Interventions for improving walking after stroke: an overview of Cochrane Reviews

Corbetta, Davide; Campbell, Pauline; van Wijck, Frederike; Filippi, Massimo; Kwakkel, Gert ; Lynch, Elizabeth A.; Mehrholz, Jan; Todhunter-Brown, Alex

Published in:
Cochrane Database of Systematic Reviews

DOI:
10.1002/14651858.CD015044

Publication date:
2023

Document Version
Publisher's PDF, also known as Version of record

Cochrane Library

Cochrane Database of Systematic Reviews

Interventions for improving walking after stroke: an overview of Cochrane Reviews (Protocol)

Corbetta D, Campbell P, van Wijck F, Filippi M, Kwakkel G, Lynch EA, Mehrholz J, Todhunter-Brown A

Corbetta D, Campbell P, van Wijck F, Filippi M, Kwakkel G, Lynch EA, Mehrholz J, Todhunter-Brown A.
Interventions for improving walking after stroke: an overview of Cochrane Reviews (Protocol).
Cochrane Database of Systematic Reviews 2023, Issue 3. Art. No.: CD015044.
DOI: 10.1002/14651858.CD015044.

www.cochranelibrary.com

WILEY

TABLE OF CONTENTS

[Overview of Reviews Protocol]

Interventions for improving walking after stroke: an overview of Cochrane Reviews

Davide Corbetta[1,2,3], Pauline Campbell[4], Frederike van Wijck[5], Massimo Filippi[2,6,7,8], Gert Kwakkel[9], Elizabeth A Lynch[10], Jan Mehrholz[11], Alex Todhunter-Brown[4]

[1]Department of Rehabilitation and Functional Recovery, San Raffaele Hospital, Milan, Italy. [2]Vita-Salute San Raffaele University, Milan, Italy. [3]PhD student, School of Health and Life Sciences, Glasgow Caledonian University, Glasgow, UK. [4]Nursing, Midwifery and Allied Health Professions Research Unit, Glasgow Caledonian University, Glasgow, UK. [5]Research Centre for Health, School of Health and Life Sciences, Glasgow Caledonian University, Glasgow, UK. [6]Neuroimaging Research Unit, Division of Neuroscience, San Raffaele Hospital, Milan, Italy. [7]Neurology Unit and Neurophysiology Service, San Raffaele Hospital, Milan, Italy. [8]Neurorehabilitation Unit, San Raffaele Hospital, Milan, Italy. [9]Department of Rehabilitation Medicine, Amsterdam Movement Sciences and Amsterdam, Amsterdam Neurosciences, Amsterdam University Medical Centre, Amsterdam, Netherlands. [10]College of Nursing and Health Sciences, Flinders University, Bedford Park, Australia. [11]Department of Public Health, Dresden Medical School, Technical University Dresden, Dresden, Germany

Contact: Davide Corbetta, corbetta.davide@hsr.it.

Editorial group: Cochrane Stroke Group.
Publication status and date: New, published in Issue 3, 2023.

Citation: Corbetta D, Campbell P, van Wijck F, Filippi M, Kwakkel G, Lynch EA, Mehrholz J, Todhunter-Brown A. Interventions for improving walking after stroke: an overview of Cochrane Reviews (Protocol). *Cochrane Database of Systematic Reviews* 2023, Issue 3. Art. No.: CD015044. DOI: 10.1002/14651858.CD015044.

ABSTRACT

Objectives

This is a protocol for a Cochrane Review (overview). The objectives are as follows:

To summarise and appraise the evidence from Cochrane Reviews assessing the effects of interventions for the recovery and/or the improvement of walking in people after stroke. We will conduct an overview of Cochrane Reviews involving stakeholders to:

- provide accessible high-quality evidence on the effects of interventions aiming to recover and/or improve walking in people after stroke;
- summarise the evidence of the effects of included interventions; clearly present to readers relevant, high-quality evidence of effective interventions; and direct them to original reviews.

A secondary objective will be to explore the outcomes reported in Cochrane Reviews assessing the effects of interventions to improve walking; how different measures are combined in reviews; and how this varies between reviews.

BACKGROUND

Worldwide, stroke represents the second most common cause of death and is the third leading cause of disability in adults (WHO 2020). Stroke is defined as the rapid development of signs of neurological dysfunction attributable to an acute injury of the central nervous system by a vascular cause, including cerebral venous thrombosis, intracerebral haemorrhage, and subarachnoid haemorrhage (not caused by trauma) according to the American Heart Association/American Stroke Association (Sacco 2013). Each year, approximately 16 million people experience a stroke, of which 5.7 million people die (Tyagi 2018). In the European Union, stroke affects about 1.1 million inhabitants and causes nearly 460,000 deaths (Béjot 2016; Wafa 2020); in the USA stroke affects more than 795,000 people and causes more than 150,000 deaths (CDC 2018; Tsao 2022). In 2019, stroke incidence per 100,000 inhabitants was 199 in Europe, 178 in Asia, 137 in North America, 109 in Latin America and the Caribbean, and 92 in Africa (GBD 2019). The direct and indirect costs associated with stroke, including the cost of healthcare services, medicines to treat stroke, and missed days of work, are conservatively estimated at EUR 45 billion in Europe (Wafa 2020), and nearly USD 46 billion in the USA (Virani 2020). The economic burden of stroke differs across countries; it has been estimated that the mean cost of stroke per patient per year is USD 27,702 for high-income countries, USD 14,478 for upper-middle-income countries, USD 6850 for low-middle-income countries, and USD 2100 for low-income countries (Strilciuc 2021; World Bank 2022). As the population continues to grow and live to an older age, the long-term sequelae of stroke and corresponding costs are also expected to increase (Bennett 2014). However, stroke is not limited to older adults: 15% of strokes occur in younger adults (< 50 years of age) (Feigin 2017; Kissela 2012; Singhal 2013), adding to the social and economic burden (Béjot 2016; Sultan 2013). A stroke occurring in a younger adult may have a long-term impact on their ability to care for their family, return to work, and other important life roles (Martinsen 2012). Eighty per cent of people who survive a stroke experience altered motor function on one side of their body (hemiplegia) that to some degree limits their ability to carry out activities of daily living (Langhorne 2009). Key activity limitations include loss of upper limb capacity of the most affected arm and reduced ability to walk.

Description of the condition

Walking can be defined as the ability to maintain the centre of mass within the base of support while moving along a surface on foot, step by step, so that one foot is always on the ground, such as when strolling; sauntering; walking forwards, backwards, or sideways. It can be for short or long distances, on different surfaces and around obstacles (Pollock 2011; WHO 2022).

Being able to walk independently is an important ability that is often taken for granted. However, impaired walking after a stroke is common and significantly impacts on daily activities; in fact, more than half of people after stroke report walking improvement as their main goal (Bohannon 1988; Bohannon 1991). In the acute phase after stroke, walking is limited: 51% of stroke survivors are unable to walk, and 12% can walk with assistance (Jørgensen 1995); all of these people will need targeted specific rehabilitation to move independently (Bates 2005; Virani 2020). At six months after stroke, up to 85% of survivors are able to walk independently, but only 30% to 50% of these individuals are capable of moving outdoors to engage in activities such as visits to the supermarket, shopping mall, and bank; social outings; vacations; and pursuit of leisure activities (Harvey 2015).

People who have had a stroke consider the activities of walking and moving independently within their environment as essential or very important (Portegijs 2016). Furthermore, in a recent study aiming at prioritising areas of research related to life after stroke, stroke survivors identified mobility and walking difficulties as the most important area of research (Rudberg 2021). Lastly, one of the 10 research priorities identified by the James Lind Alliance in the Priority Setting Partnerships of 'Life after Stroke' is the identification of best treatments to improve gait (JLA 2022).

Description of the interventions

A wide variety of rehabilitative interventions may be implemented with the aim to recover and increase the ability to walk after stroke. Recommendations for stroke rehabilitation can be found in several best practice guidelines, for example the Canadian Stroke Best Practice Guidelines (Teasell 2020), the Guidelines for Adult Stroke Rehabilitation and Recovery (Winstein 2016), the Royal College of Physicians National Clinical Guidelines for Stroke (RCP 2016), and the Australian and New Zealand Living Clinical Guidelines for Stroke Management (Stroke Foundation 2022). We will consider non-pharmacological and non-surgical interventions aiming to improve walking in this overview. Interventions may include the practice of walking, exclusively or together with mobility-related tasks, which may be delivered with support, guidance, or feedback (from a person or a device). The main interventions consist of a range of treatment formats promoting the training of functional tasks delivered through different modalities or assistive devices or acquiring strategies for improving quantity of movement during daily life, and include the following.

- Repetitive task practice: consisting of combining elements of intensity of practice (high number of repetitions within a single treatment session) and practice of a task of functional relevance (French 2016). These terms reflect the elements of a task-specific training that focuses on improvement of performance in functional tasks through goal-directed practice and repetition (Hubbard 2009). In practice, the focus is on training of functional tasks rather than impairment (Bernhardt 2017). For example, people can practice walking at increasing speed, or stepping over obstacles while walking, walking on different surfaces (a mat, a ramp), or turning to change direction of walking, including principles of repetition and progression (Salbach 2004).
- Physical fitness training: consisting of a wide variety of activities to be trained (e.g. walking, squatting) that follow a common set of well-established principles with the aim of improving physical fitness training, cardiovascular fitness, and muscular strength/endurance. The manipulation of the frequency, intensity, time, and type of the exercise (FITT principles) defines the exercise prescription and the possibility to train and improve health and specific aspects related to the fitness (e.g. endurance, strength, aerobic capacity) (ACSM 2021; Ammann 2014; Saunders 2020).
- Movement representation techniques: consisting of any type of therapy that uses the representation of movement, specifically observation or imagination, or both. These interventions include mirror therapy, action observation, and motor imagery (Thieme 2018). In mirror therapy, a mirror is used to create a reflection of the non-affected limb superimposed to the affected

limb, providing the individual with normal visual feedback of movement (Thieme 2018). Action observation refers to the visual perception of a given action performed by others (Borges 2018; Thieme 2018). Motor imagery is defined as a mentally rehearsed task in which movement is imagined but is not executed (Silva 2020), and can sometimes follow or precede physical practice.

- Strategies for behaviour change: consisting of interventions promoting the change of a behaviour referring to mechanisms of action detailed in behaviour change theories (Michie 2011), for example interventions to reduce the time spent in a sedentary lifestyle by replacing it with physical activity such as walking (Saunders 2021). The establishment of rehabilitation goals is recognised as a complex process to enhance outcomes and autonomy (Levack 2015; Morris 2022; Wade 1999; Wade 2009).

Modalities/technology-driven assistive devices to support the desired mechanism of action, through which functional task training is delivered, include the following.

- Virtual reality: consisting of the "use of interactive simulations created with computer hardware and software to present users with opportunities to engage in environments that appear and feel like real-world objects and events" (Weiss 2004, page 7). Virtual environments of training provide the user with visual feedback, which may be presented though a head-mounted device, projection system, or flat screen. Feedback may also be provided through the senses, for example hearing, touch, movement, balance (Corbetta 2015; Laver 2017).
- Treadmill, with or without body weight supported: consisting of a treadmill with or without a harness connected to an overhead support system. The walking speed induced by the treadmill, the amount of body weight support, and the amount of assistance provided by the physiotherapist can all be adjusted to set the training intensity (Mehrholz 2017).
- Electromechanical devices: consisting of the use of either a robot-driven exoskeleton orthosis or an electromechanical solution with two driven foot plates simulating and assisting the phases of gait to be trained (Mehrholz 2020).
- Crutches, canes, walkers: consisting of the use of non-electronic assistive devices while walking (Kang 2021).
- Externally applied orthoses: consisting of the application of devices, known as orthoses, to modify the structural and functional characteristics of the neuromusculoskeletal system. In general, they are applied to the ankle and foot to sustain the foot during the swing phase of stride or to provide stability to the ankle during single-leg stance (Tyson 2009).
- Biofeedback or feedback: consisting of techniques to augment the normal sensory feedback and allow better control of body functions that are usually considered involuntary. The general mechanism starts by measuring a body parameter, either physiological or biomechanical, which then gets transformed into a visual, auditory, or haptic signal. Feedback can be divided into two main categories: physiological or biomechanical. Physiological biofeedback describes a physiological, normally subliminal, body activity (e.g. muscle activity measured by electromyography is one of the most common) (Woodford 2007); biomechanical feedback provides information on motor performance (e.g. the spatial orientation or movement trajectory of a body segment). This information may be obtained through motion detectors (e.g. accelerometers, gyroscopes, force plate sensors). The acquired information is then augmented and/or transformed into a visual, auditory, or haptic signal to provide understandable information to the user, allowing better control of the movement or a body function and facilitating motor learning (Malik 2022).
- Electrical neuromuscular stimulation (ES): consisting of a device that generates electrical impulses applied to the body through electrodes attached to the skin. These impulses are similar to the action potential generated by the central nervous system and can produce contraction of muscles. ES can be applied to improve muscle tone, or strength (electrical muscle stimulation (EMS)) or to induce a sensory stimulation (neuromuscular electrical stimulation (NMES)). It can potentially improve recovery of movement control (Kristensen 2022), and can also be applied during the execution of a movement (functional electrical stimulation (FES)). During FES, a sensor controls the initiation/end of the stimulation impulses, for example helping managing foot drop while walking: currents that activate ankle dorsiflexor muscles during the swing phase are triggered by an in-shoe sensor, acting as a switch to the stimulation according to the contact of the foot with the ground.
- Non-invasive brain stimulation: consisting of an adjuvant therapy combined with rehabilitative interventions. It allows non-invasive modulation of neural processes (Klomjai 2015), and is applied mainly by two methods: 1) transcranial magnetic stimulation (TMS) or repeated transcranial magnetic stimulation (rTMS) (Chung 2016), and 2) transcranial direct current stimulation (tDCS) (Polania 2018). Depending on the specific frequency and/or pattern, different rTMS and tDCS protocols result in excitatory or inhibitory effects of cerebral activity.

Functional task training may be delivered in a number of different ways, and includes the following.

- One-to-one, face-to-face treatment sessions, in which a healthcare professional provides an individualised treatment session based on an assessment of the patient's needs. This may occur in a variety of settings, including hospital and community settings.
- Telerehabilitation: consisting of the provision of rehabilitation services to patients at a remote location using information and communication technologies such as the telephone, internet-based videoconferencing, and sensors (such as pedometers) (Laver 2020; Ramage 2021).
- Group circuit class therapy: consisting of a mode of delivery wherein participants are given the opportunity to practise active task-specific exercises (i.e. functional activities) in an intensive manner. The key components of circuit class therapy are that 1) physiotherapy is provided in groups; 2) there is a focus on the repetition of functional tasks; and 3) exercises are continually progressed as the patient's function improves (English 2017).
- Self-practice, in which a stroke survivor follows a set of instructions or exercises: this may be supported by face-to-face, online, or telephone support, and may be supported by non-healthcare professionals (Vadas 2021).

A range of different people and organisations may be involved in rehabilitation of walking following a stroke; these include:

- healthcare professionals (e.g. physiotherapists and occupational therapists) who are responsible for the delivery

of these rehabilitation interventions aiming at recovery or improving the ability to walk;
- other health professionals (e.g. nurses) who may deliver some of these interventions (Ning 2022);
- non-healthcare professionals (e.g. caregivers or family members, or exercise providers) who often contribute to their delivery (Vloothuis 2016).

Interventions are usually delivered early after a stroke and may continue - usually episodically - for months or years. For example, people after stroke may access outpatient therapy several years after the acute event (or years after their last rehabilitation intervention) for goals related to walking. For this reason, interventions aiming at improving walking after a stroke can take place in a variety of different settings including hospital (inpatients or outpatients), at home, or in a setting with a remote connection to a hospital or a rehabilitation centre.

How the intervention might work

Possible interventions that can be delivered to improve walking in people after stroke differ in their nature and might work in a variety of ways (Maier 2019). This Cochrane overview will include, but will not be limited to, those interventions whose underlying mechanism targets principles of 'recovery' or 'compensation' (restitution versus substitution), or both (Bernhardt 2017), operating at three different levels of the motor system within the International Classification of Functioning, Disability and Health (ICF) domains: health condition, body function/structure, and activity (Table 1) (Levin 2009; WHO 2022).

These principles mainly focus on the qualitative aspect of the movement; when considering the accomplishment of a complex task such as walking, it is not always possible to completely distinguish between 'recovery' and 'compensation'. While the two principles describe ways in which interventions may act on the motor system, in practice, most (if not all) interventions will often combine mechanisms of both 'recovery' and 'compensation'. For example, repetitive walking practice at increasing speed after stroke can facilitate the recovery of strength in lower limb paretic muscles and of endurance of cardiorespiratory system (exercise tolerance). At the same time, it can also promote the potentiation of compensatory strategies (e.g. larger arm and leg swing amplitudes on the non-paretic side of the body).

Interventions aiming to improve walking may comprise task-specific and goal-directed practice of walking itself (which may be facilitated by technologies such as virtual reality, or treadmill with or without body weight support, orthotics). This process may be augmented by the application of technologies to facilitate specific movements as part of the gait cycle (e.g. electromechanical devices, electrical neuromuscular stimulation of specific muscles). These interventions have in common that they offer a multisensory stimulation, often comprising feedback on the results or on the performance or both, but their mechanism of action may be diverse. Some of these interventions (e.g. movement representation techniques such as mirror therapy, action observation, and motor imagery) promote skill acquisition. Other interventions (e.g. physical fitness training) promote peripheral physiological changes (e.g. strength, aerobic and cardiovascular fitness parameters). In contrast, behavioural change interventions (e.g. education on the benefits of walking, self-monitoring of daily step count) may aim to improve understanding of the benefits of practice, enhance self-efficacy, and enhance self-management skills, enabling the stroke survivor to engage in practice independently where appropriate.

Interventions targeted to self-improvement and based on the principles of behavioural change (e.g. group circuit class therapy or specific strategies for lifestyle change) allow practice even when away from therapist. Education, cognitive understanding, self-efficacy, emotions, and drive can lead to psychosocial changes.

Why it is important to do this overview

Stroke survivors, their families, clinicians, educators, and policymakers need accessible, high-quality information on the efficacy of the available interventions for the recovery of walking and addressing gait deficits after stroke. Currently, more than 10 Cochrane Reviews have been published investigating the efficacy of different interventions and modes of delivering interventions that may enhance walking and mobility after stroke (e.g. English 2017; Mehrholz 2017; Silva 2020; States 2009). As a result, the volume of evidence may overwhelm evidence users, creating barriers to access and implementation of findings. There is a need to systematically synthesise the evidence into one single, accessible overview, to allow people after stroke, clinicians, caregivers, and policymakers to access the information required to support their decision-making (Hunt 2018). Furthermore, it is critical to involve all relevant stakeholders when bringing together this evidence to ensure that it reflects the needs of potential users.

OBJECTIVES

To summarise and appraise the evidence from Cochrane Reviews assessing the effects of interventions for the recovery and/or the improvement of walking in people after stroke. We will conduct an overview of Cochrane Reviews involving stakeholders to:

- provide accessible high-quality evidence on the effects of interventions aiming to recover and/or improve walking in people after stroke;
- summarise the evidence of the effects of included interventions; clearly present to readers relevant, high-quality evidence of effective interventions; and direct them to original reviews.

A secondary objective will be to explore the outcomes reported in Cochrane Reviews assessing the effects of interventions to improve walking; how different measures are combined in reviews; and how this varies between reviews.

METHODS

This overview will follow the guidance outlined in Chapter V (Overview) of the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2022).

We will systematically bring together and present data from Cochrane Reviews. Methods will refer to synthesised data as presented within the included reviews and will not involve any re-analysis or pooling of data.

Involving people in this overview

There is clear evidence showing that systematic reviews are likely to be more relevant, meaningful, and of higher quality if they are informed by the knowledge and views of people

with lived experience of healthcare conditions, in terms of both the topic and the methodology, and we expect this would occur also with overviews of systematic reviews (Thomas 2004). In line with Cochrane principles (Cochrane Consumers), to ensure that this overview will reflect the needs of its potential readers and users and to provide clear, reliable information that can inform clinical decisions, we will invite and involve people to contribute throughout the process of production and dissemination (Cochrane Consumers; Kayes 2019; Pollock 2019a).

Who are the stakeholders

People involved in this overview are 'stakeholders'; we use this term to refer to any individual or group who is responsible for or affected by health- and healthcare-related decisions that can be informed by research evidence (Concannon 2012). Stakeholders within this overview of systematic reviews are represented by:

- persons and the public (e.g. stroke survivors, their caregivers, families, and patient and consumer advocacy organisations);
- care providers (individuals that provide care at a professional level, e.g. physiotherapists, occupational therapists, physicians, and nurses);
- policymakers (policymaking entities such as professional associations); and
- principal investigators (e.g. researchers) (Concannon 2012; Tugwell 2006).

How we involved/will involve stakeholders

To ensure oversight over the planning and conduct of our overview, we established an advisory group of care providers and researchers. The strategy for establishing the advisory group to produce this overview followed a closed process: through purposive sampling we invited known individuals who met predetermined key characteristics such as having relevant content expertise in the field of stroke rehabilitation and Cochrane Reviews, taking into account possible different geographical and income setting, to ensure the representation of different perspectives. Using researchers' personal networks, we identified potential advisors among authors of Cochrane Reviews belonging to different world regions (Australia, Europe, the UK, the USA) and belonging to middle- to low-income regions (e.g. Southern Asia, Africa) to ensure that we were able to include a broad and diverse range of experiences and capture geographical differences. We will involve this group through email communication; the group have commented on this protocol, and will be invited to comment on a draft of the completed review. In addition, we will ask for members' views if there are disagreements between overview authors, or when key decisions (e.g. layout of summary of findings, dissemination plans) are being made. This will ensure stakeholder involvement in determining the overview aims, questions, methods, and presentation of results.

To ensure that this overview addresses the matters of greatest importance to people affected by stroke, we will involve a wide group of stroke survivors, families/caregivers, healthcare providers, and researchers in a convenience sample for the prioritisation of the outcomes of the overview. Their involvement will follow an open strategy. We will develop and conduct an online survey targeted in particular to the public (people after stroke, caregivers, and families) and care providers, from varying countries and settings, to obtain information about the perceived importance of walking-related outcomes and to select the primary and secondary outcomes of the overview (see Criteria for considering reviews for inclusion, *Types of outcome measures*) (Higgins 2022). To define the characteristics of stakeholders responding to the survey, we will collect some personal data, in particular:

- country;
- age;
- gender (only for people affected by stroke);
- time of stroke occurrence (only for people affected by stroke);
- living status (only for people affected by stroke);
- occupation (only for people affected by stroke);
- level of impairment in walking (only for people affected by stroke);
- discipline (only for health professionals);
- working setting (only for health professionals).

In addition, at the completion of the overview, we will involve patients, families and caregivers, care providers, researchers, and policymaking entities in the interpretation of findings and to promote the dissemination of results to facilitate knowledge translation. We plan to conduct an open online meeting for all stakeholders, with face-to-face interaction and discussion on pre-prepared well-defined material.

Prior to collecting data, we will have obtained approval from the university where the overview will be conducted. All collected data will be stored on a password-protected drive at the university and will be destroyed after five years according to the data security and data protection legislation.

Level of involvement

Involved people had/will have the role of influencing the development, conduct, and dissemination of the overview (e.g. commenting on the protocol, advising, voting, prioritising, and reaching consensus), without direct control over decisions or aspects of the review process.

At what stage in the overview process will the involvement occur?

Referring to the process of developing a systematic review described by the Authors and Consumers Together Impacting on eVidencE (ACTIVE) initiative (ACTIVE project; Pollock 2019b), we aim to involve stakeholders in a 'top and tail' approach (Figure 1).

Figure 1. Figure 1: Stages of the development of systematic review/overview (figure adapted from Pollock 2019b).

At the initial stages of the work, at the 'top' of the overview (Figure 1, stages 1 to 3), we involved/will involve stakeholders to influence methods of the overview and to contribute to the definition of outcomes to be included in the overview. At the final stages of the work, at the 'tail' of the overview (Figure 1, stages 10 to 12), we will present to principal investigators and clinicians the preliminary results of the overview as a draft report of findings. We will ask people involved at these stages to provide their knowledge to reach a consensus on the possible clinical implications of the obtained results. Lastly, we will invite participants to help to identify effective ways to communicate the findings and to be involved in dissemination activities.

Criteria for considering reviews for inclusion

Types of reviews

We will only search for and include Cochrane Reviews on interventions to aid recovery/improve walking after stroke. Cochrane Reviews are acknowledged to be the highest quality of systematic reviews (i.e. 'gold standard'), and so provide the best place from which to draw evidence; we anticipate that overlaps are unlikely, avoiding one of the key methodological challenges with overviews. We will include the latest published version and ensure that we contact the authors to identify the most recent version. If a retrieved review is not sufficiently up-to-date (i.e. with literature search more than two years old), we will contact authors to obtain, if possible, any pre-publication version of the updated review for its assessment for inclusion in the overview.

For included reviews with a search date of more than two years ago, we will use the Cochrane Updating Classification System decision flowchart to determine whether or not there are important new studies that might change the results of out-of-date Cochrane Reviews (UCS 2019). We will search the Database of Research in Stroke to explore if there are important new studies missing from out-of-date Cochrane Reviews (DORIS 2022), and, following guidance within the Updating Classification System, we will make a judgement as to whether any new studies are likely to change their findings. Judgements will be reached through discussions involving at least two overview authors, and all decisions will be transparently recorded and reported. For reviews in which there are no new studies or for which we judge that new studies are not likely to change the review findings, we will base our overview on the results of the published Cochrane Review only. In cases where we judge that new studies are likely to change the review findings or confidence in the review findings, we will list the studies we believe

to be missing from the review and highlight that the results of our overview may change as a result of the new evidence. Further, we will use these findings to propose priorities for updates of included Cochrane Reviews.

Types of participants

We will include Cochrane Reviews of trials enrolling adult participants who have experienced a stroke resulting in limitations of walking, irrespective of the time since stroke onset. For the purposes of this overview, we have defined the activity of walking as the ability to maintain the centre of mass within the base of support while moving along a surface on foot, step by step, so that one foot is always on the ground, such as when strolling; sauntering; walking forwards, backwards, or sideways, for short or long distances, on different surfaces and around obstacles) (Pollock 2011; WHO 2022). If one or more reviews include studies on other non-progressive neurological conditions besides stroke, we will include the review and extract and report data if more than 75% of the participants are stroke survivors.

Types of interventions and comparisons

We will include Cochrane Reviews of trials on any intervention targeted at improving the walking of people after stroke. If a review assesses the effect of an intervention on the recovery/improvement of a wider group of functions or abilities, we will consider only the subset of trials assessing the improvement/recovery of walking. We will include reviews without limitations regarding:

- the provider of the interventions (e.g. physiotherapist, relative, caregiver);
- modes of delivery of the interventions (e.g. face-to-face, group, or online);
- the location in which the interventions take place (e.g. in the hospital, at home);
- the timing of the initiation of the interventions since stroke onset;
- the frequency, intensity, time, and type of the exercise of the interventions.

We will include any Cochrane Review that compares any intervention specifically targeted at promoting the recovery of walking to:

- no intervention, including waiting list;
- attention control/placebo (efficacy comparisons);
- another active comparator, including standard care (effectiveness comparisons).

We will also include Cochrane Reviews that include trials evaluating combinations of interventions.

Types of outcome measures

To ensure that the outcomes of interest to this overview reflect the priorities of key stakeholders (people who experienced a stroke, caregivers, and health professionals), we will conduct a survey to inform the importance of outcomes.

In the survey, people who experienced a stroke, caregivers, and health professionals will be asked to provide their views on the importance of outcomes related to walking after stroke. The survey will take place online; we will ask participants (stroke survivors, caregivers, and healthcare professionals) to prioritise possible outcomes according to their subjective importance. We will advertise the survey through our networks and social media (e.g. Twitter, Facebook, Instagram). Participants must be able to read English (or be literate in English) and be able to access the online survey, with or without support. We will select the outcomes to be assessed from those reported in identified Cochrane Reviews available on the topic; in the survey, those outcomes will be displayed on a list. Participants will have to rate them according to their relevance by using a 1-to-9-point scale where '1' means the lowest importance and '9' means the highest importance for decision-making. Furthermore, survey participants will be able to suggest additional relevant outcomes to be included in the overview. We expect that the duration of the data collection within the survey will not exceed 10 minutes for people with stroke and 5 minutes for caregivers and health professionals.

We will make a classification of the importance of the outcomes according to the score obtained in the survey ratings. To facilitate ranking of outcomes according to their importance, we will distinguish three possible categories of importance according to scores attributed by survey participants:

- critical, score 7 to 9;
- important but not critical, score 4 to 6;
- of limited importance, score 1 to 3.

In this overview, we will consider the top one to three (depending on scores) critical outcomes as primary outcomes, and up to six additional critical or important outcomes as secondary outcomes.

We will obtain ethical approval for the survey and participant consent.

Search methods for identification of reviews

The search strategy has been developed in partnership with Cochrane Stroke's Information Specialist. We will search the Cochrane Database of Systematic Reviews (part of the Cochrane Library) using a combination of Medical Subject Headings (MeSH) and keywords (Appendix 1). Furthermore, we will also handsearch titles, protocols, and reviews registered with Cochrane Stroke. We will not restrict our search by publication date.

Where the search date of an included review is more than two years out-of-date (see Criteria for considering reviews for inclusion, *Types of reviews*), we will search the Database of Research in Stroke for randomised controlled trials that meet the inclusion criteria of the review (DORIS 2022).

Data collection and analysis

Selection of reviews

We will import potentially relevant reviews retrieved by the search into Covidence (Covidence). Two overview authors (DC and PC) will independently screen the title and abstract of each retrieved citation against the inclusion criteria. A third overview author (JM) will be consulted in case of disagreements during the selection process. Overview authors who are also authors of a retrieved review will not be involved in the selection process. We will record the number of reviews retrieved at each stage and report this information using a PRISMA 2020 statement flowchart (Page 2021). We will obtain the full texts of reviews meeting the inclusion criteria

as specified in Criteria for considering reviews for inclusion, and we will report the details of excluded reviews.

Data extraction and management

Two overview authors will download and import data from included Cochrane Reviews in an electronic standardised data extraction form. Any discrepancies will be resolved through consensus. We will contact authors of the included reviews for additional information as required. We will use tables to summarise characteristics of included Cochrane Reviews.

The data extraction will follow three stages: the first 'at a review level', the second 'at a pooled comparison level', and the third 'at a trial level'.

At a 'review level'

We will use a data extraction form specifically designed and piloted by the overview author team. We will extract and record key features as reported by Cochrane Review authors, including:

- objectives of the review (and review questions);
- type of review (quantitative/qualitative/mixed);
- date of publication;
- databases/resources searched;
- limitations on searches (e.g. language of publication);
- dates of last search;
- types of studies included;
- number of studies and participants included;
- references of included trials;
- characteristics of included participants (e.g. time since stroke onset, sex, age, motor function at study entry) and factors relating to health equity (using PROGRESS-Plus framework) (O'Neill 2014);
- what framework, if any, was used to describe the interventions;
- types of interventions and descriptions of these using the Template for Intervention Description and Replication (TIDieR) framework;
- outcomes assessed and relative measures/instrument/tools for the assessment;
- conflicts of interest/funding statements, which will be mapped to the Tool for Addressing Conflicts of Interest in Trials (TACIT);
- strengths and limitations sections of each of the reviews (as reported).

At a 'pooled comparison level'

We will extract or record the following, as reported by Cochrane Review authors:

- completed meta-analyses relating to our primary outcomes (main comparisons);
- subgroup and sensitivity analyses relating to our primary outcomes (record and take note of explored variables);
- time points assessed;
- GRADE judgement for completed comparisons.

At a 'trial level'

We will extract and record key features of each study included in the reviews (main publication), as reported by review authors, including:

- first author;
- title;
- year of publication;
- journal of publication;
- number of randomised participants;
- characteristics of participants (age, sex, time since stroke occurred, focal inclusion criterion);
- intervention and comparison (aim, frequency, intensity, time, and type of the exercise);
- outcomes assessed;
- risk of bias tool used and risk of bias judgement.

We recognize the possibility that there may be some overlap in the trials included for some specific comparisons and outcomes among included Cochrane Reviews. We will download lists of trials included in systematic reviews and record them on a spreadsheet using the Graphical Representation of Overlap for OVErviews GROOVE tool (Pérez-Bracchiglione 2022). For each review, we will indicate the trials included, and the generated matrix will show whether any reviews covered the same studies (Pollock 2022). This will allow us to visually explore and describe potential overlap of studies and comparisons. Where overlap is identified, two overview authors (DC and PC, FvW, or ATB) will describe the number and size of the overlapping primary studies.

Criteria for identifying comparisons

We will use extracted data to determine which reviews have meta-analyses of relevance to this overview (primary outcomes). Relevant comparisons will evaluate the effect of an:

- intervention versus 'no or very little intervention' (where 'very little' is judged to be less than approximately 10% of the dose of the active intervention);
- intervention versus placebo/attention control;
- intervention versus another intervention including 'continuation of usual practice' (delivered in a dose equivalent to the dose of the active intervention).

Data extraction for relevant comparisons

Data extracted relating to completed meta-analyses of primary outcomes of the overview will include:

- number of trials and participants per comparison;
- point estimates, 95% confidence intervals (CIs) and accompanying measures of heterogeneity for the pooled estimates of intervention effects for all relevant comparisons at all time points (i.e. mean differences (MDs), standardised mean difference (SMDs) for continuous data, and risk ratios (RRs), risk difference (RD), or odds ratios (ORs) for binary data);
- presentation of subgroup data, where provided;
- judgements of the certainty of the evidence, including details of the approach used (e.g. GRADE). In case of reviews without GRADE, the overview authors will themselves conduct GRADE

assessments using the information reported in the Cochrane Reviews.

In cases where results of statistical analyses are not available or are not performed, we will extract the description of the results. If necessary, we will request additional information from the authors of included reviews.

For secondary outcomes, we will not extract point estimates, 95% CIs, and measures of heterogeneity, but we will report the analysis number to show readers where to find data. We will not present subgroup analyses, and we will not conduct GRADE assessment even if this is lacking in the identified review.

Assessment of methodological quality of included reviews

For each included review, two overview authors (DC and an author not involved in the assessed review) will independently develop the judgement of confidence in the review findings using the AMSTAR 2 (A MeaSurement Tool to Assess systematic Reviews, Version 2) (Shea 2017). We will specifically consider seven items that may critically affect the validity of a review: 1) protocol registered before commencement of the review (item 2); 2) adequacy of the literature search (item 4); 3) justification for excluding individual studies (item 7); 4) risk of bias from individual studies being included in the review (item 9); 5) appropriateness of meta-analytical methods (item 11); 6) consideration of risk of bias when interpreting the results of the review (item 13); and 7) assessment of presence and likely impact of publication bias (item 15).

Any discrepancies will be resolved by consulting a third overview author not involved in the assessed review. We will present judgements per item with a supporting statement and will rate overall confidence in the results of the review as:

- high (no or one non-critical weakness: the systematic review provides an accurate and comprehensive summary of the results of the available studies that address the question of interest);
- moderate (more than one non-critical weakness: the systematic review has more than one weakness but no critical flaws. It may provide an accurate summary of the results of the available studies that were included in the review);
- low (one critical flaw with or without non-critical weaknesses: the review has a critical flaw and may not provide an accurate and comprehensive summary of the available studies that address the question of interest);
- critically low (more than one critical flaw with or without non-critical weaknesses: the review has more than one critical flaw and should not be relied on to provide an accurate and comprehensive summary of the available studies) (Shea 2017).

Overview authors who are also authors of an included review will not be involved in the assessment of methodological quality.

At the end of the process, we will report all judgements for every AMSTAR 2 item for every review in a table.

Assessment of methodological quality of individual studies

We will report Cochrane risk of bias assessments for the primary studies where they were conducted by authors of the included reviews, without updating. If review authors did not use the Cochrane risk of bias tool, or used it to assess only some dimensions, we will summarise the alternative tools/methods used and the results of the assessments in a descriptive manner (Bialy 2011; Foisy 2011).

Certainty of evidence in included reviews

We will report, where available, the GRADE judgement of certainty for our primary and secondary outcomes for each core comparison (see Data extraction and management; Criteria for considering reviews for inclusion, *Types of outcome measures*). Two overview authors (DC and PC, FvW, or ATB) will independently conduct GRADE assessments of the certainty of the evidence where this was not performed in the included reviews and the required information is available (Biondi-Zoccai 2016; Meader 2014). Any discrepancies will be resolved through consensus or with the contribution of a third overview author (PC, FvW, or ATB).

GRADE judgements indicate the following degrees of confidence in the conclusions of a systematic review (GRADE Handbook).

- High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
- Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
- Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
- Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

Data synthesis

We will present results for high- or moderate-certainty evidence narratively; where evidence certainty is low, very low, or unavailable, this will be summarised. We will present a summary of quality and direction of evidence in a table following a similar style to that of Pollock 2014 (Figure 2). We will create visual maps of research evidence using EPPI-mapper software to show, for example, the volumes of interventions for different outcomes for identified comparisons (see Data extraction and management, *Criteria for identifying comparisons*) (EPPI-Mapper 2022), with different colour codes for each bubble according to GRADE judgements or to different intervention providers. Furthermore, we will seek input from stakeholders to inform the presentation of summaries of evidence.

Figure 2. Figure 2: Table summarising direction and certainty of evidence.

		People after stroke outcomes			Health Care professionals outcomes			Caregivers outcomes		
Intervention for walking	Comparison	Outcome 1	Outcome 2	Outcome ...	Outcome 1	Outcome 2	Outcome ...	Outcome 1	Outcome 2	Outcome ...
Intervention A	*Comparison A*	⊕		⊖			○	⊖	⊕	
Intervention A	*Comparison B*		⊖							
Intervention B	...									
Intervention C	...									
...	...									

Colours and symbols:

	"Low" or "Very Low" certainty of evidence
	"Moderate" certainty of evidence
	"High" certainty of evidence
⊕	Evidence of "Benefit"
○	Evidence of "No Benefit"
⊖	Evidence of "Harm"
	No evidence

We will tabulate a summary of systematic review evidence relating to all interventions for walking, with summary of details regarding:

- the population of participants;
- comparisons;
- aim of the intervention at the level of the review;
- certainty of evidence.

For primary outcomes of the overview, we will identify where there is:

- high- or moderate-certainty evidence of a beneficial effect of an intervention;
- high- or moderate-certainty evidence of no benefit or harm of an intervention;
- high- or moderate-certainty evidence of a harmful effect of an intervention;
- low- or very low-certainty evidence of a beneficial effect of an intervention;
- low- or very low-certainty evidence of no benefit or harm of an intervention;
- low- or very low-certainty evidence of a harmful effect of an intervention.

For secondary outcomes, we will identify where there is high-, moderate-, low-, or very low-certainty evidence, and direct readers to this information within published Cochrane Reviews (Figure 2).

We will present outcome data separately and based on the findings of systematic reviews. We will limit the comparisons presented to the data available in the included reviews, and we will not perform re-analyses of data or make indirect comparisons among interventions. If an included review assesses the effect of an intervention on the recovery/improvement of a wider group of functions or abilities, we will describe how many trials assessing the improvement/recovery of walking contribute to that estimation. Lastly, we will present summaries according to the type of intervention for our primary outcomes.

We will report frequencies of scales/instruments used among trials included in systematic reviews, and we will assess frequencies according to the defined primary/secondary outcomes in the Methods section of the included reviews. We will attribute one or more ICF category to domains assessed by the scales/instruments. For example, we expect to attribute ICF categories such as 'walking', 'walking short distances', 'walking long distances', 'walking on different surfaces', and 'moving around within the home'.

ACKNOWLEDGEMENTS

We thank Joshua Cheyne, Cochrane Stroke Group Information Specialist, who helped with the development of the search strategy.

Advisors of the overview: Amanda Barugh, Coralie English, Massimo Filippi, Gert Kwakkel, Peter Langhorne, Elizabeth Lynch, Jan Mehrholz, Chukwudi Martin Ogbueche, Tatiana Ribeiro, John Solomon, and Rebecca States provided feedback on an earlier version of this protocol and input into its development. They will be involved in further stages of the overview development.

The following people contributed to the editorial process.

- Sign-off Editor (final editorial decision): Peter Langhorne, University of Glasgow
- Managing Editor (selected peer reviewers, collated peer-reviewer comments, provided editorial guidance to authors, edited the article, conducted editorial policy checks, and supported editorial team): Hazel Fraser, Cochrane Stroke
- Information Specialist: Joshua Cheyne, Cochrane Stroke
- Copy Editor (copy editing and production): Lisa Winer, Cochrane Copy Edit Support
- Peer reviewers (provided comments and recommended an editorial decision): Ruth Barclay, Department of Physical Therapy, College of Rehabilitation Sciences, Rady Faculty of Health Sciences, University of Manitoba; Susan Hillier, University of South Australia; Luciana Mendes, Universidade Federal do Rio Grande do Norte, Brazil (clinical/content review); Aryelly Rodriguez, Edinburgh Clinical Trials Unit (ECTU) at the University of Edinburgh (statistical review)

REFERENCES

Additional references

ACSM 2021

Liguori G. Guidelines for exercise testing and prescription. 11th edition. Wolters Kluwer Health, 2021.

ACTIVE project

Cochrane Training. ACTIVE: Authors and Consumers Together Impacting on eVidencE. https://training.cochrane.org/ACTIVE (accessed 1 August 2022).

Ammann 2014

Ammann BC, Knols RH, Baschung P, de Bie RA, de Bruin ED. Application of principles of exercise training in sub-acute and chronic stroke survivors: a systematic review. *BMC Neurology* 2014;**14**:167. [DOI: 10.1186/s12883-014-0167-2]

Bates 2005

Bates B, Choi JY, Duncan PW, Glasberg JJ, Graham GD, Katz RC, et al. Veterans Affairs/Department of Defense clinical practice guideline for the management of adult stroke rehabilitation care: executive summary. *Stroke* 2005;**36**:2049-56. [DOI: 10.1161/01.STR.0000180432.73724.AD]

Bennett 2014

Bennett DA, Krishnamurthi RV, Barker-Collo S, Forouzanfar MH, Naghavi M, Connor M, et al. The global burden of ischemic stroke: findings of the GBD 2010 study. *Global Heart* 2014;**9**:107-12.

Bernhardt 2017

Bernhardt J, Hayward KS, Kwakkel G, Ward NS, Wolf SL, Borschmann K, et al. Agreed definitions and a shared vision for new standards in stroke recovery research: the Stroke Recovery and Rehabilitation Roundtable Taskforce. *Neurorehabilitation and Neural Repair* 2017;**31**(9):793-9. [DOI: 10.1177/1545968317732668]

Bialy 2011

Bialy L, Foisy M, Smith M, Fernandes RM. The Cochrane Library and the treatment of bronchiolitis in children: an Overview of Reviews. *Evidence-Based Child Health: A Cochrane Review Journal* 2011;**6**(1):258-75.

Biondi-Zoccai 2016

Biondi-Zoccai G. Umbrella Reviews: Evidence Synthesis with Overviews of Reviews and Meta-Epidemiologic Studies. Switzerland: Springer International Publishing, 2016.

Bohannon 1988

Bohannon RW, Andrews AW, Smith MB. Rehabilitation goals of patients with hemiplegia. *International Journal of Rehabilitation Research* 1988;**11**(2):181-4.

Bohannon 1991

Bohannon RW, Horton MG, Wikholm JB. Importance of four variables of walking to patients with stroke. *International Journal of Rehabilitation Research* 1991;**14**:246-50.

Borges 2018

Borges LR, Fernandes AB, Melo LP, Guerra RO, Campos TF. Action observation for upper limb rehabilitation after stroke. *Cochrane Database of Systematic Reviews* 2018, Issue 10. Art. No: CD011887. [DOI: 10.1002/14651858.CD011887.pub2]

Béjot 2016

Béjot Y, Bailly H, Durier J, Giroud M. Epidemiology of stroke in Europe and trends for the 21st century. *La Presse Médicale* 2016;**45**:e391-e398. [DOI: 10.1016/j.lpm.2016.10.003]

CDC 2018

Centers for Disease Control and Prevention. Underlying cause of death, 1999–2018. CDC WONDER Online Database. Available at https://wonder.cdc.gov/ucd-icd10.html (accessed 22 July 2022).

Chung 2016

Chung SW, Hill AT, Rogasch NC, Hoy KE, Fitzgerald PB. Use of theta-burst stimulation in changing excitability of motor cortex: a systematic review and meta-analysis. *Neuroscience & Biobehavioral Reviews* 2016;**63**:43-64. [DOI: 10.1016/j.neubiorev.2016.01.008]

Cochrane Consumers

Cochrane Consumer Network. The statement of principles for consumer involvement in Cochrane. https://consumers.cochrane.org/news/statement-principles-consumer-involvement-cochrane (accessed prior to 22 February 2023).

Concannon 2012

Concannon TW, Meissner P, Grunbaum JA, McElwee N, Guise JM, Santa J, et al. A new taxonomy for stakeholder engagement in patient-centered outcomes research. *Journal of General Internal Medicine* 2012;**27**:985-91.

Corbetta 2015

Corbetta D, Imeri F, Gatti R. Rehabilitation that incorporates virtual reality is more effective than standard rehabilitation for improving walking speed, balance and mobility after stroke: a systematic review. *Journal of Physiotherapy* 2015;**61**:117-24.

Covidence [Computer program]

Veritas Health Innovation Covidence. Version accessed 1 August 2022. Melbourne, Australia: Veritas Health Innovation. Available at www.covidence.org.

DORIS 2022

Cochrane Stroke Group. Database Of Research In Stroke (DORIS). https://www.askdoris.org/doris2017/doris17_main.asp?opt=2709 (accessed 7 November 2022).

English 2017

English C, Hillier SL, Lynch EA. Circuit class therapy for improving mobility after stroke. *Cochrane Database of Systematic Reviews* 2017, Issue 6. Art. No: CD007513. [DOI: 10.1002/14651858.CD007513.pub3]

EPPI-Mapper 2022 [Computer program]

EPPI-Centre, UCL Social Research Institute, University College London Digital Solution Foundry and EPPI-Centre [EPPI-Mapper]. Version 2.1.0. EPPI-Centre, UCL Social Research Institute, University College London, 2022.

Feigin 2017

Feigin VL, Norrving B, Mensah GA. Global burden of stroke. *Circulation Research* 2017;**120**:439-48.

Foisy 2011

Foisy M, Boyle RJ, Chalmers JR, Simpson EL, Williams HC. The prevention of eczema in infants and children: an overview of Cochrane and non-Cochrane reviews. *Evidence-Based Child Health: A Cochrane Review Journal* 2011;**6**:1322-39.

French 2016

French B, Thomas LH, Coupe J, McMahon NE, Connell L, Harrison J, et al. Repetitive task training for improving functional ability after stroke. *Cochrane Database of Systematic Reviews* 2016, Issue 11. Art. No: CD006073. [DOI: 10.1002/14651858.CD006073.pub3]

GBD 2019

Global Burden of Disease Collaborative Network. Global Burden of Disease Study 2019 (GBD 2019) Results. Seattle, United States: Institute for Health Metrics and Evaluation (IHME), 2020. https://vizhub.healthdata.org/gbd-results/ (accessed prior to 22 February 2023).

GRADE Handbook

Schünemann H, Brożek J, Guyatt G, Oxman A, editor(s). Handbook for grading the quality of evidence and the strength of recommendations using the GRADE approach (updated October 2013). GRADE Working Group, 2013. Available from gdt.guidelinedevelopment.org/app/handbook/handbook.html.

Harvey 2015

Harvey RL. Predictors of functional outcome following stroke. *Physical Medicine and Rehabilitation Clinics* 2015;**26**:583-98.

Higgins 2022

Higgins JP, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, Welch VA (editors). Cochrane Handbook for Systematic Reviews of Interventions version 6.3 (updated February 2022). Available from www.training.cochrane.org/handbook.

Hubbard 2009

Hubbard IJ, Parsons MW, Neilson C, Carey LM. Task-specific training: evidence for and translation to clinical practice. *Occupational Therapy International* 2009;**16**(3-4):175-89. [DOI: 10.1002/oti.275] [PMID: 19504501]

Hunt 2018

Hunt H, Pollock A, Campbell P, Estcourt L, Brunton G. An introduction to overviews of reviews: planning a relevant research question and objective for an overview. *Systematic Reviews* 2018;**7**:39.

JLA 2022

James Lind Alliance. Priority Setting Partnerships, Life after Stroke Top 10. https://www.jla.nihr.ac.uk/priority-setting-partnerships/life-after-stroke/top-10-priorities/ (accessed 27 July 2022).

Jørgensen 1995

Jørgensen HS, Nakayama H, Raaschou HO, Olsen TS. Recovery of walking function in stroke patients: the Copenhagen Stroke Study. *Archives of Physical Medicine and Rehabilitation* 1995;**76**:27-32.

Kang 2021

Kang YS, Cho KH. Changes in lower limb muscle activation and gait function according to cane dependence in chronic stroke patients. *Technology and Health Care* 2021;**29**(1):133-41.

Kayes 2019

Kayes NM, Martin RA, Bright FA, Kersten P, Pollock A. Optimizing the real-world impact of rehabilitation reviews: increasing the relevance and usability of systematic reviews in rehabilitation. *European Journal of Physical and Rehabilitation Medicine* 2019;**55**:331-41.

Kissela 2012

Kissela BM, Khoury JC, Alwell K, Moomaw CJ, Woo D, Adeoye O, et al. Age at stroke: temporal trends in stroke incidence in a large, biracial population. *Neurology* 2012;**79**:1781-7.

Klomjai 2015

Klomjai W, Lackmy-Vallee A, Roche N, Pradat-Diehl P, Marchand-Pauvert V, Katz R. Repetitive transcranial magnetic stimulation and transcranial direct current stimulation in motor rehabilitation after stroke: an update. *Annals of Physical and Rehabilitation Medicine* 2015;**58**(4):220-4.

Kristensen 2022

Kristensen MGH, Busk H, Wienecke T. Neuromuscular electrical stimulation improves activities of daily living post stroke: a systematic review and meta-analysis. *Archives of Rehabilitation Research and Clinical Translation* 2022;**4**:100167.

Langhorne 2009

Langhorne P, Coupar F, Pollock A. Motor recovery after stroke: a systematic review. *Lancet Neurology* 2009;**8**:741-54.

Laver 2017

Laver KE, Lange B, George S, Deutsch JE, Saposnik G, Crotty M. Virtual reality for stroke rehabilitation. *Cochrane Database of Systematic Reviews* 2017, Issue 11. Art. No: CD008349. [DOI: 10.1002/14651858.CD008349.pub4]

Laver 2020

Laver KE, Adey-Wakeling Z, Crotty M, Lannin NA, George S, Sherrington C. Telerehabilitation services for stroke. *Cochrane Database of Systematic Reviews* 2020, Issue 1. Art. No: CD010255. [DOI: 10.1002/14651858.CD010255.pub3]

Levack 2015

Levack WM, Weatherall M, Hay-Smith EJ, Dean SG, McPherson K, Siegert RJ. Goal setting and strategies to enhance goal pursuit

for adults with acquired disability participating in rehabilitation. *Cochrane Database of Systematic Reviews* 2015, Issue 7. Art. No: CD009727. [DOI: 10.1002/14651858.CD009727.pub2]

Levin 2009

Levin MF, Kleim JA, Wolf SL. What do motor "recovery" and "compensation" mean in patients following stroke? *Neurorehabilitation and Neural Repair* 2009;**23**:313-9.

Maier 2019

Maier M, Ballester BR, Verschure Pfmj. Principles of neurorehabilitation after stroke based on motor learning and brain plasticity mechanisms. *Frontiers in Systems Neuroscience* 2019;**13**:74.

Malik 2022

Malik K, Dua A. Biofeedback. Treasure Island (FL): StatPearls Publishing, 2022. [PMID: 31971716]

Martinsen 2012

Martinsen R, Kirkevold M, Sveen U. Younger stroke survivors' experiences of family life in a long-term perspective: a narrative hermeneutic phenomenological study. *Nursing Research and Practice* 2012;**2012**:948791.

Meader 2014

Meader N, King K, Llewellyn A, Norman G, Brown J, Rodgers M, et al. A checklist designed to aid consistency and reproducibility of GRADE assessments: development and pilot validation. *Systematic Reviews* 2014;**3**:82.

Mehrholz 2017

Mehrholz J, Thomas S, Elsner B. Treadmill training and body weight support for walking after stroke. *Cochrane Database of Systematic Reviews* 2017, Issue 8. Art. No: CD002840. [DOI: 10.1002/14651858.CD002840.pub4]

Mehrholz 2020

Mehrholz J, Thomas S, Kugler J, Pohl M, Elsner B. Electromechanical-assisted training for walking after stroke. *Cochrane Database of Systematic Reviews* 2020, Issue 10. Art. No: CD006185. [DOI: 10.1002/14651858.CD006185.pub5]

Michie 2011

Michie S, van Stralen MM, West R. The behaviour change wheel: a new method for characterising and designing behaviour change interventions. *Implementation Science* 2011;**6**:42. [DOI: 10.1186/1748-5908-6-42] [PMID: 21513547]

Morris 2022

Morris JH, Irvine LA, Dombrowski SU, McCormack B, Van Wijck F, Lawrence M. We Walk: a person-centred, dyadic behaviour change intervention to promote physical activity through outdoor walking after stroke-an intervention development study. *BMJ Open* 2022;**12**:e058563.

Ning 2022

Ning M, Chen F, Wu H, Zheng H, Zheng C, Li S. Effect of early rehabilitation and nursing intervention on the rehabilitation prognosis of elderly stroke hemiplegia patients in the Department of Neurology. *Applied Bionics and Biomechanics* 2022;**2022**:4958044.

O'Neill 2014

O'Neill J, Tabish H, Welch V, Petticrew M, Pottie K, Clarke M, et al. Applying an equity lens to interventions: using PROGRESS ensures consideration of socially stratifying factors to illuminate inequities in health. *Journal of Clinical Epidemiology* 2014;**67**(1):56-64.

Page 2021

Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. Updating guidance for reporting systematic reviews: development of the PRISMA 2020 statement. *Journal of Clinical Epidemiology* 2021;**134**:103-12.

Polania 2018

Polania R, Nitsche MA, Ruff CC. Studying and modifying brain function with non-invasive brain stimulation. *Nature Neuroscience* 2018;**21**(2):174-87. [DOI: 10.1038/s41593-017-0054-4]

Pollock 2011

Pollock C, Eng J, Garland S. Clinical measurement of walking balance in people post stroke: a systematic review. *Clinical Rehabilitation* 2011;**25**(8):693-708. [DOI: 10.1177/0269215510397394]

Pollock 2014

Pollock A, Farmer SE, Brady MC, Langhorne P, Mead GE, Mehrholz J, et al. Interventions for improving upper limb function after stroke. *Cochrane Database of Systematic Reviews* 2014, Issue 11. Art. No: CD010820. [DOI: 10.1002/14651858.CD010820.pub2]

Pollock 2019a

Pollock A, van Wijck F. Cochrane overviews: how can we optimize their impact on evidence-based rehabilitation? *European Journal of Physical and Rehabilitation Medicine* 2019;**55**:395-410.

Pollock 2019b

Pollock A, Campbell P, Struthers C, Synnot A, Nunn J, Hill S, et al. Development of the ACTIVE framework to describe stakeholder involvement in systematic reviews. *Journal of Health Services Research & Policy* 2019;**24**(4):245-55. [DOI: 10.1177/1355819619841647]

Pollock 2022

Pollock M, Fernandes RM, Becker LA, Pieper D, Hartling L. Chapter V: Overviews of Reviews. In: Higgins JPT, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, Welch VA (editors). Cochrane Handbook for Systematic Reviews of Interventions version 6.3 (updated February 2022). Cochrane, 2022. Available from www.training.cochrane.org/handbook.

Portegijs 2016

Portegijs E, Rantakokko M, Viljanen A, Sipilä S, Rantanen T. Identification of older people at risk of ADL disability using the Life-Space Assessment: a longitudinal cohort study. *Journal of the American Medical Directors Association* 2016;**17**:410-4.

Pérez-Bracchiglione 2022

Pérez-Bracchiglione J, Meza N, Bangdiwala SI, Niño de Guzmán E, Urrútia G, Xavier Bonfill X, et al. Graphical Representation of Overlap for OVErviews: GROOVE tool. *Research Synthesis Methods* 2022;**13**(3):381-8.

Ramage 2021

Ramage ER, Fini N, Lynch EA, Marsden DL, Patterson AJ, Said CM, et al. Look before you leap: interventions supervised via telehealth involving activities in weight-bearing or standing positions for people after stroke - a scoping review. *Physical Therapy* 2021;**101**(6):pzab073.

RCP 2016

Royal College of Physicians Intercollegiate Stroke Working Party. National clinical guideline for stroke. Fifth Edition (2016). https://www.strokeaudit.org/Guideline/Full-Guideline.aspx (accessed 7 November 2022).

Rudberg 2021

Rudberg AS, Berge E, Laska AC, Jutterström S, Näsman P, Sunnerhagen KS, et al. Stroke survivors' priorities for research related to life after stroke. *Topics in Stroke Rehabilitation* 2021;**28**:153-8.

Sacco 2013

Sacco RL, Kasner SE, Broderick JP, Caplan LR, Connors JJ, Culebras A, et al. An updated definition of stroke for the 21st century: a statement for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke* 2013;**44**:2064-89.

Salbach 2004

Salbach NM, Mayo NE, Wood-Dauphinee S, Hanley JA, Richards CL, Côté R. A task-orientated intervention enhances walking distance and speed in the first year post stroke: a randomized controlled trial. *Clinical Rehabilitation* 2004;**18**(5):509-19. [DOI: 10.1191/0269215504cr763oa] [PMID: 15293485]

Saunders 2020

Saunders DH, Sanderson M, Hayes S, Johnson L, Kramer S, Carter DD, et al. Physical fitness training for stroke patients. *Cochrane Database of Systematic Reviews* 2020, Issue 3. Art. No: CD003316. [DOI: 10.1002/14651858.CD003316.pub7]

Saunders 2021

Saunders DH, Mead GE, Fitzsimons C, Kelly P, van Wijck F, Verschuren O, et al. Interventions for reducing sedentary behaviour in people with stroke. *Cochrane Database of Systematic Reviews* 2021, Issue 6. Art. No: CD012996. [DOI: 10.1002/14651858.CD012996.pub2]

Shea 2017

Shea BJ, Reeves BC, Wells G, Thuku M, Hamel C, Moran J, et al. AMSTAR 2: a critical appraisal tool for systematic reviews that include randomised or non-randomised studies of healthcare interventions, or both. *BMJ* 2017;**358**:j4008.

Silva 2020

Silva S, Borges LR, Santiago L, Lucena L, Lindquist AR, Ribeiro T. Motor imagery for gait rehabilitation after stroke. *Cochrane Database of Systematic Reviews* 2020, Issue 9. Art. No: CD013019. [DOI: 10.1002/14651858.CD013019.pub2]

Singhal 2013

Singhal AB, Biller J, Elkind MS, Fullerton HJ, Jauch EC, Kittner SJ, et al. Recognition and management of stroke in young adults and adolescents. *Neurology* 2013;**81**:1089-97.

States 2009

States RA, Pappas E, Salem Y. Overground physical therapy gait training for chronic stroke patients with mobility deficits. *Cochrane Database of Systematic Reviews* 2009, Issue 3. Art. No: CD006075. [DOI: 10.1002/14651858.CD006075.pub2]

Strilciuc 2021

Strilciuc S, Grad DA, Radu C, Chira D, Stan A, Ungureanu M, et al. The economic burden of stroke: a systematic review of cost of illness studies. *Journal of Medicine and Life* 2021;**14**(5):606-19. [DOI: 10.25122/jml-2021-0361] [PMID: 35027963]

Stroke Foundation 2022

Stroke Foundation (2022). Clinical guidelines for stroke management. Melbourne Australia. informme.org.au/guidelines/living-clinical-guidelines-for-stroke-management (accessed 29 October 2022).

Sultan 2013

Sultan S, Elkind MS. The growing problem of stroke among young adults. *Current Cardiology Reports* 2013;**15**:421.

TACIT

Tool for Addressing Conflicts of Interest in Trials (TACIT). https://tacit.one/ (accessed 1 August 2022).

Teasell 2020

Teasell R, Salbach NM, Foley N, Mountain A, Cameron JI, Jong A, et al. Canadian Stroke Best Practice Recommendations: rehabilitation, recovery, and community participation following stroke. Part one: rehabilitation and recovery following stroke; 6th Edition Update 2019. *International Journal of Stroke* 2020;**15**(7):763-88. [DOI: 10.1177/1747493019897843] [PMID: 31983296]

Thieme 2018

Thieme H, Morkisch N, Mehrholz J, Pohl M, Behrens J, Borgetto B, ed al. Mirror therapy for improving motor function after stroke. *Cochrane Database of Systematic Reviews* 2018, Issue 7. Art. No: CD008449. [DOI: 10.1002/14651858.CD008449.pub3]

Thomas 2004

Thomas J, Harden A, Oakley A, Oliver S, Sutcliffe K, Rees R, et al. Integrating qualitative research with trials in systematic reviews. *BMJ* 2004;**328**:1010-2.

Tsao 2022

Tsao CW, Aday AW, Almarzooq ZI, Alonso A, Beaton AZ, Bittencourt MS, et al. Heart Disease and Stroke Statistics-2022

Update: a report from the American Heart Association. *Circulation* 2022;**145**:e153-e639.

Tugwell 2006

Tugwell P, Robinson V, Grimshaw J, Santesso N. Systematic reviews and knowledge translation. *Bulletin of the World Health Organization* 2006;**84**:643-51.

Tyagi 2018

Tyagi S, Koh GC, Nan L, Tan KB, Hoenig H, Matchar DB, et al. Healthcare utilization and cost trajectories post-stroke: role of caregiver and stroke factors. *BMC Health Services Research* 2018;**18**:881.

Tyson 2009

Tyson SF, Kent RM. WITHDRAWN: Orthotic devices after stroke and other non-progressive brain lesions. *Cochrane Database of Systematic Reviews* 2009, Issue 3. Art. No: CD003694. [DOI: 10.1002/14651858.CD003694.pub3]

UCS 2019

Cochrane Editorial and Methods Department. Updating classification system: guide to applying to Cochrane Reviews. Version: 18 April 2019. https://documentation.cochrane.org/display/EPPR/Updating+Classification+System (accessed 7 November 2022).

Vadas 2021

Vadas D, Prest K, Turk A, Tierney S. Understanding the facilitators and barriers of stroke survivors' adherence to recovery-oriented self-practice: a thematic synthesis. Disability and Rehabilitation 2021 Aug 30 [Epub ahead of print]. [DOI: 10.1080/09638288.2021.1968512]

Virani 2020

Virani SS, Alonso A, Benjamin EJ, Bittencourt MS, Callaway CW, Carson AP, et al. Heart Disease and Stroke Statistics-2020 Update: a report from the American Heart Association. *Circulation* 2020;**141**:e139-e596.

Vloothuis 2016

Vloothuis JD, Mulder M, Veerbeek JM, Konijnenbelt M, Visser-Meily JM, Ket JC, et al. Caregiver-mediated exercises for improving outcomes after stroke. *Cochrane Database of Systematic Reviews* 2016, Issue 12. Art. No: CD011058. [DOI: 10.1002/14651858.CD011058.pub2]

Wade 1999

Wade DT. Goal planning in stroke rehabilitation: how? *Topics in Stroke Rehabilitation* 1999;**6**(2):16-36. [DOI: 10.1310/h3yj-qew4-favk-m16b]

Wade 2009

Wade DT. Goal setting in rehabilitation: an overview of what, why and how. *Clinical Rehabilitation* 2009;**23**(4):291-5. [DOI: 10.1177/0269215509103551]

Wafa 2020

Wafa HA, Wolfe CDA, Emmett E, Roth GA, Johnson CO, Wang Y. Burden of stroke in Europe: thirty-year projections of incidence, prevalence, deaths, and disability-adjusted life years. *Stroke* 2020;**51**:2418-27.

Weiss 2004

Weiss PL, Katz N. The potential of virtual reality for rehabilitation. *Journal of Rehabilitation Research and Development* 2004;**41**(5):vii-x. [PMID: 15558392]

WHO 2020

World Health Organization. World Stroke Day; October 2020. https://www.who.int/southeastasia/news/detail/29-10-2020-world-stroke-day-ms (accessed 22 June 2022).

WHO 2022

World Health Organization. International Classification of Functioning, Disability and Health (ICF). https://www.who.int/standards/classifications/international-classification-of-functioning-disability-and-health (accessed 22 July 2022).

Winstein 2016

Winstein CJ, Stein J, Arena R, Bates B, Cherney LR, Cramer SC, et al. Guidelines for adult stroke rehabilitation and recovery: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke* 2016;**47**(6):e98-e169. [DOI: 10.1161/STR.0000000000000098]

Woodford 2007

Woodford H, Price C. EMG biofeedback for the recovery of motor function after stroke. *Cochrane Database of Systematic Reviews* 2007, Issue 2. Art. No: CD004585. [DOI: 10.1002/14651858.CD004585.pub2]

World Bank 2022

The World Bank. World Bank Country and Lending Groups. datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups (accessed 21 October 2022).

ADDITIONAL TABLES

Table 1. Principles of action: recovery and compensation*

Motor system level	Recovery	Compensation
Health condition	Reactivation in brain areas previously non-activated by the circulatory event	Activation in alternative brain areas not normally observed in healthy individuals

Table 1. Principles of action: recovery and compensation* *(Continued)*

Body function/structure	Reappearance of premorbid movement patterns during task accomplishment	***Adaptative***	***Substitutive***
		Appearance of alternative movement patterns during the accomplishment of a task	The use of different effectors to replace lost motor elements during the accomplishment of a task
Activity	A task is performed using the same end effectors and joints in the same movement patterns typically used by healthy individuals	A task is accomplished using alternate joints or end effectors (substitution)	

*Adapted from Levin 2009.

APPENDICES

Appendix 1. Cochrane Library, Cochrane Database of Systematic Reviews (CDSR) search strategy

ID Search Hits

#1 MeSH descriptor: [Walking] this term only

#2 MeSH descriptor: [Gait] this term only

#3 (walk* or gait or ambulat* or saunter$ or mobil* or balance* or locomot* or stride* or stroll* or treadmill*):ti,ab,kw

#4 #1 or #2 or #3

#5 MeSH descriptor: [Cerebrovascular Disorders] this term only

#6 MeSH descriptor: [Basal Ganglia Cerebrovascular Disease] explode all trees

#7 MeSH descriptor: [Brain Ischemia] explode all trees

#8 MeSH descriptor: [Brain Infarction] this term only

#9 MeSH descriptor: [Brain Stem Infarctions] this term only

#10 MeSH descriptor: [Cerebral Infarction] this term only

#11 MeSH descriptor: [Infarction, Anterior Cerebral Artery] this term only

#12 MeSH descriptor: [Infarction, Middle Cerebral Artery] this term only

#13 MeSH descriptor: [Infarction, Posterior Cerebral Artery] this term only

#14 MeSH descriptor: [Ischemic Attack, Transient] this term only

#15 MeSH descriptor: [Carotid Artery Diseases] this term only

#16 MeSH descriptor: [Carotid Artery Thrombosis] this term only

#17 MeSH descriptor: [Carotid Stenosis] this term only

#18 MeSH descriptor: [Cerebral Arterial Diseases] this term only

#19 MeSH descriptor: [Intracranial Arteriosclerosis] this term only

#20 MeSH descriptor: [Intracranial Arteriovenous Malformations] explode all trees

#21 MeSH descriptor: [Intracranial Embolism and Thrombosis] explode all trees

#22 MeSH descriptor: [Intracranial Hemorrhages] this term only

#23 MeSH descriptor: [Cerebral Hemorrhage] this term only

#24 MeSH descriptor: [Cerebral Intraventricular Hemorrhage] this term only

#25 MeSH descriptor: [Intracranial Hemorrhage, Hypertensive] this term only

#26 MeSH descriptor: [Subarachnoid Hemorrhage] this term only

#27 MeSH descriptor: [Stroke] this term only

#28 MeSH descriptor: [Hemorrhagic Stroke] this term only

#29 MeSH descriptor: [Ischemic Stroke] explode all trees

#30 MeSH descriptor: [Vasospasm, Intracranial] this term only

#31 (stroke or poststroke or post-stroke or cerebrovasc* or (cerebr* near/3 vasc*) or CVA* or apoplectic or apoplex* or (transient near/3 isch?emic near/3 attack) or tia* or SAH or AVM or ESUS or ICH or (cerebral small vessel near/3 disease*)):ti,ab,kw

#32 ((cerebr* or cerebell* or arteriovenous or vertebrobasil* or interhemispheric or hemispher* or intracran* or intracerebral or infratentorial or supratentorial or MCA* or ((anterior or posterior) near/3 circulat*) or lenticulostriate or ((basilar or brachial or vertebr*) near/3 arter*)) near/3 (disease or damage* or disorder* or disturbance or dissection or syndrome or arrest or accident or lesion or vasculopathy or insult or attack or injury or insufficiency or malformation or obstruct* or anomal*)):ti,ab,kw

#33 ((cerebr* or cerebell* or arteriovenous or vertebrobasil* or interhemispheric or hemispher* or intracran* or corpus callosum or intracerebral or intracortical or intraventricular or periventricular or posterior fossa or infratentorial or supratentorial or MCA* or ((anterior or posterior) near/3 circulation) or basal ganglia or ((basilar or brachial or vertebr*) near/3 arter*) or space-occupying or brain ventricle* or lacunar or cortical or ocular) near/3 (isch?emi* or infarct* or thrombo* or emboli* or occlus* or hypoxi* or vasospasm or obstruct* or vasoconstrict*)):ti,ab,kw

#34 ((cerebr* or cerebell* or vertebrobasil* or interhemispheric or hemispher* or intracran* or corpus callosum or intracerebral or intracortical or intraventricular or periventricular or posterior fossa or infratentorial or supratentorial or MCA* or ((anterior or posterior) near/3 circulation) or basal ganglia or ((basilar or brachial or vertebr*) near/3 arter*) or space-occupying or brain ventricle* or subarachnoid* or arachnoid*) near/3 (h?emorrhag* or h?ematom* or bleed*)):ti,ab,kw

#35 ((carotid or cerebr* or cerebell* or intracranial or ((basilar or brachial or vertebr*) near/3 arter*)) near/3 (aneurysm or malformation* or block* or dysplasia or disease* or bruit or injur* or narrow* or obstruct* or occlusion or constriction or presclerosis or scleros* or stenos* or atherosclero* or arteriosclero* or plaque* or thrombo* or embol* or arteriopathy)):ti,ab,kw

#36 MeSH descriptor: [Hemiplegia] this term only

#37 MeSH descriptor: [Paresis] explode all trees

#38 (hemipleg* or hemipar* or paresis or paretic or hemineglect):ti,ab,kw

#39 ((unilateral or visual or hemispatial or attentional or spatial) near/5 neglect):ti,ab,kw

#40 {OR #5-#39}

#41 #40 and #4 in Cochrane Reviews, Cochrane Protocols

CONTRIBUTIONS OF AUTHORS

DC, PC, FvW, and ATB conceived the overview and designed the protocol.

ATB is the guarantor.

MF, GK, EL, and JM commented on and approved the protocol.

DECLARATIONS OF INTEREST

Davide Corbetta: none known

Pauline Campbell: declared funding from the Heath Technology Assessment Programme, National Institute of Health Research (NIHR).

Frederike van Wijck: none known

Massimo Filippi: none known

Gert Kwakkel: none known

Elizabeth Lynch: declared previous funding (2018-21) from Early Career Fellowship from the National Health and Medical Research Council (NHMRC). Author of two studies that may be considered for inclusion. Co-chair of Australian and New Zealand Clinical Guidelines for Stroke Management working group.

Jan Mehrholz: none known

Alex Todhunter-Brown: none known

SOURCES OF SUPPORT

Internal sources

- No sources of support provided

External sources

- No sources of support provided