION FOR SUBGROUP WITH 'REPEATED EXERCISE REHABILITATION'



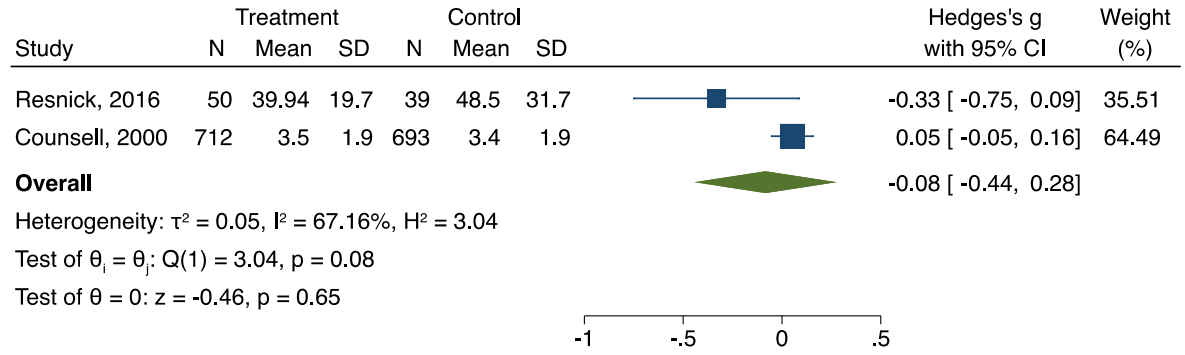
Random-effects REML model

INPATIENT REHABILITATION VERSUS COMPARATOR ON ACTIVITIES OF DAILY LIVING AFTER INPATIENT REHABILITATION FOR SUBGROUP WITH 'NUTRITIONAL INTERVENTION'



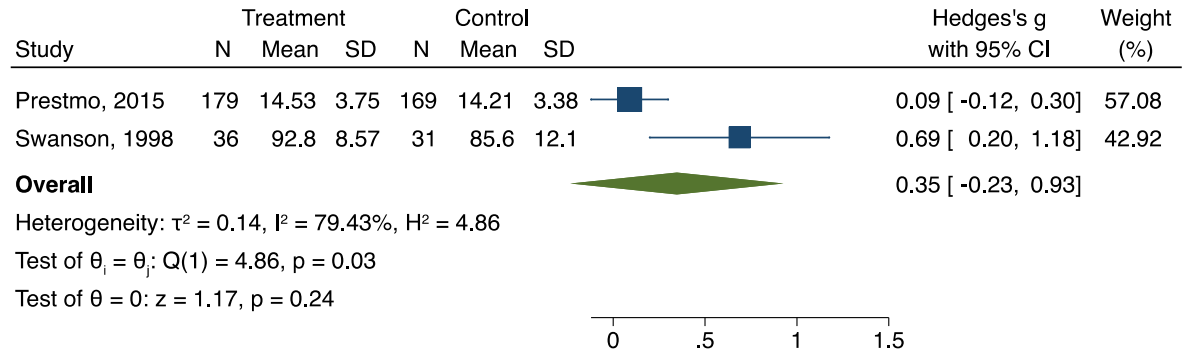
Random-effects REML model

INPATIENT REHABILITATION VERSUS COMPARATOR ON ACTIVITIES OF DAILY LIVING AFTER INPATIENT REHABILITATION FOR SUBGROUP WITH 'ANTECEDENTS'



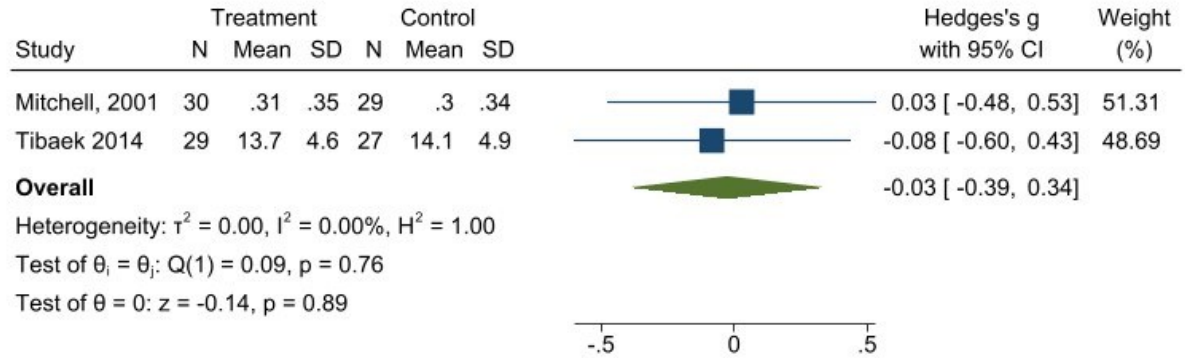
Random-effects REML model

INPATIENT REHABILITATION VERSUS COMPARATOR ON ACTIVITIES OF DAILY LIVING AFTER INPATIENT REHABILITATION FOR SUBGROUP WITH 'EARLY INTERVENTION'



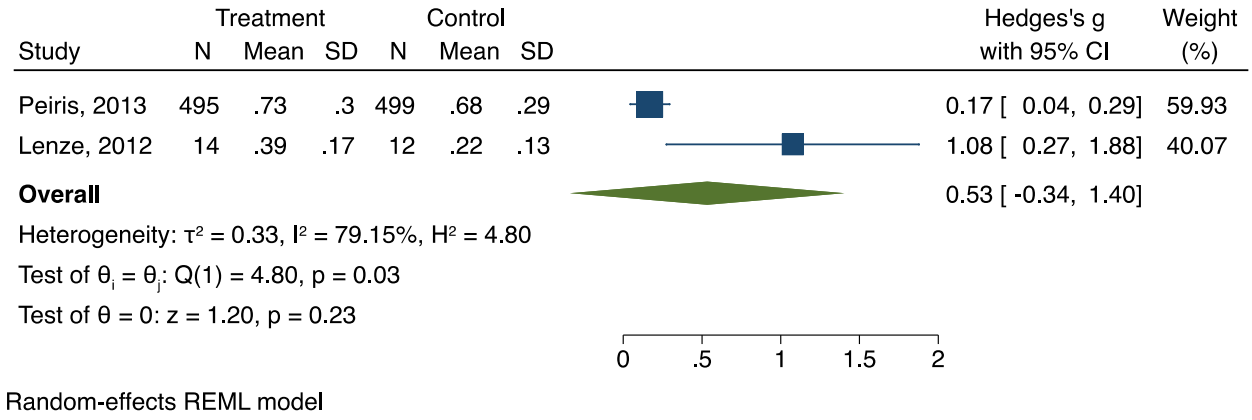
Random-effects REML model

INPATIENT REHABILITATION VERSUS COMPARATOR ON WALKING SPEED AFTER INPATIENT REHABILITATION FOR SUBGROUP WITH 'STRENGTHENING EXERCISE'

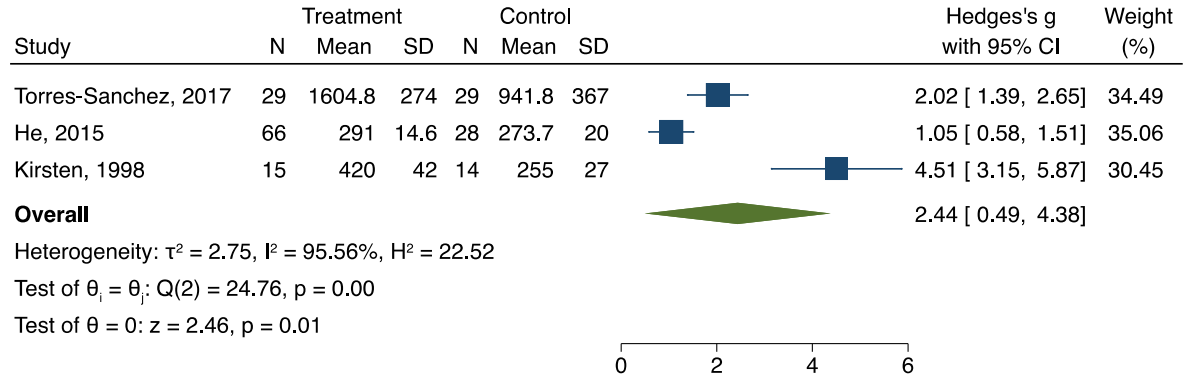


Random-effects REML model

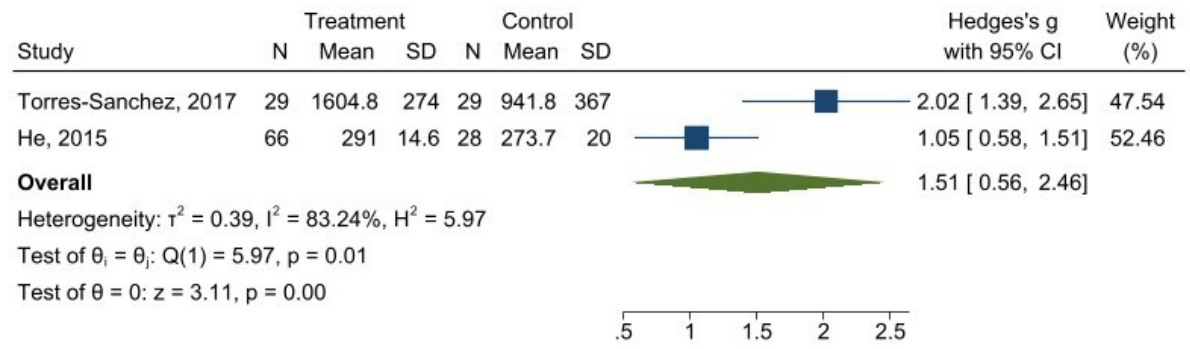
INPATIENT REHABILITATION VERSUS COMPARATOR ON WALKING SPEED AFTER INPATIENT REHABILITATION FOR SUBGROUP WITH 'REPEATED EXERCISE REHABILITATION'



INPATIENT REHABILITATION VERSUS COMPARATOR ON WALKING ENDURANCE AFTER INPATIENT REHABILITATION FOR SUBGROUP WITH 'ENDURANCE EXERCISE'

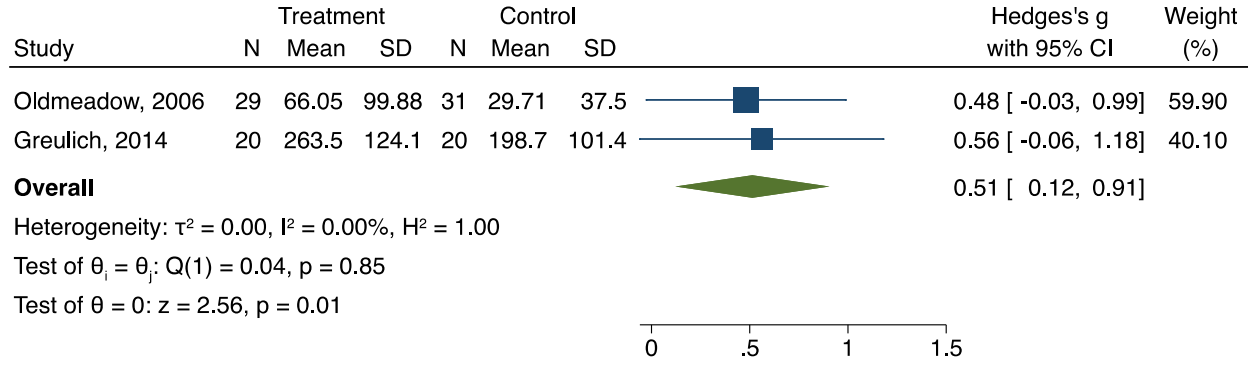


INPATIENT REHABILITATION VERSUS COMPARATOR ON WALKING ENDURANCE AFTER INPATIENT REHABILITATION FOR SUBGROUP WITH 'SHAPING KNOWLEDGE'



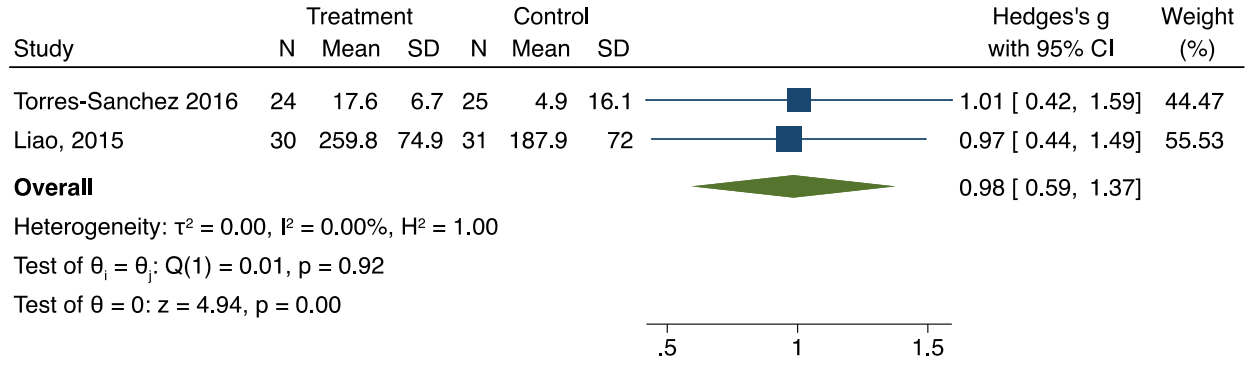
Random-effects REML model

INPATIENT REHABILITATION VERSUS COMPARATOR ON WALKING ENDURANCE AFTER INPATIENT REHABILITATION FOR SUBGROUP WITH 'EARLY INTERVENTION'



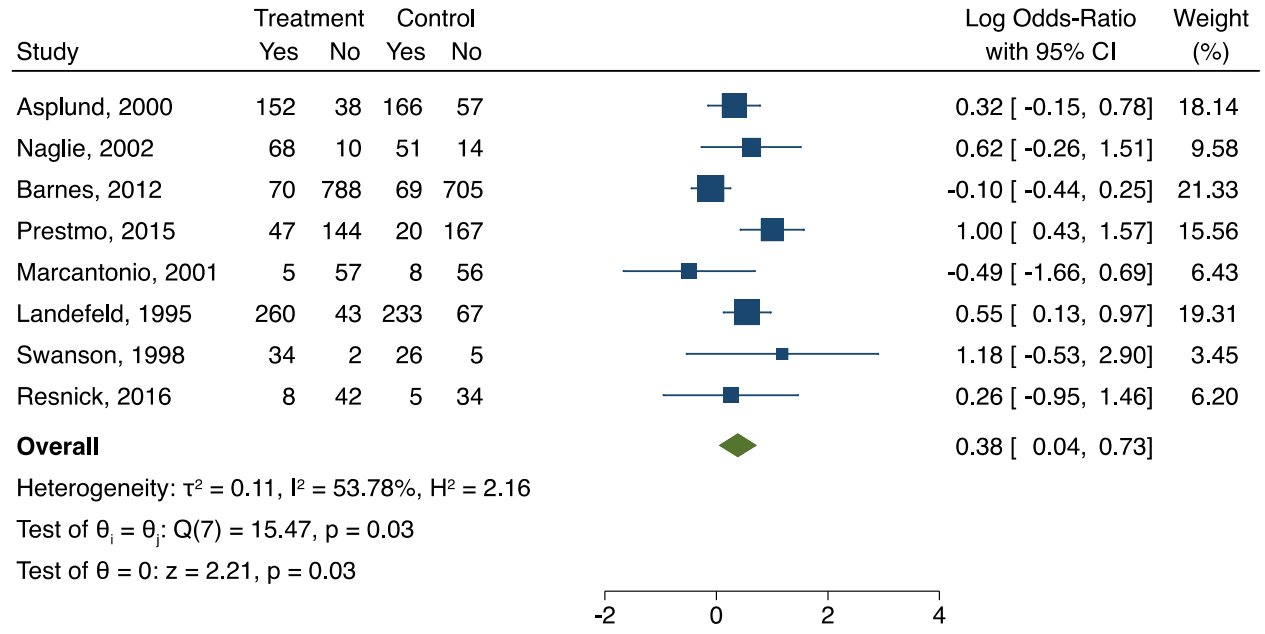
Random-effects REML model

INPATIENT REHABILITATION VERSUS COMPARATOR ON WALKING ENDURANCE PRE/POST INTERVENTION FOR SUBGROUP WITH 'ENDURANCE EXERCISE'



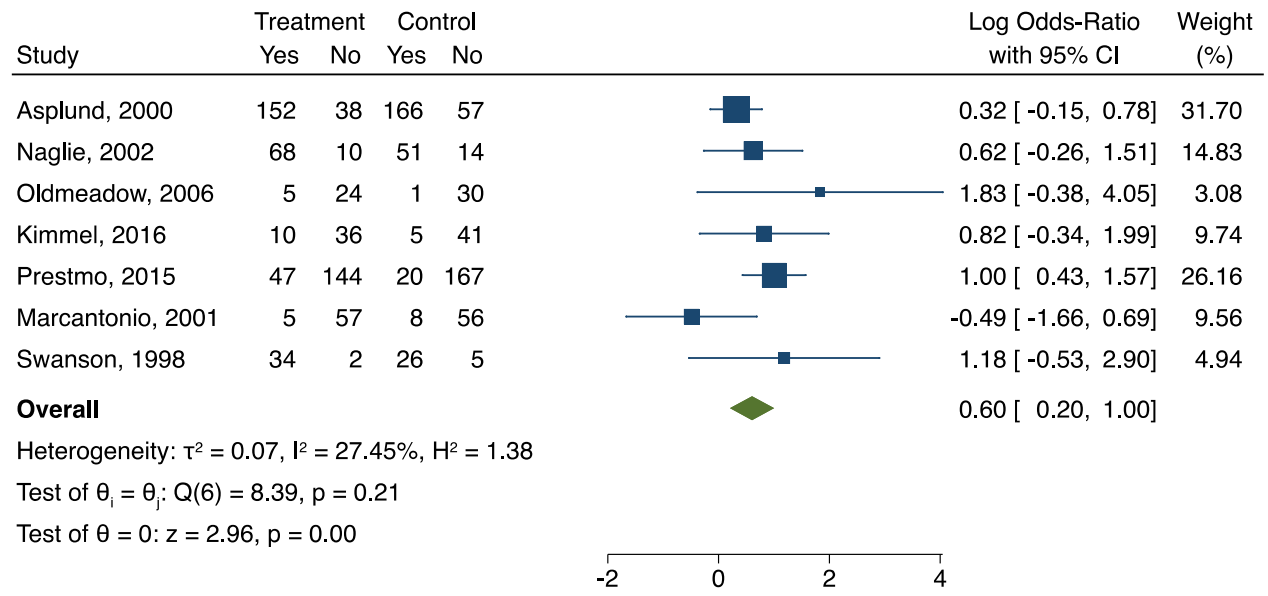
Random-effects REML model

INPATIENT REHABILITATION VERSUS COMPARATOR ON DISCHARGE DESTINATION OF HOME AFTER INPATIENT REHABILITATION FOR SUBGROUP WITH 'INCREASED MEDICAL CARE'



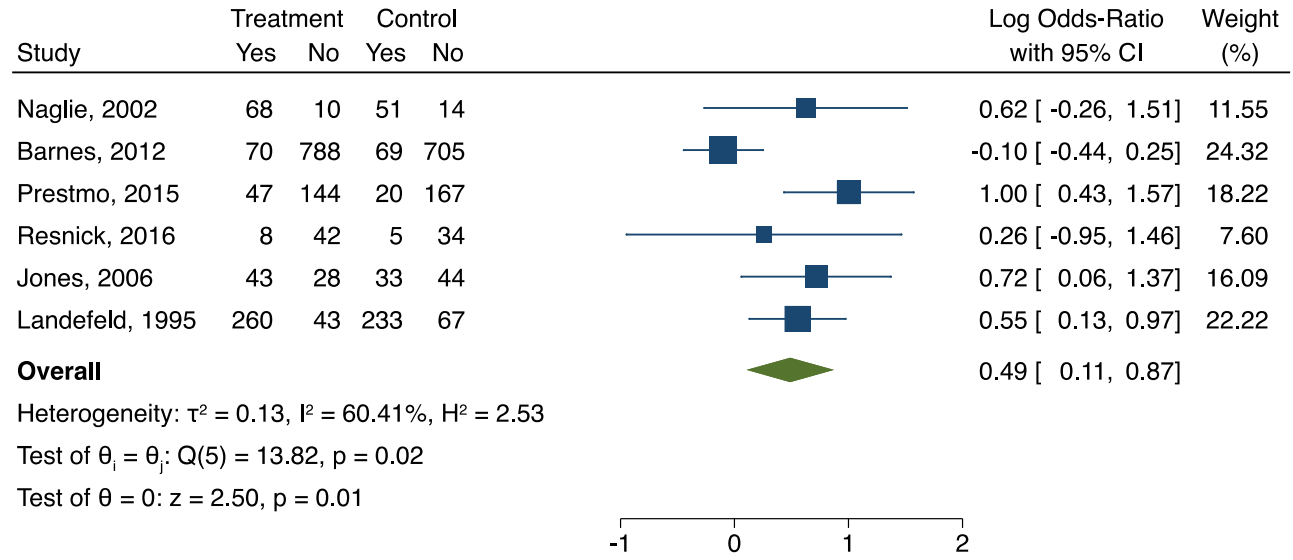
Random-effects REML model

INPATIENT REHABILITATION VERSUS COMPARATOR ON DISCHARGE DESTINATION OF HOME AFTER INPATIENT REHABILITATION FOR SUBGROUP WITH 'EARLY INTERVENTION'



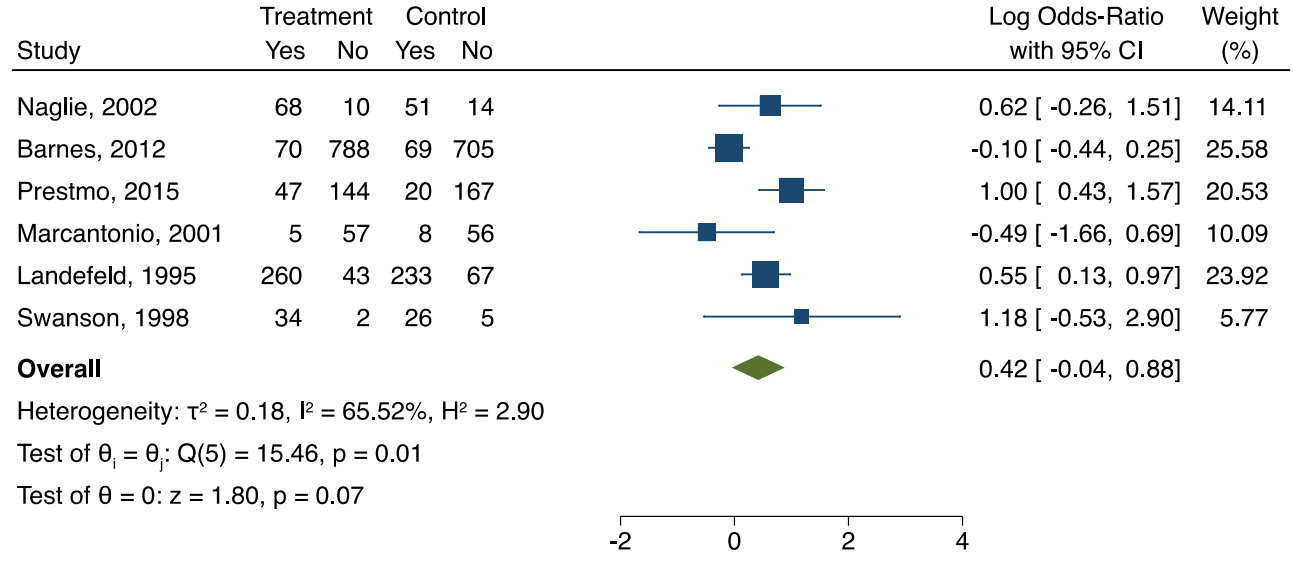
Random-effects REML model

INPATIENT REHABILITATION VERSUS COMPARATOR ON DISCHARGE DESTINATION OF HOME AFTER INPATIENT REHABILITATION FOR SUBGROUP WITH 'REPEATED PRACTICE ACTIVITIES'



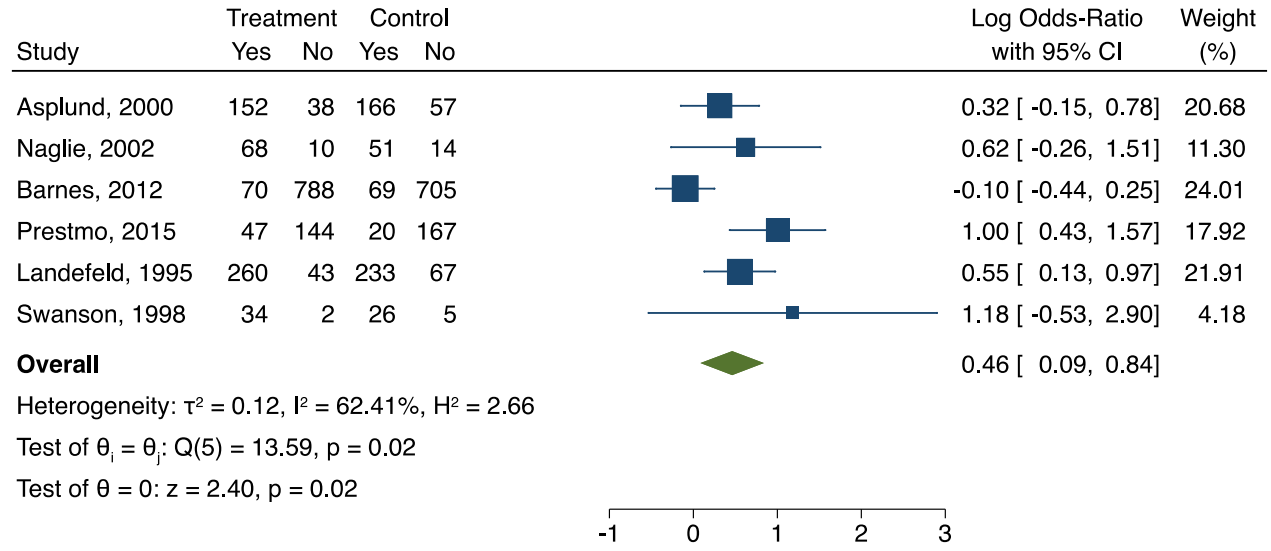
Random-effects REML model

INPATIENT REHABILITATION VERSUS COMPARATOR ON DISCHARGE DESTINATION OF HOME AFTER INPATIENT REHABILITATION FOR SUBGROUP WITH 'TEAM MEETING AND CARE PLANNING'



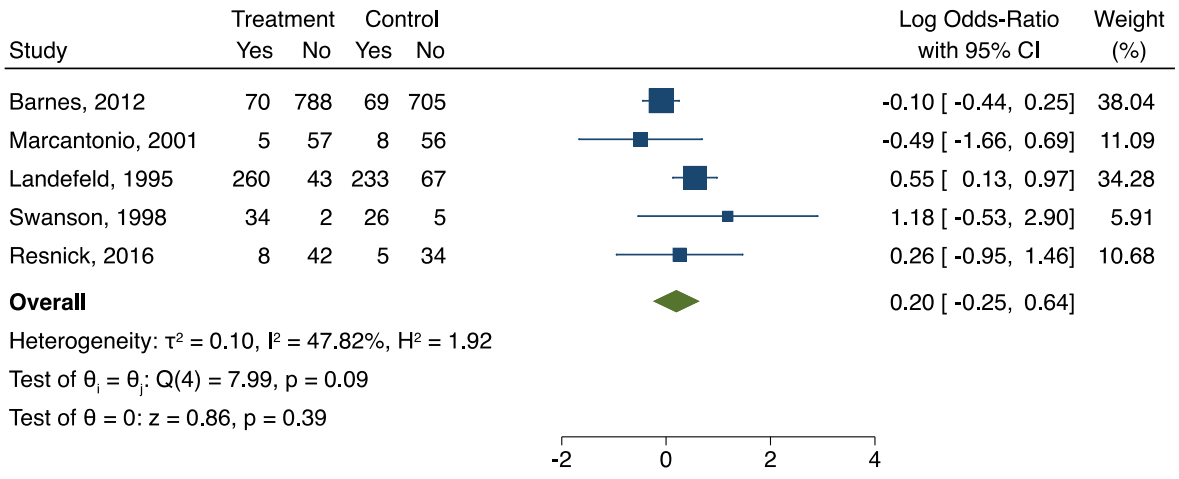
Random-effects REML model

INPATIENT REHABILITATION VERSUS COMPARATOR ON DISCHARGE DESTINATION OF HOME AFTER INPATIENT REHABILITATION FOR SUBGROUP WITH 'DISCHARGE PLANNING'



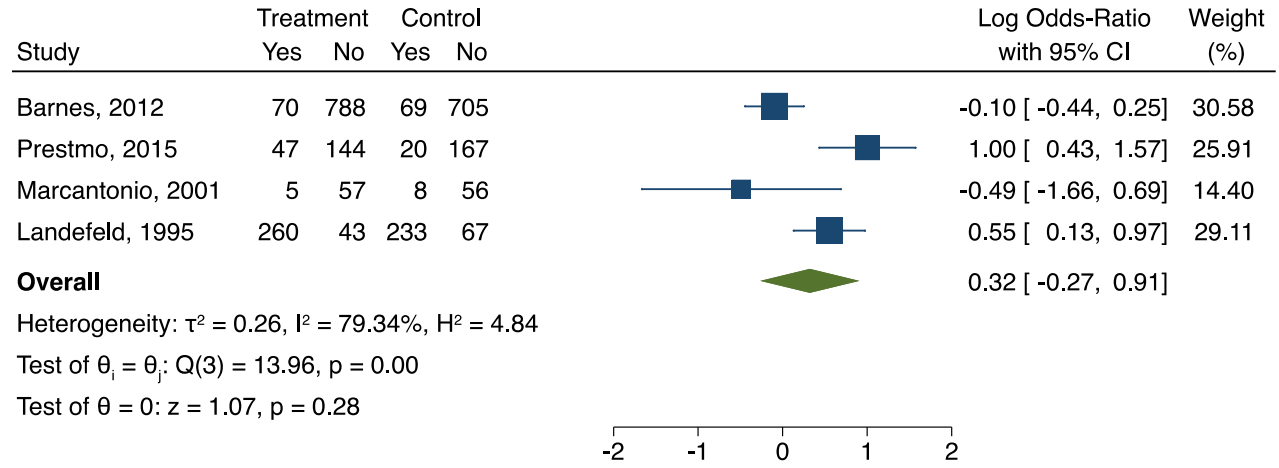
Random-effects REML model

INPATIENT REHABILITATION VERSUS COMPARATOR ON DISCHARGE DESTINATION OF HOME AFTER INPATIENT REHABILITATION FOR SUBGROUP WITH 'ANTECEDENTS'



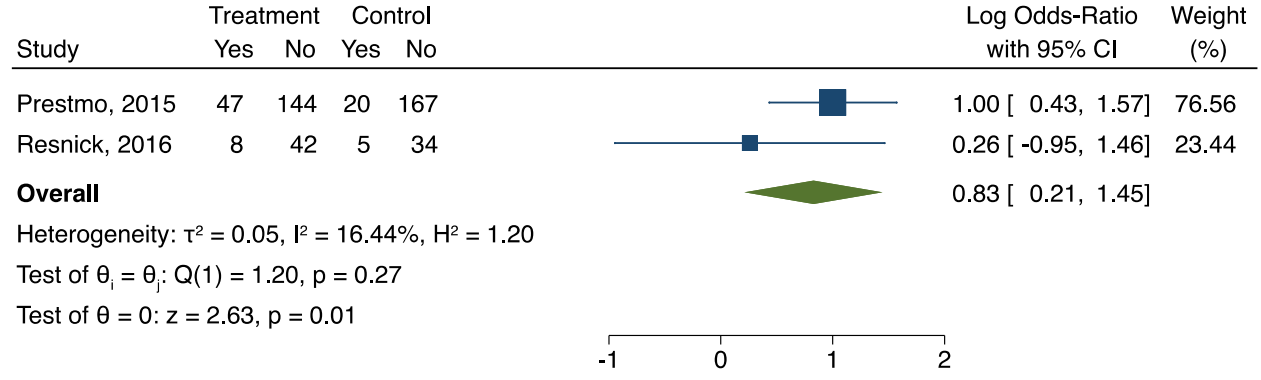
Random-effects REML model

INPATIENT REHABILITATION VERSUS COMPARATOR ON DISCHARGE DESTINATION OF HOME AFTER INPATIENT REHABILITATION FOR SUBGROUP WITH 'NUTRITIONAL INTERVENTION'



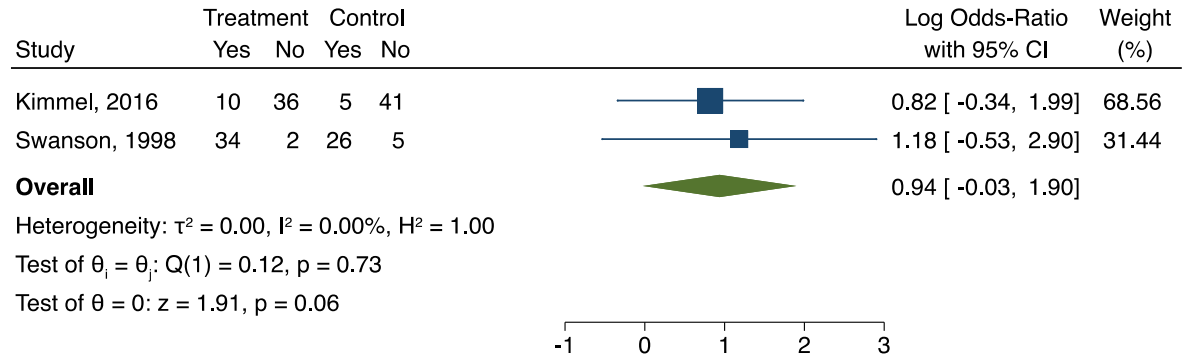
Random-effects REML model

INPATIENT REHABILITATION VERSUS COMPARATOR ON DISCHARGE DESTINATION OF HOME AFTER INPATIENT REHABILITATION FOR SUBGROUP WITH 'GOALS AND PLANNING'



Random-effects REML model

INPATIENT REHABILITATION VERSUS COMPARATOR ON DISCHARGE DESTINATION OF HOME AFTER INPATIENT REHABILITATION FOR SUBGROUP WITH 'REPEATED EXERCISE REHABILITATION'



Supplementary File 7: Summary of randomized controlled trials/outcomes not included in meta-analyses.

Reason not in MA	Review author year	RCT author year	Outcome	Result
RCT in MA with different measure	Heldmann 2019	Kimmel 2016	modified Iowa Level of Assistance score intervention end	No between group difference. Between group difference favouring intervention when controlling for confounders.
no measure of dispersion	Heldmann 2019	Blanc-Bisson 2008	Course of ADL (Katz Index) between intervention end and follow up.	No between group difference.
sole study	Heldmann 2019	Jones 2006	change in Barthel Index at intervention end stratified by Barthel Index at admission	No between group difference.
sole study	Heldmann 2019	Jones 2006	change in TUG	No between group difference.
RCT in MA with different measure	Heldmann 2019	Prestmo 2015	Short Physical Performance Battery at intervention end	No between group difference.
RCT in MA with different measure	Heldmann 2019	Prestmo 2015	Short Physical Performance Battery at follow up (12 months)	Between group difference favouring intervention: 0.69 (95% CI: 0.1, 1.28) p = 0.023
no measure of central tendency/dispersion	Heldmann 2019	Hagsten 2004	Modified Klein-Bell ADL Scale at follow up (2 months)	Between group differences: moving around indoors (p = 0.03), Performance of light housework (p = 0.05), and getting in and out of a car (p = 0.05)
RCT in MA with different measure	Handoll2011	Mitchell 2001	TUG at intervention end	No between group difference.
RCT in MA with different measure	Handoll2011	Mitchell 2001	TUG at follow up (16 weeks)	No between group difference.
sole study	Handoll2011	Mitchell 2001	gait speed- (metres/second) at follow up (16 weeks)	No between group difference.
no measure of central tendency/dispersion	Handoll2011	Karumo 1977	Mortality at follow-up (9 weeks)	No between group difference.
RCT in MA with different measure	Machado 2020	Lopez-Lopez 2019a (1)	London chest ADL score at intervention end	No between group difference.
RCT in MA with different measure	Machado 2020	Lopez-Lopez 2019a (2)	London chest ADL score at intervention end	No between group difference.
no measure of central tendency/dispersion	Machado 2020	Liao 2015	6MWD at intervention end	Between group difference favouring intervention p <0.05.
no measure of central tendency/dispersion	Machado 2020	Nava 1998	6MWD at intervention end	Between group difference favouring intervention p < 0.001.
no measure of central tendency/dispersion	Machado 2020	Borges 2014	Saint George's Respiratory Questionnaire at follow up (1 month)	Between group difference favouring intervention for impact domain p < 0.05. No between group difference for activity domain.
no measure of central tendency/dispersion	Machado 2020	Borges 2014	6MWD at follow up (30 days)	Within group differences: control p > 0.05. intervention p < 0.05.
no measure of central tendency/dispersion	Machado 2020	He 2015	CRQ-SAS score at intervention end.	Within group differences: control 'slight decline'. intervention p <0.001.

no measure of central tendency/dispersion	Martinez Vellila 2016	Saltvedt 2002	TUG at intervention end	No between group difference.
no measure of central tendency/dispersion	Martinez Vellila 2016	Saltvedt 2002	Barthel Index at follow up (12 months)	No between group difference.
RCT in MA with different measure	Peiris 2018	Peiris 2013	EuroQoL visual analogue scale at intervention end	No between group difference.
RCT in MA with different measure	Peiris 2018	Peiris 2013	EuroQoL visual analogue scale (12 months)	No between group difference.
RCT in MA with different measure	Peiris 2018	Peiris 2013	Personal Care Participation Assessment and Resource Tool at intervention end	No between group difference.
sole study	Peiris 2018	Peiris 2013	EuroQoL questionnaire 5D (minimally clinically important difference) at intervention end	Between group difference favouring intervention (RR = 1.18 95% CI 1.04 – 1.34)
sole study	Peiris 2018	Peiris 2013	EuroQoL questionnaire 5D (minimally clinically important difference) (12 months)	No between group difference.
sole study	Scrivener 2015	Said 2012	change in DEMMI at intervention end	No between group difference.
RCT in MA with different measure	Smith, 2020b	Counsell 2000	Physical Performance and Mobility Examination at intervention end	Between group difference favouring intervention (mean difference 0.63, 95% CI 0.09 - 1.17) p = 0.027)
RCT in MA with different measure	Smith, 2020b	Timmer 2019	AusTOMs-OT Impairment-Scale 4 at intervention end	No between group difference.
RCT in MA with different measure	Smith, 2020b	Timmer 2019	AusTOMs-OT Impairment-Scale 4 (3 months)	No between group difference.
RCT in MA with different measure	Smith, 2020b	Timmer 2019	AusTOMs-OT Impairment-Scale 7 at intervention end	No between group difference.
RCT in MA with different measure	Smith, 2020b	Timmer 2019	AusTOMs-OT Impairment-Scale 7 (3 months)	No between group difference.
RCT in MA with different measure	Smith, 2020b	Timmer 2019	AusTOMs-OT Impairment-Scale 8 at intervention end	No between group difference.
RCT in MA with different measure	Smith, 2020b	Timmer 2019	AusTOMs-OT Impairment-Scale 8 (3 months)	No between group difference.
RCT in MA with different measure	Smith, 2020b	Timmer 2019	AusTOMs-OT Activity limitation-scale 4 at intervention end	No between group difference.
RCT in MA with different measure	Smith, 2020b	Timmer 2019	AusTOMs-OT Activity limitation-scale 4 (3 months)	No between group difference.
RCT in MA with different measure	Smith, 2020b	Timmer 2019	AusTOMs-OT Activity limitation-scale 7 at intervention end	No between group difference.
RCT in MA with different measure	Smith, 2020b	Timmer 2019	AusTOMs-OT Activity limitation-scale 7 (3 months)	No between group difference.

RCT in MA with different measure	Smith, 2020b	Timmer 2019	AusTOMs-OT Activity limitation-scale 8 at intervention end	No between group difference.
RCT in MA with different measure	Smith, 2020b	Timmer 2019	AusTOMs-OT Activity limitation-scale 8 (3 months)	No between group difference.
RCT in MA with different measure	Yasmeen, 2020	Louie 2012	Lawton Instrumental ADL scale at intervention end	Within group difference pre and post programme in both control ($p<0.01$) and intervention ($p<0.01$). No between group difference.

MA = meta-analysis; RCT= randomized controlled trial; ADL = activities of daily living; eq-5d = EuroQol 5 dimensions; 6mwd = 6 minute walk distance; TUG = timed up and go; CRQ-SAS score = Chronic Respiratory Disease Questionnaire Self-Administered Standardized; DEMMI = de Morton Mobility Index. AusTOMs-OT = Australian Therapy Outcome Measures-Occupational Therapy